

**Government of Rajasthan
Water Resources Department**

TENDER DOCUMENT

**VOLUME-I
TECHNICAL BID**

for

**Construction of Kaliteer Lift Scheme, Dholpur on
Engineering, Procurement and Construction Basis
(single Responsibility Turn-Key project) and its operation
& maintenance for 8 Years**

January 2023

**Additional Chief Engineer,
Water Resources Zone, JLN Marg, JAIPUR**

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VOLUME- I

(TECHNICAL BID)

Section-I:	Instructions to Bidders
Section-II:	Bid Data Sheet
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Office of the Additional Chief Engineer Water Resources Zone Jaipur

No:-

Date:-

**E-Notice Inviting Bid
NIB no 15/2022-23**

The Additional Chief Engineer Water Resources Zone Jaipur on behalf of The Governor of Rajasthan, Invites bids from eligible bidders for the following work under e-procurement procedure. The interested bidders shall have to be enrolled/ registered with portal of www.eproc.rajasthan.gov.in for participating in the bidding process.

S.no	Name of work and site	Estimated cost of work (INR in Crore)	Completion Period	Price of Bidding Document	Processing Fee	Bid Security (INR Crore)
1	Construction of Kaliteer Lift Scheme, Dholpur on Engineering, Procurement and Construction Basis (single Responsibility Turn-Key project) and its operation & maintenance for 8 years	705.86	30 Months	50,000/-	1,000/-	1/2% i.e. Rs 3.53 crore for registered eligible contractor with the department & 2% i.e. Rs 14.12 Crore for eligible registered contractor with other department
2	Date for Downloading of Tender Document	From 9:30 AM of 13.01.2023 to 16.02.2023 up to 6:00 PM				
3	Site Visit along with SE Dholpur/EE Dholpur II	24.01.2023				
4	Pre bid meeting (office of Additional Chief Engineer Water Resources Zone Jaipur, Sinchai Bhawan JLN Marg Jaipur)	30.01.2023 at 2:30 PM				
5	Last Date of Uploading of Tender Document	16.02.2023 Up to 6:00 PM				
6	Physical submission of Bid security & scanned copies of Tender fee, Processing fee etc in the office of Additional Chief Engineer Water Resources Zone Jaipur, Sinchai Bhawan JLN Marg Jaipur/ Executive Engineer Water Resources Division II Dholpur	17.02.2023 up to 2:00 PM				
7	Date of opening of Technical Bid	17.02.2023 at 4:00 PM onwards				
8	Date of opening of financial bid	Will be intimated online to qualified bidders.				

1. The complete bidding document containing Instructions to bidder, Bid Data Sheet, Evaluation and Qualification Criteria, Bidding Forms, Procuring Entity's Requirements, General Condition of

Contract, contract Data/Special condition of contract, Contract Forms, Technical specifications etc may be seen or Downloaded from the website of State Public Procurement Portal <http://sppp.rajasthan.gov.in> or e-procurement portal <http://eproc.rajasthan.gov.in> details are also available on Water Resources Department official website www.water.rajasthan.gov.in/wrd and www.dipr.rajasthan.gov.in .

2. Technical and financial bids, duly digitally signed on all pages and serially numbered enclosed in separate covers and third cover containing copies of proofs of payment of price of bidding document Rs 50,000/- (Fifty Thousand only) in favour of Executive Engineer Water Resources Division II Dholpur Payable at Dholpur, Processing fee of Rs 1000/- in favour of MD RISL payable at Jaipur (Both Being non-refundable) to be submitted electronically through e gras Payment.

Details of Deposition of various fee through e-grass portal in respective head: -

(Department 47 – Water Resources Department,

Division 31658 - Executive Engineer Water Resources Division II Dholpur

(Processing Fees Rs. 1,000.00

Head 8658-00-102-16-02)

(Tender Fees Rs. 50,000.00

Head 0075-00-800-52-01)

3. The bid security in the form of e-gras (Head 8443-00-108-00-00)/DD/BC/Bank Guarantee in the specified format from a Nationalized or scheduled Bank in India in favour of Executive Engineer Water Resources Division II Dholpur Payable at Dholpur to be uploaded electronically (with scanned copies) to the procuring entity on the e-procurement portal <http://eproc.rajasthan.gov.in> by using your ID, password and digital signature certificate latest by 6:00 PM on dated 16.02.2023 and to be submitted physically in the office of Additional Chief Engineer Water Resources Zone Jaipur Sinchai Bhawan JLN Marg Jaipur/Executive Engineer Water Resources Division II Dholpur last by dated 17.02.2023 up to 2:00 PM.
4. The Bid validity period will be 120 days.
5. The procedure for submission of bids including payment of price of bidding documents, user charges/processing fee; Bid security etc shall be as specified on the e-procurement portal.
6. Enlisted contractors in the Water Resources Department shall be required to deposit ½% of estimated cost of work as bid security. For outside the Water Resources Department 2% bid security shall be required to be deposited.
7. The technical bid shall be opened at 4:00 PM on dated 17.02.2023 in the office of procuring entity Additional Chief Engineer Water Resources Zone Jaipur Sinchai Bhawan JLN Marg Jaipur.
8. The procuring entity is not bound to accept the lowest bid and may reject any or all bids without assigning any reason thereof.
9. The bidders shall have to submit copies of a valid Tax clearances certificate>Returns from the concerned Commercial Taxes Office and the Permanent Account Number (PAN) issued by Income Tax Department.
10. Other Details may be seen in the bidding document.

Additional Chief Engineer
Water Resources Zone Jaipur

कार्यालय अतिरिक्त मुख्य अभियंता जल संसाधन संभाग जयपुर

जवाहर लाल नेहरू मार्ग, जयपुर- 15

क्रमांक:-

दिनांक:-

श्रीमान आयुक्त

सूचना एवं जन संपर्क विभाग

जयपुर

विषय:- निविदा सूचना संख्या 15/2022-23 प्रकाशित करवाने बावत्।

महोदय

उपरोक्त विषयान्तर्गत निवेदन है कि इस कार्यालय की निविदा सूचना संख्या 13/2022-23 समाचार पत्रों में प्रकाशनार्थ संलग्न कर भिजवाई जा रही है। कृपया निविदा का प्रकाशन राजस्थान लोक उपापन में पारदर्शिता नियम 2013 के नियम 43 (7) के आईटम नं. 4 के अनुसार One leading Regional daily newspaper and one State level leading daily newspapers having circulation of 50,000 copies or more, and One all India level daily English newspaper with wide circulation में न्यूनतम स्पेस में शीघ्र कराकर इस कार्यालय को अवगत कराने का श्रम करावे।

UBN No:

संलग्न:- निविदा की आठ प्रतियां व सॉफ्ट कॉपी एक।

अतिरिक्त मुख्य अभियंता
जल संसाधन संभाग, जयपुर

क्रमांक:-

दिनांक:-

प्रतिलिपि निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रस्तुत है:-

1. श्रीमान मुख्य अभियंता जल संसाधन विभाग राजस्थान जयपुर।
2. अधीक्षण अभियंता जल संसाधन वृत्त धौलपुर।
3. उपनिदेशक आई.टी. जल संसाधन सिंचाई भवन जयपुर।
4. अधिशाषी अभियन्ता जल संसाधन खण्ड द्वितीय धौलपुर को प्रेषित कर लेख है कि निर्धारित दिनांक को वेब साईट पर बिड डोक्यूमेंट को अपलोड करवाया जाना सुनिश्चित करें।
5. नोटिस बोर्ड कार्यालय।

अतिरिक्त मुख्य अभियंता
जल संसाधन संभाग, जयपुर

(For Publication)

Office of The Additional Chief Engineer Water Resources Zone Jaipur

No:

Date:

E-NIT 15/2022-23

On behalf of the Governor of Rajasthan, bid is invited from eligible bidders for " Construction of Kaliteer Lift Scheme, Dholpur on Engineering, Procurement and Construction Basis (single Responsibility Turn-Key project) and its operation & maintenance for 8 years " costing Rs 705.86 Crore up to 06.00 PM (time) 16.02.2023 (date) and Technical bid will be opened at 4:00 PM on 17.02.2023.

Other particulars of the bid may be visited on the procurement portal (<http://eproc.rajasthan.gov.in>, <http://sppp.raj.nic.in>) of the state.

NIB Code

UBN No

अतिरिक्त मुख्य अभियंता
जल संसाधन संभाग, जयपुर

Section I: Instructions to Bidders

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Important Instruction: -If there is any discrepancy between the provisions of the Act & the Rules “Rajasthan Public Procurement Rules, 2013” and this Bidding Document, the provisions of the Act and the Rules shall prevail.

Section-1: Instructions to Bidders

1. General			
1.1	Scope of Bid	1.1.1	In support of the Invitation to Bid indicated in the Bid Data Sheet (BDS), the Procuring Entity as indicated in the BDS, issues this Bidding Document for the procurement of works as named in the BDS and as specified in Section V, Procuring Entity's Requirements.
1.2	Interpretation	1.2.1	Throughout this Bidding Document: (1) the term “in writing” means communicated in written form through letter, fax, e-mail etc. with proof of (2) if the context so requires, singular means plural and vice versa; and (3) “Day” means a calendar day
1.3	Code of Integrity	1.3.1	Any person participating in the procurement process shall not offer any bribe, reward or gift or any material benefit either directly or indirectly in exchange for an unfair advantage in procurement process or to otherwise influence the procurement process. ii. not misrepresent or omit that misleads or attempts to mislead so as to obtain a financial or other benefit or avoid an obligation. iii. not indulge in any collusion, bid rigging or anti- competitive behavior to impair the transparency, fairness, and progress of the procurement process. iv. not misuse any information shared between the Procuring Entity and the Bidders with an intent to gain unfair advantage in the procurement process. v. not indulge in any coercion including impairing or harming or threatening to do the same, directly or indirectly, to any party or to its property to influence the procurement process. vi. not obstruct any investigation or audit of a procurement process. vii. disclose conflict of interest, if any; and viii. disclose any previous transgressions with any Entity in India or any other country during the last three years or any debarment by any other Procuring Entity.
		1.3.2	Conflict of Interest: A conflict of interest is considered to be a situation in which a party has interests that could improperly influence that party's performance of official duties or responsibilities, contractual obligations, or compliance with applicable laws and regulations. A Bidder may be considered to be in conflict of interest with one or more parties in this bidding process if, including but not limited to: I have controlling partners/ shareholders common

			or received or have received any direct or indirect subsidy from any of them; or ii. receive or have received any direct or indirect subsidy from any of them, or iii. have the same legal representative for purposes of this Bid or iv. have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the Bid of another Bidder, or influence the decisions of the Procuring Entity regarding this bidding process; or v. the Bidder participates in more than one Bid in this bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all Bids in which the Bidder is involved. However, this does not limit the inclusion of the same subcontractor, not otherwise participating as a Bidder, in more than one Bid: or vi. the Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the Works that are the subject of the Bid; or vii. the Bidder or any of its affiliates has been hired (or is proposed to be hired) by the Procuring Entity as Engineer- in- charge/ consultant for the Contract. The Bidder shall have to give a declaration regarding compliance of the Code of Integrity prescribed in the Act, the Rules and stated above in this Clause along with its Bid, in the format specified in Section IV, Bidding Forms. Breach of Code of Integrity by the Bidder: - Without prejudice to the provisions of Chapter IV of the Rajasthan Transparency in Public Procurement Act, in case of any breach of the Code of Integrity by a Bidder or prospective Bidder, as the case may be, the Procuring Entity may take appropriate action in accordance with the provisions of sub-section (3) of section 11 and section 46 of the Act.
1.4	Eligible Bidders	1.4.1	A Bidder may be a natural person, private Entity, government- owned Entity or, where permitted in the Bidding documents, any combination of them

		1.4.2	A Bidder/Company constituting the Bidder, shall have the nationality of India.
		1.4.3	A Bidder should not have a conflict of interest in the procurement in question as stated in the Rule 81 and this Bidding document.
		1.4.4	A Bidder debarred under section 46 of the Act shall not be eligible to participate in any procurement process undertaken by any Procuring Entity, if debarred by the State Government; and a Procuring Entity, if debarred by such Procuring Entity
		1.4.5	The Bidder must be an enlisted Contractor in appropriate class with the Relevant Departments / Organizations. He shall furnish necessary proof for the same.
		1.4.6	i. Any change in the constitution of the firm etc., shall be notified forth with by the Bidder in writing to the Procuring Entity and such change shall not relieve any former partner/ member of the firm, etc. from any liability under the Contract. ii No new partner/partners shall be accepted in the firm by the Bidder in respect of the contract unless he/they agree to abide by all its terms, conditions, and deposit with the Procuring Entity a written agreement to this effect. The Bidder's receipt for acknowledgement or that of any partners subsequently accepted as above shall bind all of them and will be sufficient discharge for any of the purpose of the Contract. iii The status of the lead partner/ representative of the Joint Venture, Consortium or Association as a major stake holder shall not change without the consent of the Procuring Entity. New major stake holder must agree to abide by all terms and conditions of the Contract.
		1.4.7	Bidders shall provide such evidence of their continued eligibility satisfactory to the Procuring Entity, should the Procuring Entity request.
		1.4.8	In case a prequalification or empanelment or registration process has been conducted prior to the bidding process, this bidding shall be open only to the pre-qualified, empaneled or registered Bidders.
		1.4.9	Each Bidder shall submit only one Bid except in case of alternative bids, if permitted.

		1.4.10	No Bidder who is not registered under the GST Act/rule shall bid. The GST Registration Number should be quoted and without which the bid is liable to be rejected. He is also required to provide proof of Permanent Account Number (PAN) given by income tax department
2. Contents of Bidding Document			
2.1	Sections of the Bidding Document	2.1.1	The Bidding Document consists of Parts I, II, and III, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB Clause 2.3 [Amendment of Bidding Document]. Part I: Bidding Procedures Section I. Instructions to Bidders (ITB) Section II. Bid Data Sheet (BDS) Section III. Evaluation and Qualification Criteria Section IV. Bidding Forms Part II: Requirements Section V. Procuring Entity's Requirements. Part III: Contract Section VI A. General Conditions of Contract [GCC] Section VI B. Special Conditions of Contract [SCC] Section VI C. Contract Forms VII. Price Bid
		2.1.2	The Invitation for Bids (NIB) issued by the Procuring Entity is also part of the Bidding Document.
		2.1.3	The Bidding Document shall be uploaded on the e- procurement portal, http://eproc.rajasthan.gov.in along with the Notice Inviting Bids. The complete Bidding Document shall also be placed on the State Public Procurement Portal, http://sppp.rajasthan.gov.in The prospective Bidders may download the bidding document from these portals. The price of the Bidding Document and processing fee of e-bidding shall have to be paid to the Procuring Entity in the amount and manner as specified in Bid Data Sheet and e-procurement portal.
		2.1.4	The Procuring Entity is not responsible for the completeness of the Bidding Document and its addenda, if they were not downloaded correctly from the e- procurement portal or the State Public Procurement Portal.

		2.1.5	The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or authentic documentation required by the Bidding Document may result in the rejection of the Bid.
2.2	Clarification of Bidding Document and Pre-Bid Conference	2.2.1	The Bidder shall be deemed to have carefully examined the conditions, specifications, size, make and drawings, etc. of the Works and Related Services to be provided. If any Bidder has any doubts as to the meaning of any portion of the conditions or of the specifications, drawings etc., it shall, before submitting the Bid, refer the same to the Procuring Entity and get clarifications. A Bidder requiring any clarification of the Bidding Document shall contact the Procuring Entity in writing or e-mail at the Procuring Entity's address indicated in the BDS. The Procuring Entity will respond in writing or e-mail to any request for clarification, within seven days provided that such request is received no later than twenty-one (21) days prior to the deadline for submission of Bids as specified in ITB Sub-Clause 4.2.1[Deadline for Submission of Bids]. The clarification issued, including a description of the inquiry but without identifying its source shall also be placed on the State Public Procurement Portal and should the Procuring Entity deem it necessary to amend the Bidding Document as a result of a clarification, it shall do so following the procedure under ITB Clause 2.3 [Amendment of Bidding Document] through an addendum which shall form part of the Bidding Document.
		2.2.2	The Bidder or his authorized representative is invited to attend the Pre- Bid Conference, if provided for in the BDS. The purpose of the Pre- Bid Conference will be to clarify issues and to answer questions on any matter related to this procurement that may be raised at that stage. If required, a conducted site visit may be arranged by the Procuring Entity.
		2.2.3	The Bidder is requested, to submit questions in writing, to reach the Procuring Entity not later than 7 Days before the date of Pre-Bid Conference
		2.2.4	Minutes of the Pre-Bid Conference, including the text of the questions raised, and the responses given, without identifying the source, will be transmitted promptly to all Bidders who attended the Pre-Bid Conference and shall also be placed on the State Public Procurement Portal and the e-procurement portal. Any modification to the Bidding Document that may become necessary as a result of the Pre-Bid Conference shall be made by the Procuring Entity exclusively through the issue of an addendum (part of Bidding document) and not through the minutes of the Pre-Bid Conference.
		2.2.5	At any time prior to the deadline for submission of the Bids, the Procuring Entity, Suo motto, may also amend the Bidding Document, if required, by issuing an addendum which will form part of the Bidding Document.
		2.2.6	Non-attendance at the Pre-Bid Conference will not be a cause for disqualification of a Bidder.

2.3	Amendment of Bidding Document	2.3.1	Any addendum issued shall be part of the Bidding Document and shall be uploaded on the State Public Procurement Portal and the e-procurement portal.
		2.3.2	To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Procuring Entity may, at its discretion, extend the deadline for the submission of the Bids, pursuant to ITB Sub-Clause 4.2 [Deadline for Submission of Bids], under due publication on the State Public Procurement Portal and the e-procurement portal and newspapers.
3.0	Preparation of Bids		
3.1	Cost of Bidding	3.1.1	The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Procuring Entity shall not be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
		3.1.2	The Bidder shall furnish the scanned attested copies of following documents with its Bid: - i. Partnership Deed and valid registration certificate issued by the Registrar of Firms in case of Partnership Firms. Power of Attorney in favour of the partner signing the Bid, authorizing him to represent all partners of the firm. - ii Valid GST clearance certificate and Permanent Account Number (PAN) given by the Income Tax Department. iii. Address of residence and office, telephone numbers e- mail address in case of sole Proprietorship. - iv Certificate of Registration and Memorandum of Association issued by Registrar of Companies in case of a registered company. In case of any other statutory or registered body, certificate of incorporation or registration issued by concerned authorities. Power of attorney in favor of the person signing the Bid.

3.2	Language of Bid	3.2.1	The Bid, as well as all correspondence and documents relating to the Bid exchanged by the Bidder and the Procuring Entity, shall be written in English/ Hindi or a language specified in the BDS. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an self-attested accurate translation of the relevant passages duly accepted by the Bidder in English/ Hindi or the language specified in the BDS, in which case, for purposes of interpretation of the Bid, such translation shall govern.
3.3	Documents Comprising the Bid	3.3.1	The Bid shall comprise of two covers, one containing the Technical Bid/ Proposal and the other the Financial or PriceBid/ Proposal. One more cover containing scanned copies of proof of payment in form specified in Bid Data Sheet, of the price of Bidding Document, processing fee and Bid Security/ Bid Securing Declaration shall be enclosed separately.
		3.3.2	The technical bid/proposal shall content following: i. Technical Bid/ Proposal Submission Sheet and Technical Bid containing the filled-up Bidding Forms and Declarations related to Technical Bid, possession of required qualifications and Code of Integrity given in Section IV [Bidding Forms]; ii. proof of payment of price of Bidding Document, processing fee and Bid Security in accordance with ITB Clause 3.10. iii. written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB Clause 3.11. iv. documentary evidence in accordance with ITB Clause 3.7 establishing the Bidder's eligibility to bid. v. documentary evidence in accordance with ITB Clause 3.8 establishing the Bidder's qualifications to perform the contract if its Bid is accepted. vi. Drawings/ designs in support of the Works to be executed. vii. the Notice Inviting Bids. viii. any other document required in the BDS; and ix. Others considered necessary to strengthen the Bid submitted.
		3.3.3	The Financial Bid/ Price Proposal shall contain the following: Financial Bid/ Price Proposal Submission Sheet and the applicable Price Schedules, in accordance with ITB Clauses 3.4, 3.5. Any other document required in the BDS.
3.4	Bid Submission Sheets and Price Schedules	3.4.1	The Bidder shall submit the Technical Bid and Financial Bid using the Bid Submission Sheets provided in Section IV [Bidding Forms]. These forms must be completed without any alterations to their format, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested
		3.4.2	The Bidder shall submit as part of the Financial Bid, the Price Schedules for Works, using the forms provided in Section IV [Bidding Forms].

3.5	Bid Prices	3.5.1	i. In case of Item Rate Contracts, the Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the Bidder will not be paid for by the Procuring Entity but will have to be executed and shall be deemed covered by the rates for other items and prices in the Bill of Quantities. ii. In case of Percentage Rate Contracts, combined single percentage above or below the total amount of the Bill of Quantities must be quoted by the Bidder for all items. iii. In case of Lump Sum Contracts, only Total Price which the Bidder wants to charge for the entire Works with all its contingencies in accordance with drawings and specifications shall be quoted by the Bidder. A Schedule of Rates shall be specified in the Bid Data Sheet in order to regulate the amount to be added to or deducted from the fixed sum on account of additions and alterations not covered by the Contract. Payments shall be linked to various stages of completion of the Works specified in Activity Schedule given in Bid Data Sheet.
		3.5.2	Prices quoted by the Bidder shall be fixed during the Bidder's Performance of the Contract and not subject to variation on any account, unless otherwise specified in the BDS. A Bid submitted with an adjustable price quotation shall be treated as non-responsive and shall be rejected, pursuant to ITB Clause 5.7 [Responsiveness of Bids]. However, if in accordance with the BDS, prices quoted by the Bidder shall be subject to adjustment during the performance of the Contract, a Bid submitted with a fixed price quotation shall not be rejected, but the price adjustment shall be treated as zero.
		3.5.3	All duties, taxes, and other levies payable by the Bidder under the contract, or for any other cause, shall be included in the rates and prices, and the total Bid Price shall be submitted by the Bidder.
3.6	Currencies of Bid.	3.6.1	The unit rates and the prices shall be quoted by the Bidder entirely in Indian Rupees unless otherwise specified in BDS. All payments shall be made in Indian Rupees only, unless otherwise specified in the BDS.
3.7	Documents Establishing the Eligibility of the Bidder	3.7.1	To establish their eligibility in accordance with ITB Clause 1.4 [Eligible Bidders], Bidders shall: complete the eligibility declarations in the Bid Submission Sheet and Declaration Form included in Section IV [Bidding Forms]. if the Bidder is an existing or intended Joint Venture [JV], Consortium or Association in accordance with ITB Sub- Clause 1.4.1 [Eligible Bidders], it shall submit a copy of the Agreement, or a letter of intent to enter into such Agreement. The respective document shall be signed by all legally authorized signatories of all the parties to the existing or intended JV, Consortium or Association as appropriate; and the existing or intended JV shall authorize an individual/ partner in one of the firms as lead partner of the JV to act and commit all the partners of JV for the Bid.

3.8	Documents Establishing the Qualifications of the Bidder	3.8.1	To establish its qualifications to perform the Contract, the Bidder shall submit as part of its Technical Proposal the documentary evidence indicated for each qualification criteria specified in Section III, [Evaluation and Qualification Criteria].
3.9	Period of Validity of Bids	3.9.1	Bids shall remain valid for 120 days or the period specified in the BDS, after the Bid submission deadline date. A Bid valid for a shorter period shall be rejected by the Procuring Entity as non-responsive.
		3.9.2	In exceptional circumstances, prior to the expiration of the Bid validity period, the Procuring Entity may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. The Bid Security or a Bid Securing Declaration in accordance with ITB Clause 3.10 [Bid Security] shall also be got extended for thirty days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its Bid Security or a Bid Securing Declaration. A Bidder granting the request shall not be permitted to modify its bid
3.10	Bid Security	3.10.1	Unless otherwise specified in the BDS, the Bidder shall furnish as part of its Bid, a Bid Security for the amount specified in the BDS.
		3.10.2	Bid Security shall be 2% of the value of the Works indicated in the NIB. For bidders registered with the Procuring Entity, the bid security shall be 0.5% of the value of works indicated in the NIB. The bid security shall be in Indian Rupees, if not otherwise specified in the BDS
		3.10.3	The Bid Security may be given in the form of a banker's Cheque or demand draft or bank guarantee of a Scheduled Bank in India in specified format, in favor of the Executive Engineer Water Resources Division-II Dholpur, or deposited through eGRAS/ net banking, if permitted.
		3.10.4	In lieu of Bid Security, a Bid Securing Declaration shall be taken from Government Departments and State Government Public Sector Enterprises, Autonomous bodies, Registered Societies, Cooperative Societies which are owned or controlled or managed by the State Government, Public Sector Enterprises of Central Government. For the Bid Securing Declaration, the Bidder shall use the form included in Section IV [Bidding Forms].
		3.10.5	Scanned copy of Bid Security instrument or a Bid Securing Declaration shall necessarily accompany the sealed Bid. Any Bid not accompanied by Bid Security or Bid Securing Declaration, if not exempted, shall be liable to be rejected.
		3.10.6	Bid Security of a Bidder lying with the Procuring Entity in respect of other Bids awaiting decision shall not be adjusted towards Bid Security for this Bid. The Bid Security originally deposited may, however be taken into consideration in case Bids are re-invited.

		3.10.7	The issuer of the Bid Security and the confirmer, if any, of the Bid Security, as well as the form and terms of the Bid Security, must be acceptable to the Procuring Entity.
		3.10.8	Prior to submitting its Bid, a Bidder may request the Procuring Entity to confirm the acceptability of a proposed issuer of a Bid Security or of a proposed confirmer, if different than as specified in ITB Clause 3.10.3. The Procuring Entity shall respond promptly to such a request.
		3.10.9	The bank guarantee presented as Bid Security shall be got confirmed from the concerned issuing bank. The confirmation of the acceptability of a proposed issuer or of any proposed confirmer does not preclude the Procuring Entity from rejecting the Bid Security on the ground that the issuer or the confirmer, as the case may be, has become insolvent or is under liquidation or has otherwise ceased to be creditworthy.
		3.10.10	The Bid Security of unsuccessful Bidders shall be refunded soon after final acceptance of successful Bid and signing of Contract Agreement and submitting Performance Security by successful Bidder pursuant to ITB Clause 6.4 [Performance Security].
		3.10.11	The Bid Security taken from a Bidder shall be forfeited in the following cases namely :-i. when the Bidder withdrawal or modifies its Bid after opening of Bids;

			ii. when the Bidder does not execute the agreement in accordance with ITB Clause 6.3 [Signing of Contract] after issue of letter of acceptance/ placement of Work order within the specified time period; or iii. when the Bidder fails to commence the Works as per Work Order within the time specified; or iv. when the Bidder does not deposit the Performance Security in accordance with ITB Clause 6.4 [Performance Security]; in the prescribed time limit after the work order is placed. v. if the Bidder breaches any provision of the Code of Integrity prescribed for Bidders in the Act and Chapter VI of the Rules or as specified in ITB Clause 1.3 [Code of Integrity]; or vi. if the Bidder does not accept the correction of its Bid Price pursuant to ITB Sub-Clause 5.5 [Correction of Arithmetical Errors].
		3.10.12	In case of the successful bidder, the amount of Bid Security may be adjusted in arriving at the amount of the Performance Security or refunded if the successful bidder furnishes the full amount of Performance Security. No interest will be paid by the Procuring Entity on the amount of Bid Security.
		3.10.13	The Procuring Entity shall promptly refund the Bid Security of the Bidders at the earliest of any of the following events, namely: -i. the expiry of validity of Bid Security. ii. the execution of agreement for procurement and Performance Security is furnished by the successful bidder. iii. the cancellation of the procurement process; or iv. the withdrawal of Bid prior to the deadline for presenting Bids, unless the Bidding Document stipulates that no such withdrawal is permitted.
		3.10.14	DELETED
3.11	Format and Signing of Bid	3.11.1	All pages of the Technical and Financial Bid shall be digitally signed by the Bidder or authorized signatory on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the BDS and shall be attached to the Bid.

4. Submission and Opening of Bids			
4.1	Sealing and Marking of Bids	4.1.1	Bidders shall submit their Bids to the Procuring Entity only electronically on the e-procurement portal, http://eproc.rajasthan.gov.in . In submission of their Bids, the Bidders should follow the step-by-step instructions given on the e-procurement portal.
		4.1.2	The Bidder shall enclose the Technical Bid and the Financial Bid in separate covers. The scanned copies of proof of payment of price of Bidding Document, processing fee and Bid Security shall be enclosed in third cover. The price of Bidding Document and Bid Security shall be paid in the name of the Procuring Entity while the processing fee shall be paid in the name of M.D., R.I.S.L.
4.2	Deadline for Submission of Bids	4.2.1	Bids shall be submitted electronically only up to the time and date specified in the Notice Inviting Bids and BDS Or an extension issued thereof.
4.3	Withdrawal, Substitution and Modification of Bids	4.3.1	A Bidder may withdraw, substitute, or modify its Bid after it has been submitted by submitting electronically on the e-procurement portal a written Withdrawal/ Substitutions/ Modifications etc. notice on the e-procurement portal, duly digitally signed by the Bidder or his authorized representative, and shall include a copy of the authorization in accordance with ITB Sub-Clause 3.11.1 [Format and Signing of Bid]. The corresponding Withdrawal, Substitution or Modification of the Bid must accompany the respective written notice. All notices must be received by the Procuring Entity on the e-procurement portal prior to the deadline specified for submission of Bids in accordance with ITB Sub-Clause 4.2. [Deadline for Submission of Bids].
		4.3.2	No Bid shall be withdrawn, substituted, or modified in the interval between the deadline for submission of the Bids and the expiration of the period of Bid validity specified in ITB Clause 3.9.[Period of Validity of Bids] or any extension thereof.
4.4	Bid Opening	4.4.1	The electronic Technical Bids shall be opened by the Bids opening committee constituted by the Procuring Entity at the time, date and place specified in the Bid Data Sheet in the presence of the Bidders or their authorized representatives, who choose to be present.
		4.4.2	The Bids opening committee may co-opt experienced persons in the committee to conduct the process of Bid opening

		4.4.3	The Bidders may choose to witness the electronic Bid opening procedure online.
		4.4.4	The Financial Bids shall be kept unopened until the time of opening of the Financial Bids. The date, time, and location of electronic opening of the Financial Bids shall be intimated to the bidders who are found qualified by the Procuring Entity in evaluation of their Technical Bids.
		4.4.5	The Bids opening committee shall prepare a list of the Bidders or their representatives attending the opening of Bids and obtain their signatures on the same. The list shall also contain the representative's name and telephone number and corresponding Bidders' names and addresses. The authority letters brought by the representatives shall be attached to the list. The list shall be signed by all the members of Bids opening committee with date and time of opening of the Bids.
		4.4.6	First, covers marked as "WITHDRAWAL Technical Bid" shall be opened, read out, and recorded and the covers containing the corresponding Technical Bids and Financial Bids shall not be opened. No Bid shall be permitted to be withdrawn unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out and recorded at Bid opening. If the withdrawal notice is not accompanied by the valid authorization, the withdrawal shall not be permitted, and the corresponding Technical Bid shall be opened. Next, covers marked as "SUBSTITUTION Technical Bid" shall be opened, read out, recorded. The covers containing the Substitution Technical Bids and/ or Substitution Financial Bids shall be exchanged for the corresponding covers being substituted. Only the Substitution Technical Bids shall be opened, read out, and recorded. Substitution Financial Bids will remain unopened in accordance with ITB Sub-Clause No Bid shall be substituted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out and recorded at Bid opening. Covers marked as "MODIFICATION Technical Bid" shall be opened thereafter, read out and recorded with the corresponding Technical Bids. No Technical Bid and/ or Financial Bid shall be modified unless the corresponding modification notice contains a valid authorization to request the modification and is read out and recorded at opening of Technical Bids. Only the Technical Bids, both Original as well as Modification, are to be opened, read out and recorded at the opening. Financial Bids,

			both Original as well as Modification, will remain unopened in accordance with ITB Sub-Clause 4.4.4.
		4.4.7	All other covers containing the Technical Bids shall be opened one at a time and the following read out and recorded i. the name of the Bidder; ii. whether there is a modification or substitution. iii. whether proof of payment of Bid Security or Bid Securing Declaration, if required, payment of price of the Bidding Document and processing fee have been enclosed. iv. any other details as the Bids opening committee may consider appropriate. After all the Bids have been opened, their hard copies shall be printed and shall be initialed and dated on the first page and other important papers of each Bid by the members of the Bids opening committee.
		4.4.8	Only Technical Bids shall be read out and recorded at the bid opening and shall be considered for evaluation. No Bid shall be rejected at the time of opening of Technical Bids except Alternative Bids (if not permitted) and Bids not accompanied with the proof of payment of the required price of Bidding Document, processing fee and Bid Security.
		4.4.9	The Bids opening committee shall prepare a record of opening of Technical Bids that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, substitution, modification, or alternative offer (if they were permitted), any conditions put by Bidder and the presence or absence of the price of Bidding Document, processing fee and Bid Security. The Bidders or their representatives, who are present, shall sign the record. The members of the Bids opening committee shall also sign the record with date.
		4.4.10	After completion of the evaluation of the Technical Bids, the Procuring Entity shall invite Bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified, to attend the electronic opening of the Financial Bids. The date, time, and location of the opening of Financial Bids will be intimated in writing by the Procuring Entity. Bidders shall be given reasonable notice of the opening of Financial Bids.
		4.4.11	The Procuring Entity shall notify Bidders in writing whose Technical Bids have been rejected on the grounds of being substantially non-responsive and not qualified in accordance with the requirements of the Bidding Document.
		4.4.12	The Bids opening committee shall conduct the electronic opening of Financial Bids of all Bidders who submitted

			substantially responsive Technical Bids and have qualified in evaluation of Technical Bids, in the presence of Bidders or their representatives who choose to be present, at the address, date, and time specified by the Procuring Entity.
		4.4.13	All covers containing the Financial Bids, including Modified and Substituted Financial Bids, if any, shall be opened one at a time and the following read out and recorded- i. the name of the Bidder. ii. whether there is a modification or substitution. iii. the Bid Prices. iv. any other details as the Bids opening committee may consider appropriate. After all the Bids have been opened, their hard copies shall be printed and shall be initialed and dated on the first page of each Bid by the members of the Bids opening committee. All the pages of the Price Schedule and letters, Bill of Quantities attached shall be initialed and dated by the members of the committee. Key information such as prices, completion period etc. shall be encircled and unfilled spaces in the Bids shall be marked and signed with date by the members of the Bids opening committee.
		4.4.14	The Bids opening committee shall prepare a record of opening of Financial Bids that shall include as a minimum: the name of the Bidder and whether there is a withdrawal, substitution, or modification, the Bid Price, any conditions, any discounts, and alternative offers (if they were permitted). The Bidders or their representatives, who are present, shall sign the record. The members of the Bids opening committee shall also sign the record with date.
5. Evaluation and Comparison of Bids			
5.1	Confidentiality	5.1.1	Information relating to the examination, evaluation, comparison, and post-qualification of Bids, and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on Contract award is communicated to all Bidders.
		5.1.2	Any attempt by a Bidder to influence the Procuring Entity in its examination of qualification, evaluation and comparison of the Bids or Contract award decisions may result in the rejection of its Bid, in addition to the legal action which may be taken by the Procuring Entity under the Act and the Rules.
		5.1.3	Notwithstanding ITB Sub-Clause 5.1.2, from the time of opening the Bid to the time of Contract award, if any Bidder wishes to contact the Procuring Entity on any matter related to the Bidding process, it shall do so in writing.
		5.1.4	In addition to the restrictions specified in section 49 of the

			Act, the Procuring Entity, while procuring a subject matter of such nature which requires the procuring Entity to maintain confidentiality, may impose condition for protecting confidentiality of such information.
5.2	Clarification of Technical or Financial Bids	5.2.1	To assist in the examination, evaluation, and comparison of the Technical or Financial Bids, the Bid evaluation committee may, at its discretion, ask any Bidder for a clarification regarding its Bid. The committee's request for clarification and the response of the Bidder shall be in writing.
		5.2.2	Any clarification submitted by a Bidder with regard to its Bid that is not in response to a request by the Bid evaluation Committee shall not be considered.
		5.2.3	No change in the prices or substance of the Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetical errors discovered by the Bid evaluation committee in the evaluation of the financial Bids.
		5.2.4	No substantive change to qualification information or to a submission, including changes aimed at making an unqualified Bidder, qualified or an unresponsive submission, responsive shall be sought, offered or permitted.
5.3	Deviations, Reservations and Omissions in Technical or Financial Bids	5.3.1	During the evaluation of Technical or Financial Bids, the following definitions apply: i. "Deviation" is a departure from the requirements specified in the Bidding Document. ii. "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Document; and iii. "Omission" is the failure to submit part or all of the Information or documentation required in the Bidding Document.
5.4	Nonmaterial Non conformities in Technical or Financial Bids	5.4.1	Provided that a Technical or Financial Bid is substantially responsive, the Procuring Entity may waive any nonconformity (with recorded reasons) in the Bid that do not constitute a material deviation, reservation, or omission.
		5.4.2	Provided that a Technical or Financial Bid is substantially responsive, the Procuring Entity may request the Bidder to submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities or omissions in the Bid related to documentation requirements. Request for information or documentation on such nonconformities shall not be related to any aspect of the Financial Proposal of the Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid

		5.4.3	Provided that a Technical or Financial Bid is substantially Responsive, the Procuring Entity will rectify nonmaterial nonconformities or omissions (with recorded reasons).
5.5	Correction of Arithmetical Errors in Financial Bid	5.5.1	Provided that a Financial Bid is substantially responsive, the Bid evaluation committee shall correct arithmetical errors during evaluation of Financial Bid on the following basis: i. 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 Procuring Entity 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. ii. 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 iii. 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 (i) and (ii) above.
		5.5.2	If the Bidder that submitted the lowest evaluated Bid does not accept the correction of arithmetical errors, its Bid shall be disqualified, and its Bid Security shall be forfeited or its Bid Securing Declaration shall be executed.
5.6	Preliminary Examination of Technical or Financial Bids	5.6.1	The Procuring Entity shall examine the Technical or Financial Bids to confirm that all documents and technical documentation requested in ITB Sub-Clause 3.3 [Documents Comprising the Bid] have been provided, and to determine the completeness of each document submitted.
		5.6.2	The Procuring Entity shall confirm, following the opening of the Technical or Financial Bids, that the following documents and information have been provided: i. Bid is signed, as per the requirements listed in the Bidding Document. ii. Bid has been submitted as per instructions provided in the Bidding Document and e-procurement portal. iii. Bid is valid for the period, specified in the Bidding Document. iv. Bid is accompanied by Bid Security or Bid Securing Declaration. v. Bid is unconditional and the Bidder has agreed to give the required Performance Security. vi. Price Schedules in the Financial Bid are in accordance with ITB Clause 3.4 [Bid Submission Sheets and Price Schedules];

			vii. written confirmation of authorization to commit the Bidder. viii. Declaration by the Bidder in compliance of Section 7 and 11 of the Act; and ix. Other conditions, as specified in the Bidding Document are fulfilled.
5.7	Responsiveness of Technical or Financial Bids	5.7.1	The Procuring Entity's determination of the responsiveness of a Technical or Financial Bid is to be based on the contents of the Bid itself, as defined in ITB Sub-Clause 3.3[Documents Comprising the Bid].
		5.7.2	A substantially responsive Technical or Financial Bid is one that meets without material deviation, reservation, or omission to all the terms, conditions, and specifications of the Bidding Document. A material deviation, reservation, or omission is one that: (a) if accepted, would-i. affect in any substantial way the scope, quality, or performance of the Works; or ii. limits in any substantial way, inconsistent with the Bidding Document, the Procuring Entity's rights or the Bidder's obligations under the proposed Contract; or (b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.
		5.7.3	The Procuring Entity shall examine the technical aspects of the Bid in particular, to confirm that requirements of Section V [Procuring Entity's Requirements] have been met without any material deviation, reservation, or Omission.
		5.7.4	If a Technical or Financial Bid is not substantially responsive to the Bidding Document, it shall be rejected by the Procuring Entity and may not subsequently be made responsive by the Bidder by correction of the material deviation, reservation, or omission.
5.8	Examination of Terms and Conditions of the Technical or Financial Bids	5.8.1	The Procuring Entity shall examine the Bids to confirm that all terms and conditions specified in the GCC and the SCC have been accepted by the Bidder without any material deviation or reservation.
		5.8.2	The Procuring Entity shall evaluate the technical aspects of the Bid submitted in accordance with ITB Clause 3.3 [Documents Comprising the Bid] and to confirm that all requirements specified in Section V [Procuring Entity's Requirements] of the Bidding Document and all amendments or changes made by the Procuring Entity in accordance with ITB Clause 2.3 [Amendment of Bidding Document] have been met without any material deviation or reservation.

5.9	Evaluation of Qualification of Bidders in Technical Bids	5.9.1	The determination of qualification of a Bidder in evaluation of Technical Bids shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB Clause 3.8 [Documents Establishing the Qualifications of the Bidder] and in accordance with the qualification criteria indicated in Section III [Evaluation and Qualification Criteria]. Factors not included in Section III, shall not be used in the evaluation of the Bidder's qualification.
5.10	Evaluation of Financial Bids	5.10.1	The Procuring Entity shall evaluate each Financial Bid, the corresponding Technical Bid of which has been determined to be substantially responsive.
		5.10.2	To evaluate a Financial Bid, the Procuring Entity shall only use all the criteria and methodologies defined in this Clause and in Section III [Evaluation and Qualification Criteria]. No other criteria or methodology shall be permitted.
		5.10.3	To evaluate a Financial Bid, the Procuring Entity shall consider the following: i. the Bid Price quoted in the Financial Bid. ii. price adjustment for correction of arithmetical errors in accordance with ITB Clause 5.5 [Correction of Arithmetical Errors];
5.11	Comparison of Bids	5.11.1	The Procuring Entity shall compare all substantially responsive Financial Bids to determine the lowest-evaluated Financial Bid in accordance with ITB Sub-Clause 5.10 [Evaluation of Financial Bids].
5.12	Negotiations	5.12.1	To the extent possible, no negotiations shall be conducted after the pre-Bid stage. All clarifications needed to besought shall be sought in the pre-Bid stage itself.
		5.12.2	Negotiations may, however, be undertaken only with the lowest Bidder under the following circumstances- i. when ring prices have been quoted by the Bidders for the subject matter of procurement. Or ii. when the rates quoted vary considerably and considered much higher than the prevailing market rates.
		5.12.3	The Bid evaluation committee shall have full powers to undertake negotiations. Detailed reasons and results of negotiations shall be recorded in the proceedings.
		5.12.4	The lowest Bidder shall be informed about negotiations in writing either through messenger or by registered letter and e-mail (if available). A minimum time of seven days shall be given for calling negotiations. In case of urgency, the Bid evaluation committee, after recording reasons, may reduce the time, provided the lowest Bidder has received the intimation and consented to holding of negotiations.
		5.12.5	Negotiations shall not make the original offer made by the Bidder inoperative. The Bid evaluation committee

			shall have option to consider the original offer in case the Bidder decides to increase rates originally quoted or imposes any new terms or conditions.
		5.12.6	In case of non-satisfactory achievement of rates from lowest Bidder, the Bid evaluation committee may choose to make a written counter offer to the lowest Bidder and if this is not accepted by him, the committee may decide to reject and re-invite Bids or to make the same counter- offer first to the second lowest Bidder, then to the third lowest Bidder and so on in the order of their initial standing in the bid evaluation and work order be awarded to the Bidder who accepts the counteroffer.
		5.12.7	In case the rates even after the negotiations are considered very high, fresh Bids shall be invited.
5.15	Procuring Entity's Right to Accept Any Bid, and to Reject Any or All Bids	5.13.1	The Procuring Entity reserves the right to accept or reject any Bid, and to annul the Bidding process and reject all Bids at any time prior to Contract award without assigning any reasons thereof and without there by incurring any liability to the Bidders.
6. Award of Contract			
6.1	Procuring Entity's Right to Vary Quantities	6.1.1	If the Procuring Entity does not procure any subject matter of procurement or procures less than the quantity specified in the Bidding Document due to change in circumstances, the Bidder shall not be entitled for any claim or compensation except otherwise provided in the Bidding Document.
		6.1.2	Order for additional quantity of an item of the Works upto 50 percent of the original quantity of that item in the Bill of Quantities and for extra items not provided for in the Bill of Quantities may be given but the amount of the additional quantities and extra items, taken together, shall not exceed 50 percent of the Contract Price.
6.2	Acceptance of the successful Bid and award of contract	6.2.1	The Procuring Entity after considering the recommendations of the Bid Evaluation Committee and the conditions of Bid, if any, financial implications, samples, test reports etc., shall accept or reject the successful Bid.
		6.2.2	Before award of the Contract, the Procuring Entity shall ensure that the price of successful Bid is reasonable and consistent with the required specifications.
		6.2.3	A Bid shall be treated as successful only after the competent authority has approved the procurement in terms of that Bid.
		6.2.4	The Procuring Entity shall award the contract to the Bidder whose offer has been determined to be the lowest in accordance with the evaluation criteria set out in the Bidding Document if the Bidder has been determined to be qualified to perform the contract satisfactorily on the basis

			of qualification criteria fixed for the Bidders in the Bidding Document for the subject matter of procurement.
		6.2.5	Prior to the expiration of the period of validity of Bid, the Procuring Entity shall inform the successful Bidder in writing, by registered post or email, that its Bid has been accepted.
		6.2.6	If the issuance of formal letter of acceptance (LOA) is likely to take time, in the meanwhile a Letter of Intent (LOI) may be sent to the Bidder. The acceptance of an offer is complete as soon as the letter of acceptance or letter of intent is posted and/ or sent by email (if available) to the address of the Bidder given in the Bidding Document.
6.3	Signing of Contract	6.3.1	In the written intimation of acceptance of its Bid sent to the successful Bidder, it shall also be requested to execute an agreement in the format given in the Bidding Document on a non-judicial stamp of requisite value at his cost and deposit the Performance Security or a Performance Security Declaration, if applicable, within a period specified in the BDS or where the period is not specified in the BDS, then within fifteen days from the date on which the LOA or LOI is dispatched to the Bidder
		6.3.2	If the Bidder, whose Bid has been accepted, fails to sign a written procurement contract, or fails to furnish the required Performance Security or Performance Security Declaration within the specified time period, the Procuring Entity shall forfeit the Bid Security of the successful bidder/ execute the Bid Securing Declaration and take required action against it as per the provisions of the Act and the Rules.
		6.3.3	The Bid Security, if any, of the Bidders whose Bids could not be accepted shall be refunded soon after the contract with the successful Bidder is signed and his Performance Security is obtained. Until a formal contract is executed, LOA or LOI shall constitute a binding contract.
6.4	Performance Security	6.4.1	Performance Security shall be solicited from the successful Bidder except State Govt. Departments and undertakings, corporations, autonomous bodies, registered societies, co- operative societies which are Owned or controlled or managed by the State Government and undertakings of Central Government. However, a Performance Security Declaration shall be taken from them. The State Government may relax the provision of Performance Security in particular procurement.
		6.4.2	(i) The amount of Performance Security shall be 3%, or as specified by finance department at the time of signing of contract agreement, of the amount of the Work Order. The currency of Performance Security shall be Indian Rupees, if otherwise not specified in BDS.

			(ii) If the Bid, which results in the lowest evaluated bid price, is seriously unbalanced or front loaded in the opinion of the Procuring Entity, the Procuring Entity 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 Procuring Entity may require that the amount of the performance security be increased (to a maximum of 20% of the bid value of such items) at the expense of the Bidder to a level sufficient to protect the Procuring Entity against financial loss in the event of default of the successful Bidder under the Contract. (i) The amount of Performance Security shall be ten percent, or as specified in the BDS, of the amount of the Work Order. The currency of Performance Security shall be Indian Rupees, if otherwise not specified in BDS. (ii) If the Bid, which results in the lowest evaluated bid price, is seriously unbalanced or front loaded in the opinion of the Procuring Entity, the Procuring Entity 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 Procuring Entity may require that the amount of the performance security be increased (to a maximum of 20% of the bid value of such items) at the expense of the Bidder to a level sufficient to protect the Procuring Entity against financial loss in the event of default of the successful Bidder under the Contract. (iii) (a) In addition to Performance Security as specified in rule 75, an Additional Performance Security shall also be taken from the successful bidder in case of unbalanced bid. The Additional Performance Security shall be equal to fifty percent of Unbalanced Bid Amount. The Additional Performance Security shall be deposited in lump sum by successful bidder before execution of Agreement. The Additional Performance Security shall be deposited through e-Grass, Demand Draft, Banker's Cheque, Government Securities or Bank Guarantee (Inserted by Finance Department Order Dated October 22, 2021) i. Explanation: For the purpose of this rule, - i. Unbalanced Bid means any bid below more than fifteen percent of Estimated Bid Value. ii. Estimated Bid Value means value of subject matter of procurement mention in bidding documents by Procuring Entity. iii. Unbalanced Bid Amount means positive difference of eighty five percent of Estimated Bid Value minus Bid Amount Quoted by the bidder. (b) The Additional Performance Security shall be refunded to the contractor after satisfactory completion of entire work. The Additional Performance Security shall be forfeited by the Procuring Entity when work is not completed within stipulated period by the contractor.
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			Provision for Unbalanced Bid and Additional Performance Security shall be mentioned in the Bidding Documents by the Procuring Entity.
		6.4.3	Performance Security and additional performance security shall be furnished in one of the following forms as applicable- i. Deposit through eGRAS; or ii. Bank Draft or Banker's Cheque of a Scheduled Bank in India; or iii. National Savings Certificates and any other script/ instrument under National Savings Schemes for promotion of small savings issued by a Post Office in Rajasthan, if the same can be pledged under the relevant rules. They shall be accepted at their surrender value at the time of Bid and formally transferred in the name of the Procuring Entity with the approval of Head Postmaster; or iv. Bank guarantee. It shall be got verified from the issuing bank. Other conditions regarding bank guarantee shall be same as specified in ITB Sub-Clause 3.10 [Bid Security]; or v. Fixed Deposit Receipt (FDR) of a Scheduled Bank. It shall be in the name of the Procuring Entity on account of Bidder and discharged by the Bidder in advance. The Procuring Entity shall ensure before accepting the Fixed Deposit Receipt that the Bidder furnishes an undertaking from the bank to make payment/ premature payment of the Fixed Deposit Receipt on demand to the Procuring Entity without requirement of consent of the Bidder concerned. In the event of forfeiture of the Performance Security, the Fixed Deposit shall be forfeited along with interest earned on such Fixed Deposit. vi. The successful Bidder at the time of signing of the Contract agreement, may submit option for deduction of Performance Security from each running and final bill @ 3% or percentage as specified by the finance department circular applicable, of the amount of the bill.
		6.4.4	Performance Security furnished in the form of a document mentioned at options i. to v. of Sub-Clause 6.4.3 above,

			shall remain valid for a period of sixty days beyond the date of completion of all contractual obligations of the Bidder, including defect liability period, operation and/ or maintenance period, if any.
		6.4.5	Failure of the successful Bidder to submit the above- mentioned Performance Security or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security. In that event the Procuring Entity may either cancel the procurement processor if deemed appropriate, award the Contract at the rates of the lowest Bidder, to the next lowest evaluated Bidder whose offer is substantially responsive and is determined by the Procuring Entity to be qualified to perform the Contract satisfactorily.
		6.4.6	Forfeiture of Performance Security: Amount of Performance Security in full or part may be forfeited in the following cases: -i. when the Bidder does not execute the agreement in accordance with ITB Clause 6.3[Signing of Contract] within the specified time; after issue of letter of acceptance; or ii. when the Bidder fails to commence the Works as per Work order within the time specified; or iii. when the Bidder fails to complete Contracted Works satisfactorily within the time specified; or iv. when any terms and conditions of the Contract is breached; or v. Failure by the Bidder to pay the Procuring Entity any established dues under any other contract; or vi. if the Bidder breaches any provision of the Code of Integrity as specified for the Bidders in the Act, Chapter VI of the Rules and this Bidding Document. Notice of reasonable time will be given in case of forfeiture of Performance Security. The decision of the Procuring Entity in this regard shall be final.
7. Grievance Handling Procedure during Procurement Process (Appeals)			
7	Grievance handling procedure during procurement process	7.1	Any grievance of a Bidder pertaining to the procurement process shall be by way of filing an appeal to the First or Second Appellate Authority, as the case may be, as specified in the BDS, in accordance with the provisions of chapter III of the Act and chapter VII of the Rules and as given in Appendix A to these ITB.

Appendix A: Grievance Handling Procedure during Procurement Process (Appeals)**(1) Filing an appeal**

(a) If any Bidder or prospective Bidder is aggrieved that any decision, action or omission of the Procuring Entity is in contravention to the provisions of the Act or the Rules or the Guidelines issued thereunder, he may file an appeal to the First Appellate Authority as specified in the Bid Data Sheet, within a period of ten days from the date of such decision, action, or omission, as the case may be, clearly giving the specific ground or grounds on which he feels aggrieved:

Provided that after the declaration of a Bidder as successful in terms of section 27 of the Act, the appeal may be filed only by a Bidder who has participated in procurement proceedings:

Provided further that in case a Procuring Entity evaluates the Technical Bid before the opening of the Financial Bid, an appeal related to the matter of Financial Bid may be filed only by a Bidder whose Technical Bid is found to be acceptable.

(b) After hearing the parties, the First Appellate Authority shall dispose of the appeal and pass an order within a period of 30 days of the date filing of the appeal.

(c) If the First Appellate Authority fails to dispose of the appeal within the period 30 days of the date of filing the appeal or if the bidder or prospective bidder or the procuring entity is aggrieved by the order passed by the First Appellate Authority, the bidder or prospective bidder or the procuring entity, as the case may be, may file a second appeal to the Second Appellate Authority as specified in the Bid Data Sheet, within fifteen days. The Second Appellate Authority, after hearing the parties, shall dispose of the appeal and pass an order within a period of 30 days which shall be final and binding on the parties.

(2) Appeal not to lie in certain cases

No appeal shall lie against any decision of the Procuring Entity relating to the following matters, namely:-

- (a) determination of need of procurement;
- (b) provisions limiting participation of Bidders in the bidding process;
- (c) the decision of whether or not to enter into negotiations;
- (d) cancellation of a procurement process;
- (e) applicability of the provisions of confidentiality.

(3) Form and procedure of filing an appeal

- (a) An appeal shall be in the annexed Form along with as many copies as there are respondents in the appeal.
- (b) Every appeal shall be accompanied by an order appealed against, if any, affidavit verifying the facts stated in the appeal and proof of payment of fee.
- (c) Every appeal may be presented to First Appellate Authority or Second Appellate Authority, as the case may be, in person or through registered post or authorised representative.

(4) Fee for filing appeal

- (a) Fee for first appeal shall be rupees two thousand five hundred and for second appeal shall be rupees ten thousand, which shall be non-refundable.
- (b) The fee shall be paid in the form of bank demand draft or banker's Cheque of a Scheduled Bank in India payable in the name of Appellate Authority concerned.

(5) Procedure for disposal of appeals

- (a) The First Appellate Authority or Second Appellate Authority, as the case may be, upon filing of appeal, shall issue notice accompanied by copy of appeal, affidavit and documents, if any, to the respondents and fix date of hearing.
- (b) On the date fixed for hearing, the First Appellate Authority or Second Appellate Authority, as the case may be, shall, -
 - (i) Hear all the parties to appeal present before him; and
 - (ii) Peruse or inspect documents, relevant records or copies thereof relating to the matter.
- (c) After hearing the parties, perusal or inspection of documents and relevant records or copies thereof relating to the matter, the Appellate Authority concerned shall pass an order in writing and provide the copy of order to the parties to appeal free of cost.
- (d) The order passed under sub-clause (c) above shall be placed on the State Public Procurement Portal.

Annexure**FORM No. 1****[See rule 83]****Memorandum of Appeal under the Rajasthan Transparency in Public Procurement Act, 2012**

Appeal Noof

Before the (First / Second Appellate Authority)

1. Particulars of appellant:

(i) Name of the appellant:

(ii) Official address, if any:

(iii) Residential address:

2. Name and address of the respondent(s):

(i)

(ii)

(iii)

3. Number and date of the order appealed against and name and designation of the officer / authority who passed the order (enclose copy), or a statement of a decision, action or omission of the Procuring Entity in contravention to the provisions of the Act by which the appellant is aggrieved:

4. If the Appellant proposes to be represented by a representative, the name and postal address of the representative:

5. Number of affidavits and documents enclosed with the appeal:

6. Grounds of appeal:

.....

 (Supported by an affidavit)

7. Prayer:

.....

Place

Date

Appellant's Signature

Section II: Bid Data Sheet**Contents**

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1. Introduction

ITB 1.1.1	NIT No: 15/ 2022-23 The Procuring Entity is: Additional Chief Engineer Water Resources Zone Jaipur
ITB1.4.1	The Joint Ventures are Not permitted
ITB 2.1.3	The price of Bidding document is Rs. 50000/- (Fifty Thousand Only) and it has to be paid in the following manner: Bidding Document Price Rs 50000 Fifty Thousand being non-refundable in the form of deposit online through eGRAS in favour of Executive Engineer Water Resources Division II Dholpur, payable at Dholpur, Processing fee of Rupees 1000 being non-refundable in the form of deposit online through eGRAS in favour of Managing Director Rajasthan Comp Info Services Limited (MDRISL).
ITB 2.2.1	For clarification purposes only, the Procuring Entity's address is: Additional Chief Engineer Water Resources Zone, Jaipur, Sinchai Bhawan, JLN Marg Jaipur. PIN Code – 302-017 Telephone 0141-2702353 Email address: acejpr.wr@gmail.com
ITB 2.2.2	(i) The pre bid conference will take place on 30/01/2023 at 2.30 PM in the Meeting Hall of Sinchai Bhawan JLN Marg Jaipur (ii) Site visit shall be conducted by the Executive Engineer Water Resources Division-II, Dholpur on Dated 24/01/2023.

2. Contents of Bidding Documents**3. Preparation of Bids**

ITB 3.2.1	The language shall be English
ITB 3.3.2	The Bidder shall submit the following additional documents with its Technical Bid: i. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in English language attested & authenticated by competent authority in India/or an agency appointed by GoI/GoR/other State Government for such certified translation works. ii. If the Bidder has submitting any documents, created or originating from outside the Republic of India, such as work experience certificate(s), financial detail(s), power of attorney(s), undertaking(s), documentary evidence(s), qualifying document(s), etc. (collectively "Foreign Documents") then the Bidder, before any such Foreign Document(s) are sent to India for the purpose of applying towards this Project, shall be required to get each and every page of such Foreign Document(s), duly authenticated/ embossed/ legalized/ notarized from the Indian Embassy/Indian High Commission situated in the country from where such Foreign Document(s) were created or are originating from. Such

	authentication/ embossment/ legalization/ notarization from the Indian Embassy/Indian High Commission shall also apply to all such document(s) that are in a language other than English, which shall compulsorily be required to be translated (as the true translated copies of the original) by a duly certified/ authorized /qualified Translator, supported by the affidavit of the said translator, certifying the correctness of the English translation. In case of any inconsistency between the original Foreign Document and its English translation, the latter shall prevail and be held binding on such Bidder. iii. However, in the case of Foreign Document(s) created or originating from countries that have signed, ratified, and have made operational the Hague Convention abolishing the requirement of legalization for foreign public documents, 5 October 1961 - "Hague Legalization Convention, 1961", the Bidders may affix an 'Apostle' sticker on each and every page of their Foreign Document(s) [including all commercial document(s) duly notarized]. Thereafter, the Bidder shall be compulsorily required to get all such "Apostilled" Foreign Document(s) approved, certified and attested from the Indian Embassy /Indian High Commission in that country where the 'Foreign Document(s)' were created or are originated from or the Ministry of External Affairs, Government of India, New Delhi and the Bidder/s shall follow any other norms/guidelines laid by the Ministry of External Affairs, Government of India, New Delhi. iv. For the purpose of interpretation and evaluation of the Bid, the certified English language translation shall prevail. Technical Schedules i. Tech Schedule-1: Method Statement ii. Tech Schedule-2: Construction Schedule iii. Tech Schedule-3: Subcontracting for Sub Contractors iv. Tech Schedule-4: Quality Assurance and Quality Control Plan v. Tech Schedule-5: Safety Plan vi. Tech Schedule-6: Environmental Quality Management Plan
ITB 3.3.3	The Bidder shall submit the following additional documents with its properly bound Financial Bid The Price Bid consists of Two parts as follows, schedule wise rate justification for each part required: i. After performing his own detailed design and estimation of quantities, The Bidder shall quote its lump sum Design Build Cost for implementing the Project as envisaged in Bid document more precisely as defined in Employer's Requirements for Design-Build part of the Project. <i>(The payment schedule shall be as per the provisions described under payment schedule).</i> ii. The defect liability period of this scheme is eight years after completion of project and the Bidder shall quote O&M cost for this period of eight years (other than Power cost) as follows: The Bidder shall quote Annual O&M Cost (other than Power Cost) of the Project components. This shall be a lump sum amount to be quoted including all escalations. (However, it is clarified that the actual payments by Employer during the Operation Service Period shall be made as per the provisions described under PCC) During project implementation on turnkey basis and O&M over 8-year period, all state and central duties, taxes, and other levies shall be paid by the Bidder/ Contractor and shall be factored in the Price Bid to be submitted by the Bidder.

ITB 3.5.2	The prices quoted by the bidder shall be fixed.
ITB 3.6.1	The unit rates and the prices shall be quoted only in INR
ITB 3.9.1	The bid validity period shall be 120 days from deadline for submission of bids.
ITB 3.10.1/ 3.10.2	A Bid Security / Bid- Securing Declaration shall be required. (i) For Registered eligible contractor with the department shall be required to deposit 1/2% of estimated cost of the work i.e., INR 3.53 crores (three crores fifty-three lacs) as bid security while bidding. For eligible registered contractor with other department, 2% of estimated cost (iii) i.e., INR 14.12 /- (Fourteen crore twelve lacs) seventy bid security shall be required to be deposited as bid security while bidding (iv) Bid- Security shall be deposited in the form of deposit through eGRAS/ demand draft/ banker's cheque, bank guarantee in the specified format from a Scheduled Bank in India, (v) Regarding Bid Security original document must be submitted physically in the office of Additional Chief Engineer Water Resources Zone Jaipur latest by date 17/02/2023 and time 02:00 PM.
ITB 3.11.1	The written confirmation of authorization to sign on behalf of the Bidder shall consist of: Registered Power of Attorney on Judicial Stamp Paper

4. Submission and Opening of Bids

ITB 4.2.1	The deadline for bid submission is: Date: -16/02/2023 Time: 6.00 PM
ITB 4.5.1	The bid opening shall take place at: Office of: - Additional Chief Engineer Water Resources Zone, Jaipur, Sinchai Bhawan, JLN Marg Jaipur. PIN Code – 302-017 Telephone 0141-2702353 Email address: acejpr.wr@gmail.com

5. Evaluation and Comparison of Bids

6. Award of Contract

ITB 6.4.2	The period within which the Performance Security is to be submitted by the successful Bidder and the Contract Agreement is to be signed by him from the date of issue of Letter of Acceptance is 10 Days.
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7. Redressal of Grievances (Appeals)

ITB 7.1.1	The designation and complete address of the First Appellate Authority is: (1) Chief Engineer Water Resources, Bhawani Singh Marg, Jaipur PIN Code – 302005 Telephone 0141-2227042 Email address :cewr@rajasthan.gov.in The designation and complete address of the Second Appellate Authority is: Additional chief Secretary Water Resources Department, Government of Rajasthan, Jaipur Telephone 0141-2227142 Email address: osd.wr@gmail.com
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SECTION-3 EVALUATION AND QUALIFICATION CRITERIA**Table of Contents**

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Section III: Evaluation and Qualification Criteria

The criteria to evaluate the financial bids of qualified bidders of this scheme shall be as under, no other methods, criteria and factors shall be used. The bidder shall provide all the information requested in the forms included in Section IV (Bidding Forms) and Schedules I to IX in Section VII (Price Schedule).

A. Financial Evaluation

In addition to the sub clause of ITB 5.10 the following criteria shall apply for evaluating the price bid of the bidders:

(1) Design and Build Cost:

Bidder shall be required to quote lump sum Design Build cost for implementing the project in INR for the Design Build part of the complete scheme as designed and analyzed by bidder as per detailed in work profile and Scope of work. Cost for construction of all the project components derived from schedule 1 to 6. However, for financial evaluation, individual cost of schedules shall not be considered, only total cost of price bid, comprising sum of all schedules shall be considered.

(2) Operation and Maintenance Cost:

Bidder shall be required to provide O&M services for the project assets for a period of 8 (eight) years after the completion of the scheme.

The bidder shall quote lump sum annual cost for O&M (other than power cost & receipts) of the project components. This shall be a lump sum amount to be quoted including all escalations during contract period. For the purpose of evaluation, price escalation of 7% shall be adopted and a discount factor of 10% shall be taken to find out the final multiplication factor. Accordingly, the annual O&M cost is to be discounted and escalated to evaluate price bid for the total O&M for the entire operation service period of eight years.

(3) Power Loading: -

Bidder will quote maximum daily Power requirement for main pumping stations contractors shall fill daily power requirement for all year's power requirement shall be calculated for 92 days in a year. for calculating the power cost escalation factor of 7% and discount factor 10% shall be applied to calculate the cost of O&M for each subsequent year. Power consumption for subsequent years shall not be less than previous year. Base rate of unit power has been considered Rs. 8.00

Computation of Evaluated Price Bid would be as under: -

Evaluated Price Bid = Design Build Cost + Evaluated O&M cost + Evaluated Power Cost

B- Technical Evaluation / Qualification**1.0 Adequacy of Technical Proposal**

Evaluation of the Bidder's Technical Proposal will include an assessment of the Bidder's technical capacity to mobilize key equipment and personnel for the contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail.

2.0 Qualification Criteria

Bidders fulfilling the eligibility criteria, as given below shall be considered technically responsive.

1. Eligibility:

Criteria	Requirement	Compliance Requirements				Documents
		Single Entity				Submission / Requirements
i) Nationality	Nationality in accordance with ITB sub Clause 1.4.2	Must meet requirement				As per forms ELI 1, ELI 2 with attachments.
ii) Conflict of Interest	No conflicts of interest in accordance with ITB Sub-clause 1.4.3	Must meet requirement				Letter of Bid
iii) Debarment/ Transgression by any Procuring Entity.	Must declare	Must declare				Declaration form given in the Bidding Document

2. Pending Litigation:

Pending Litigation	All pending litigation shall be treated as resolved against the Bidder and so shall in total not represent more than 50.0 percent of the Bidder's net worth.	Must meet requirement				Form LIT -1
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3. Financial Requirement:

Criteria	Requireme nt	Compliance Requirements				Documents Submission / Requirements
		Single Entity				
i) Historical Financial Performance	Submission of audited accounts for the last 7 years to Demonstrate the current soundness of the Bidders financial position and its prospective long-term profitability.	Must meet requirement				Form FIN-1 with attachments
ii) Average Annual Construction Turn over	Minimum average annual construction Turnover of Rupees Two Hundred Forty-Seven Crore and Six Lac only (247.06 Crore) as total certified payments received for contracts completed or in progress with in the last 07 years	Must meet requirement				Form FIN-2
	To calculate Weighted Average Annual Turnover on current price level weightage is to be considered as given in table	Financial	Annual Turn Over	Weighted Annual Turnover on current price level		
		2015-16	A	1.6 A		
		2016-17	B	1.5 B		
		2017-18	C	1.4 C		
		2018-19	D	1.3 D		
		2019-20	E	1.2 E		
		2020-21	F	1.1 F		
		2021-22	G	1.0 G		

iii) Financial Resources	Using Forms FIN-3 and FIN- 4 in Section IV (Bidding Forms) the Bidder must demonstrate access to, or availability of, financial resources such as liquid assets, unencumbered real assets, lines of credit, and other financial means, other than any contractual advance payments to meet: (1) The following cash-flow requirement Rs 70.59 crore quarterly, and (2) The overall cash flow requirements for this contract and its current works commitment.	Must meet requirement				Form FIN-3
	Net Worth (As on 31.03.22) (1/3rd of Average Annual Turn Over= 1/3 of 35% =11.67% of bid amount duly certified by Chartered Accountant	The bidder must have a minimum positive net worth of Rs. 82.36 Crore				

4. Experience:

Criteria	Requirement	Compliance Requirements				Documents Submission / Requirements
(i) General Construction Experience	Experience under construction contracts in the role of contractor, subcontractor, or management contractor for at least the last 7 financial Years prior to the Bid submission deadline.	Must meet requirement				Form Exp-I

(ii) Specific Construction Experience

Contract of similar size and nature	The bidder having experience of successfully completed and commissioned the similar works	Must meet requirement				Form EXP -2(a)
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	during last 7 years ending last day of month previous to the one in which application are invited should be either of the following: - 1. Three similar completed works costing not less than Rs 352.93 crore each work. (Attach certificate for required value of each work. - or 2. Two similar completed works costing not less than 282.34 crore each work. (Attach certificate for required value of each work) - or 3. One similar completed work costing not less than the Rs 247.05 crore each work. (Attach certificate) This / these completed or substantially completed work(s) shall include the executed quantities more than the following items mentioned below: -					
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Technical eligibility for specific quantities							
		S.No	Items Executed in completed Work	Single completed work	Two completed works	Three completed work	
		1	Supplying, Laying, jointing, testing, commissioning, of pressurized pipeline work (minimum 2000 mm diameter pipe)	Piped Network for 10.60 KM	Piped Network for 12.15 KM	Piped Network for 15.15 KM	
		2	Construction of intake well with pump house and all Hydro Electromechanical (HEM) works of at least 7.5 MW. Intake well dia (equivalent area) and height should be more than 15 m each.	must meet requirement			

Definition of Similar works:

Similar works means "work of supplying, laying, jointing, testing and commissioning of piped network with construction of intake structure, pumping station including all HEM with pumps" as per eligible quantities. The work which is completed in all respect including commissioning except final bill and defect liability period will be considered as similar completed work."

MOU Requirement

Bidder has to submit mandatorily a MOU with Pipe manufacturer size of 2500 mm dia HDPE pipe and a proof of manufacturing capacity of this size duly certified by any Government Agency.

5. Personnel:

S. No.	Position required	Educational Qualifications	Experience on similar work years / No	Mandated by the Single bidder				Total Personal
1	Project Team Leader	Graduate in civil Engineering desirable: project qualifications. management	10 years on Similar engineering works.					1
2	Civil Engineer	Graduate in civil Engineering	5 Yr. Similar engineering works.					1
3	Electrical Engineer (Grid and other Electrical Machinery Design)	Graduate in electrical Engineering	5 Yr Similar engineering works.					1
4	Mechanical Engineer	Graduate in mechanical Engineering	5 Yr Similar engineering works.					1

6. Bid capacity:

Bidders who meet the minimum qualification criteria shall be qualified only if their available bid capacity at the time of bidding is more than the total estimated cost of the works for which bid is submitted. The available bid capacity shall be calculated as under:

Assessed Available Bid Capacity: $(A \times N \times 2 - B)$

Where,

A= Maximum value of works executed in any one year during the last five years (updated to the current price level) taking into account the completed as well as works in progress.

N = completion period of the Works for which the bid has been invited in number of years, and

B = Value at current price level of the existing commitments and ongoing works to be completed during the next N years

7. Machinery & Equipment:**(a) list of Machinery & Equipment required**

S.No.	Equipment	Quantity of equipment's
1	Automatic Batching plant	1
2	JCB of Suitable capacity	4 No
3	Tippers, 12-40 T	10
4	Tractors with or without tankers/ trolleys.	10
5	Mechanical Mortar mixers	5
6	Steel centering shuttering and interlocking in sqm	400
7	Scaffolding	yes
8	Transit mixers for CC	2
9	Vibro Compactor	1 No
10	Trench less piping Augor Boring Machine	one
11	Mobile crane 20 MT	1
12	Mobile crane 5 MT	2

(b) list of survey equipment required

S. No	Survey Equipment	Minimum No. required.
1.	DGPS	1
2.	Total Station	1
3.	Auto Level with staff	2
4.	Measuring Equipment	As required.

Section IV: Bidding Forms

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4.1 Technical Bid [With reference to Section III] Check List

The Technical Bid/ Proposal must necessarily contain scanned copies of all the filled up forms of Technical Bid along with attested copies of the relevant referred documents as proof:

1	Letter of Technical Bid.
2	Details of Registration/ Incorporation of the Bidder as firm/ company/ society etc. including complete address, telephone/ fax/ mobile numbers, e-mail address etc. (enclose copies of certificate of registration/ incorporation issued by concerned authority like Registrar of Firms, Registrar of Companies, Registrar of Societies, etc., Memorandum of Association/ Partnership Deed/ By-laws/ others.
3	Power of Attorney/ Authority authorizing the person signing the Bid.
4	Enlistment details with address and contact details of the enlisting authority (enclose copy of Enlistment Certificate of appropriate class).
5	Permanent Account Number (PAN) Card issued by Income Tax Department.
6	GST Registration with GSTIN and latest valid tax clearance Certificate issued by concerned Commercial Taxes Authority of Rajasthan, valid up to January 31, 2023 (mention the required date).
7	Instrument of Bid Security/ Bid Securing Declaration instrument.
8	Receipt/ instrument of cost of Bidding Document.
9	Receipt/ instrument of bid processing fee.
10	Audited Statements of Accounts for the past 7 Financial Years
	Declaration by the Bidder regarding Code of Integrity, Conflict of Interest, Qualification and Eligibility.
	Bid capacity statement.
	Any modifications, substitutions, or withdrawal in the Bid.
	Financial details (except the Financial Bid) of the Bidder, as requested
	List of key personnel with recent signed CVs (along with recent colored photograph).
	List of mechanical and other equipment (owned or leased), as required, with proof of ownership or confirmed lease.
	List of laboratory equipment and personnel
	Mobilization Schedule.
	Construction Schedule (on MS Project or other similar software).
	Qualifying works experience.
	Construction safety plan (subject to safety audit).
	Method Statement.
	All Technical Bidding forms duly completed and digitally signed.
	Others considered necessary to strengthen the bid.
	List similar work experience
	list of specified quantity experiences
	Copy of The MOU with HDPE pipe manufacturer

Signature of Authorized Signatory

4.2 Letter of Technical Bid**Technical Bid Submission Sheet**

Date: NIB No.:

Alternative No., if permitted:

To:

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Document, including Addenda No.
- (b) We declare that we fulfill the eligibility and qualification criteria in conformity with the Bidding Document and offer to execute the following Works as per designs, drawings, specifications, terms and conditions:
- (c) Our Bid shall be valid for a period of 120 days from the date fixed for the bid submission deadline in accordance with the Bidding Document, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
- (d) If our Bid is accepted, we commit to obtain a Performance Security in the amount of percent of the Contract Price, or get it deducted from our running and final bills, or shall submit a Performance Security Declaration, as the case may be, for the due performance of the Contract;
- (e) Our firm, including any subcontractors or suppliers for any part of the Contract, have nationalities of India or other eligible countries.
- (f) We are not participating, as Bidder, in more than one Bid for this Works in this bidding process, other than alternative offers, if permitted, in the Bidding Document.
- (g) Our firm, its affiliates or subsidiaries, including any subcontractors or suppliers for any part of the Contract, have not been debarred by the State Government or the Procuring Entity.
- (h) 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.
- (i) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive;
- (j) We agree to permit Government of Rajasthan or the Procuring Entity or their representatives to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by them;
- (k) We declare that we have complied with and shall continue to comply with the provisions of the Code of Integrity including Conflict of Interest as specified for Bidders in the Rajasthan Transparency in Public Procurement Act, 2012, the Rajasthan Transparency in Public Procurement Rules, 2013 and

this Bidding Document during the procurement process and execution of the Works till completion of all our obligations under the Contract.

(l) Other comments, if any:

Name:

In the capacity of: _

Signed:

Date:

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

Complete Address

Tel: Fax:

E-mail:

4.3.1 Bid Security (Bank Guarantee Unconditional)

Form of Bid Security

[insert Bank's Name, and Address of Issuing Branch or Office] Beneficiary:

[insert Name and Address of Procuring Entity]

Date: *[insert date]*

BID GUARANTEE No.: *[insert number]*

We have been informed that *[insert name of the Bidder]* (hereinafter called "the Bidder") has submitted to you its bid dated *[insert date]* (hereinafter called "the Bid") for the execution of *[insert name of contract]* under Notice Inviting Bids No. *[insert NIB number]* ("the NIB").

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

At the request of the Bidder, we *[insert name of Bank]* hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of --

-----*[insert amount in figures] [insert 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) has withdrawn or modified its Bid after deadline for submission of bids, during the period of bid validity specified by you in the Bid Data Sheet (hereinafter "the BDS"); or
- (b) having been notified during the period of bid validity specified in the BDS, about the acceptance of its Bid by you,
 - (i) failed or refused to execute the Contract Agreement within the time period specified in the BDS, or
 - (ii) failed or refused to furnish the performance security, in accordance with the Instructions to Bidders (hereinafter "the ITB") within the time period specified in the BDS, or
- (c) has not accepted the correction of arithmetical errors in accordance with the ITB; or
- (d) has breached a provision of the Code of Integrity specified in the RTPP Act, RTPP Rules and the ITB.

This guarantee will expire: (a) if the Bidder is the successful Bidder, upon our receipt of copies of the contract signed by the Bidder and the performance security issued to you upon the instruction of the Bidder; and (b) if the Bidder is not the successful Bidder, upon the earlier of (i) our receipt of a copy of your notification to the Bidder of the name of the successful Bidder; or (ii) thirty days after the expiration of the validity of the Bidder's bid.

Consequently, any demand for payment under this guarantee must be received by us at the office on or before that date.

Signed:

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

Name:

[insert complete name of person signing the Bid Security]

In the capacity of:

[insert legal capacity of person signing the Bid Security]

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

[insert name of the Bank]

Dated on day of,

[insert date of signing]

Bank's Seal

[affix seal of the Bank]

4.3.2 Bid Securing Declaration

Form of Bid Securing Declaration

Date: *[insert date (as day, month and year)]*

Bid No.: *[insert number of bidding process]*

Alternative No, if permitted.: *[insert identification No if this is a Bid for an alternative]*

To: *[insert complete name and address of Procuring Entity]*

We, the undersigned, declare that:

We understand that, according to your conditions, bids must be supported by a Bid-Securing Declaration.

We accept that we will automatically be suspended from being eligible for bidding in any contract with you, *[insert designation of the Procuring Entity]*, for the period of time of *[insert number of months or years, as required by the Procuring Entity]* starting on *[insert date]*, if we are in breach of our obligation(s) under the bid conditions, more specifically, if we:

- (a) withdraw or modify our Bid after deadline for submission of bids, during the period of bid validity specified in the Bid Data Sheet (hereinafter “the BDS”); or
 - (b) having been notified during the period of bid validity specified in the BDS, about the acceptance of our Bid by you,
 - (i) fail or refuse to execute the Contract Agreement within the time period specified in the BDS,
 - (ii) fail or refuse to furnish the performance security, in accordance with the Instructions to Bidders (hereinafter “the ITB”) within the time period specified in the BDS,
 - (c) not accept the correction of arithmetical errors in accordance with the ITB; or
 - (d) breach a provision of the Code of Integrity specified in the RPPP Act, RPPP Rules and the ITB.
- We understand this Bid-Securing Declaration shall expire if we are not the successful Bidder, upon the earlier of (i) our receipt of your notification to us of the name of the successful Bidder; or (ii) thirty days after the expiration of our Bid.

We understand this Bid-Securing Declaration shall expire if we are not the successful Bidder, upon the earlier of (i) our receipt of your notification to us of the name of the successful Bidder; or (ii) thirty days after the expiration of our Bid.

Signed:

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

Name:

[insert complete name of person signing the Bid-Securing Declaration]

In the capacity of:

[insert legal capacity of person signing the Bid-Securing Declaration]

Duly authorized to sign the bid for and on behalf of:

[insert complete name and address of the Bidder]

Dated on day of ,

[insert date of signing]

Corporate Seal

[affix corporate seal of the bidder]

4.4.1 Personnel

Bidders should provide the names of suitably qualified personnel to meet the requirements specified in Section III (Evaluation and Qualification Criteria). The data on their experience should be supplied using the Form below for each candidate.

(a) Form PER – 1: Proposed Personnel

[As listed in Section III: Evaluation and Qualification Criteria]

S.No.	Title and Name

Signature of Authorised Signatory

(b) Form PER – 2: Resume of Proposed Personnel (attach a recent passport size coloured photo)

Position		
Personnel information	Name	Date of birth
	Professional qualifications (<i>attach a copy of Degree/Diploma</i>)	
Present employment	Name of Procuring Entity	
	Address of Procuring Entity	
	Telephone	Contact (Manager / Personnel officer)
	Fax	E-mail
	Job title	Years with present Procuring Entity

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

From	To	Company / Project / Position / Relevant technical and management experience

Signature of the person

Countersigned by the Bidder

4.4.2 Equipment

The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Section III (Evaluation and Qualification Criteria). A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.

Item of Equipment		
Equipment Information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current Status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment (Owned or Leased)	

Add the following information for equipment to be taken on confirmed lease by the bidder

Owner	Name of owner	
	Address of owner	
	Telephone	Contact name and title
	Fax	Telex /e-mail id
Agreements	Details of rental/ lease / manufacture agreements specific to the project	

Signature of Authorised Signatory

4.4.3 Site Organization:

[Comment on site office, Quality Control Laboratory, Procuring Entity's site office, labour camps, safety plan, Security, storage of material, enabling services etc.]

Signature of Authorised Signatory

4.4.4 Method Statement

[State the methodological process to execute the key items of works]

Signature of Authorised Signatory

4.4.5 Mobilization Schedule

[Preferably in the form of a bar chart]

Signature of Authorised Signatory

4.4.6 Construction Schedule

[On MS Project or other similar software indicating the critical path]

Signature of Authorised Signatory

4.5 Bidder's Qualification

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

4.5.1 Form ELI - 1: Bidder's Information Sheet

BIDDER'S INFORMATION	
Bidder's legal name	
Bidder's country of constitution.	
Bidder's year of constitution	
Bidder's legal address in country of constitution	
Bidder's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)	
Attached are attested copies of the following original documents: 1. certificate of registration/ incorporation and memorandum of association or constitution of the legal entity named above. 2. Authorization to represent the firm.	

Signature of Authorized Signatory

4.5.2 Form ELI – 2: Deleted

Signature of Authorised Signatory

4.5.3 Form LIT 1- Pending Litigation**(To be certified by the statutory auditors of the Bidder)**

Pending Litigation			
- No pending litigation in accordance with Section III (Evaluation and Qualification Criteria). - Pending litigation in accordance with Section III (Evaluation and Qualification Criteria)			
Year	Matter in Dispute	Value of Pending Claim in INR	Value of Pending Claim as a Percentage of Net Worth

Signature of the statutory auditors Signature of Authorized Signatory

4.5.4 Form FIN - 1: Financial Situation

Each Bidder must fill in this form
(To be certified by the statutory auditors of the Bidder)

Financial Data for Past 7 years in Rupees							
Year/Item	Year 1:	Year 2:	Year 3:	Year 4:	Year 5:	Year 6:	Year 7:

Information from Balance Sheet in Rupees

(Bidders from outside India, data to be converted at the exchange rate prevailing 28 days prior to the deadline of submission of the bids)

Total Assets				
Total Liabilities				
Net Worth				
Current Liabilities				
Other as required				

Information from Profit & Loss Account/ Income & Expenditure Statement

Total Operating Revenues / Income				
Profit /Excess of Income over Expenditure before Taxes				
Profit /Excess of Income over Expenditure after Taxes				
Charges as required				

Attached are attested copies of audited financial statements (balance sheets including all related notes, and Profit & Loss Account/ Income & Expenditure Statement) for the last 7 financial years, as indicated above, complying with the following conditions:

- All such documents reflect the financial situation of the Bidder not sister or parent companies.
- Historic financial statements must be audited by a chartered accountant.
- Historic financial statements must be complete, including all notes to the financial statements.
- Historic financial statements must correspond to accounting periods already completed and audited. (No statements for partial periods shall be requested or accepted).

Signature of the statutory auditors Signature of Authorized Signatory

4.5.5 Form FIN – 2: Average Annual Construction Turnover in Rupees**Each Bidder must fill in this form*****(To be certified by the statutory auditors of the Bidder)***

Annual Turnover Data for the last 7 years <i>(Construction works only)</i>	
Year	Amount-Rupees
2015-16	
2016-17	
2017-18	
2018-19	
2019-20	
2020-21	
2021-22	
Average Annual Construction Turnover	

The information supplied should be the Annual Turnover of the Bidder in terms of the amounts billed to clients for each year for work in progress or completed, at the end of the period reported. **To bring the earlier year's amount to the last financial year's level a multiplier of 1.08 per year may be applied**

Signature of the statutory auditors Signature of Authorized Signatory

4.5.6 Form FIN – 3: Financial Resources - Rupees

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject contract as indicated in Section III (Evaluation and Qualification Criteria).

FINANCIAL RESOURCES		
S.No	Source of Financing	Amount in Rupees

Signature of Authorised Signatory

4.5.7 Form FIN- 4: Current Contract Commitments / Works in Progress

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

CURRENT CONTRACT COMMITMENTS					
S.No.	Name of Contract	Procuring Entity's Contact Address, Tel., Mobile, Fax, e-mail id	Value of Outstanding work in Rupees	Estimated Completion Date	Average Monthly Invoicing during Last 6 months (Rupees per month)

Signature of Authorised Signatory

4.5.8 Calculation of Available Bid Capacity

Using the following formula the Bidder must calculate his available Bid Capacity:-

Assessed Available Bid Capacity: $(A \times N \times 2 - B)$

Where

A= Maximum value of works executed in any one year during the last five years (updated to the current price level) taking into account the completed as well as works in progress;

N = Number of years prescribed for completion of the works for which bids are invited, and

B = Value at current price level of the existing commitments and ongoing works to be completed during the next 2.5 years (period of completion of the work for which bids have been invited)

Signature of Authorized Signatory

4.5.9 Form EXP – 1: General Construction Experience**Each Bidder must fill in this form**

GENERAL CONSTRUCTION EXPERIENCE				
Starting Month Year	Ending Month Year	Years	Contract Identification and Name Name and Address of Procuring Entity Brief Description of the Works Executed by the Bidder	Role of Bidder

Signature of Authorised Signatory

4.5.10 Form EXP – 2(a): Specific Construction Experience**Note:** Please fill up one sheet per contract

CONTRACT OF SIMILAR SIZE AND NATURE		
Contract No of.....	Contract Identification	
Award Date		Completion Date
Role in Contract	Contractor / Management Contractor / Subcontractor	
Total Contract Amount	INR	
If partner in a JV or subcontractor, specify participation of total contract amount	Percent of Total	Amount
Procuring Entity's Name, Address, Telephone Number, Fax Number, E-mail address		
Description of Similarity in accordance with criteria 4(ii) (a), Section III		
Similarity, size, nature complexity [The Procuring Entity should insert here contract size, complexity, methods, technology or other characteristics as described in Section V (Procuring Entity 's Requirements) against which the Bidder demonstrates similarity in the box on the right- hand-side.]		

Signature of Authorised Signatory

4.5.11 EXP - 2(b) : Specific Construction Experience in Key activities

CONTRACT WITH SIMILAR KEY ACTIVITIES		
Contract No of.	Contract Identification	
Award Date		Completion Date
Role in Contract	Contractor / Management Contractor / Subcontractor	
Total Contract Amount	INR	
If partner in a JV or subcontractor, specify participation of total contract amount	Percent of Total	Amount
Procuring Entity's Name, Address, Telephone Number, Fax Number, E-mail address		
Description of the Key-activities in accordance with Criteria 4(ii) (b) of Section III		
[The Procuring Entity should insert here quantities/work(s) for the Key activities in the subject contract against which the Bidder demonstrates in the box on the right-hand-side. production rate(s) achieved by him on previous contracts)		

Signature of Authorized Signatory

4.6 Sample format for evidence of access to or availability of credit facilities**SAMPLE FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF CREDIT FACILITIES****BANK CERTIFICATE****Name of the Bank with Branch address**

Date

This is to certify that M/s is a reputed firm/ company with a good financial standing.

If the contract for the work, namely is awarded to the above firm, we shall be able to provide overdraft/ credit facilities to the extent of Rupees to meet their working capital requirements for executing the above contract during the contract period.

Signature

Name

In the capacity of

Telephone No. _Fax No. _E-mail

Seal of the Bank

4.7 Declaration by the Bidder in compliance of Section 7 & 11 of the Act**Declaration by the Bidder**

In relation to our Bid submitted to *[enter designation and address of the procuring entity]* for procurement of *[insert name of the Works]* in response to their Notice Inviting Bids No..... Dated we hereby declare under Section 7 and 11 of the Rajasthan Transparency in Public Procurement Act, 2012, that:

1. We are eligible and possess the necessary professional, technical, financial and managerial resources and competence required by the Bidding Document issued by the Procuring Entity;
2. We have fulfilled our obligation to pay such of the taxes payable to the Central Government or the State Government or any local authority, as specified in the Bidding Document;
3. We are not insolvent, in receivership, bankrupt or being wound up, not have our affairs administered by a court or a judicial officer, not have our business activities suspended and are not the subject of legal proceedings for any of the foregoing reasons;
4. We do not have, and our directors and officers not have, been convicted of any criminal offence related to our professional conduct or the making of false statements or misrepresentations as to our qualifications to enter into a procurement contract within a period of three years preceding the commencement of this procurement process, or not have been otherwise disqualified pursuant to debarment proceedings;
5. We do not have a conflict of interest as specified in the Rajasthan Transparency in Public Procurement Act, the Rajasthan Transparency in Public Procurement Rules and this Bidding Document, which materially affects fair competition;
6. We have complied and shall continue to comply with the Code of Integrity as specified in the Rajasthan Transparency in Public Procurement Act, the Rajasthan Transparency in Public Procurement Rules and this Bidding Document, till completion of all our obligations under the Contract.

Date: Signature of Bidder

Place: Name :

Designation:

Address:

4.8 Letter of Financial Bid**Financial Bid Submission Sheet**

Date: NIB No.:

Alternative No., if permitted:

To:

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Document, including Addenda No.:-
- (b) We offer to execute in conformity with the Bidding Document the following Works:
- (c) The total Price for our Bid, excluding any discounts offered, if permitted, in item (d) below is:
- (d) The discounts offered, if permitted, and the methodologies for their application are:
- (e) 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.
- (f) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.
- (g) Other comments, if any:

Name:

In the capacity of:

Signed:

Duly authorised to sign the Bid for and on behalf of: _

Complete Address

Date:

Tel: Fax: E-mail:

Transparency Act**Annexure A : Compliance with the Code of Integrity and No Conflict of Interest**

Any person participating in a procurement process shall -

- (a) not offer any bribe, reward or gift or any material benefit either directly or indirectly in exchange for an unfair advantage in procurement process or to otherwise influence the procurement process;
- (b) not misrepresent or omit that misleads or attempts to mislead so as to obtain a financial or other benefit or avoid an obligation;
- (c) not indulge in any collusion, Bid rigging or anti-competitive behavior to impair the transparency, fairness and progress of the procurement process;
- (d) not misuse any information shared between the procuring Entity and the Bidders with an intent to gain unfair advantage in the procurement process;
- (e) not indulge in any coercion including impairing or harming or threatening to do the same, directly or indirectly, to any party or to its property to influence the procurement process;
- (f) not obstruct any investigation or audit of a procurement process; (g) disclose conflict of interest, if any; and
- (h) disclose any previous transgressions with any Entity in India or any other country during the last three years or any debarment by any other procuring entity.

Conflict of Interest:-

The Bidder participating in a bidding process must not have a Conflict of Interest.

A Conflict of Interest is considered to be a situation in which a party has interests that could improperly influence that party's performance of official duties or responsibilities, contractual obligations, or compliance with applicable laws and regulations.

i. A Bidder may be considered to be in Conflict of Interest with one or more parties in a bidding process if, including but not limited to:

- a. have controlling partners/ shareholders in common; or
- b. receive or have received any direct or indirect subsidy from any of them; or
- c. have the same legal representative for purposes of the Bid; or
- d. have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the Bid of another Bidder, or influence the decisions of the Procuring Entity regarding the bidding process; or
- e. the Bidder participates in more than one Bid in a bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all Bids in which the Bidder is involved. However, this does not limit the inclusion of the same subcontractor, not otherwise participating as a Bidder, in more than one Bid; or
- f. the Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the Goods, Works or Services that are the subject of the Bid; or
- g. Bidder or any of its affiliates has been hired (or is proposed to be hired) by the Procuring Entity as engineer-in-charge/ consultant for the contract.

Annexure B : Declaration by the Bidder regarding Qualifications**Declaration by the Bidder**

In relation to my/our Bid submitted to for procurement of in response to their Notice Inviting Bids No Dated I/we hereby declare under Section 7 of Rajasthan Transparency in Public Procurement Act, 2012, that:

1. I/we possess the necessary professional, technical, financial and managerial resources and competence required by the Bidding Document issued by the Procuring Entity;
2. I/we have fulfilled my/our obligation to pay such of the taxes payable to the Union and the State Government or any local authority as specified in the Bidding Document;
3. I/we are not insolvent, in receivership, bankrupt or being wound up, not have my/our affairs administered by a court or a judicial officer, not have my/our business activities suspended and not the subject of legal proceedings for any of the foregoing reasons;
4. I/we do not have, and our directors and officers not have, been convicted of any criminal offence related to my/our professional conduct or the making of false statements or misrepresentations as to my/our qualifications to enter into a procurement contract within a period of three years preceding the commencement of this procurement process, or not have been otherwise disqualified pursuant to debarment proceedings;
5. I/we do not have a conflict of interest as specified in the Act, Rules and the Bidding Document, which materially affects fair competition;

Date: Signature of bidder

Place: Name:

Designation:

Address:

Annexure C : Grievance Redressal during Procurement Process

The designation and address of the First Appellate Authority is

The designation and address of the Second Appellate Authority is

(1) Filing an appeal

If any Bidder or prospective bidder is aggrieved that any decision, action or omission of the Procuring Entity is in contravention to the provisions of the Act or the Rules or the Guidelines issued thereunder, he may file an appeal to First Appellate Authority, as specified in the Bidding Document within a period of ten days from the date of such decision or action, omission, as the case may be, clearly giving the specific ground or grounds on which he feels aggrieved:

Provided that after the declaration of a Bidder as successful the appeal may be filed only by a Bidder who has participated in procurement proceedings:

Provided further that in case a Procuring Entity evaluates the Technical Bids before the opening of the Financial Bids, an appeal related to the matter of Financial Bids may be filed only by a Bidder whose Technical Bid is found to be acceptable.

(2) The officer to whom an appeal is filed under para (1) shall deal with the appeal as expeditiously as possible and shall endeavour to dispose it of within thirty days from the date of the appeal.

(3) If the officer designated under para (1) fails to dispose of the appeal filed within the period specified in para (2), or if the Bidder or prospective bidder or the Procuring Entity is aggrieved by the order passed by the First Appellate Authority, the Bidder or prospective bidder or the Procuring Entity, as the case may be, may file a second appeal to Second Appellate Authority specified in the Bidding Document in this behalf within fifteen days from the expiry of the period specified in para (2) or of the date of receipt of the order passed by the First Appellate Authority, as the case may be.

(4) Appeal not to lie in certain cases

No appeal shall lie against any decision of the Procuring Entity relating to the following matters, namely:-

- (a) determination of need of procurement;
- (b) provisions limiting participation of Bidders in the Bid process;
- (c) the decision of whether or not to enter into negotiations;
- (d) cancellation of a procurement process;
- (e) applicability of the provisions of confidentiality.

(5) Form of Appeal

- (a) An appeal under para (1) or (3) above shall be in the annexed Form along with as many copies as there are respondents in the appeal.
- (b) Every appeal shall be accompanied by an order appealed against, if any, affidavit verifying the facts stated in the appeal and proof of payment of fee.
- (c) Every appeal may be presented to First Appellate Authority or Second Appellate Authority, as the case may be, in person or through registered post or authorised representative.

(6) Fee for filing appeal

- (a) Fee for first appeal shall be rupees two thousand five hundred and for second 'appeal shall be rupees ten thousand, which shall be non-refundable.
- (b) The fee shall be paid in the form of bank demand draft or banker's cheque of a Scheduled Bank in India payable in the name of Appellate Authority concerned.

(7) Procedure for disposal of appeal

- (a) The First Appellate Authority or Second Appellate Authority, as the case may be, upon filing of appeal, shall issue notice accompanied by copy of appeal, affidavit and documents, if any, to the respondents and fix date of hearing.
- (b) On the date fixed for hearing, the First Appellate Authority or Second Appellate Authority, as the case may be, shall,-
 - (i) hear all the parties to appeal present before him; and
 - (ii) peruse or inspect documents, relevant records or copies thereof relating to the matter.
- (c) After hearing the parties, perusal or inspection of documents and relevant records or copies thereof relating to the matter, the Appellate Authority concerned shall pass an order in writing

- and provide the copy of order to the parties to appeal free of cost.
- (d) The order passed under sub-clause (c) above shall also be placed on the State Public Procurement Portal.

FORM No.1

[See rule 83]

**Memorandum of Appeal under the Rajasthan Transparency in Public Procurement
Act, 2012**

Appeal Noof

Before the (First I Second Appellate Authority)

1. Particulars of appellant:

(i) Name of the appellant:

(ii) Official address, if any:

(iii) Residential address:

2. Name and address of the respondent(s):

(i)

(ii)

(iii)

3. Number and date of the order appealed against and name and designation of the officer I authority who passed the order (enclose copy), or a statement of a decision, action or omission of the Procuring Entity in contravention to the provisions of the Act by which the appellant is aggrieved:

4. If the Appellant proposes to be represented by a representative, the name and postal address of the representative:

5. Number of affidavits and documents enclosed with the appeal:

6. Grounds of appeal:

.....

..... (Supported by an affidavit)

7.

Prayer:

.....

Place

Date

Appellant's Signature

Annexure D : Additional Conditions of Contract

1. Correction of arithmetical errors

Provided that a Financial Bid is substantially responsive, the Procuring Entity will correct arithmetical errors during evaluation of Financial Bids on the following basis:

- i. 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 Procuring Entity 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;
- ii. 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
- iii. 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 (i) and (ii) above.

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 or its Bid Securing Declaration shall be executed.

2. Procuring Entity's Right to Vary Quantities

- (i) At the time of award of contract, the quantity of Goods, works or services originally specified in the Bidding Document may be increased or decreased by a specified percentage, but such increase or decrease shall not exceed twenty percent, of the quantity specified in the Bidding Document. It shall be without any change in the unit prices or other terms and conditions of the Bid and the conditions of contract.
- (ii) If the Procuring Entity does not procure any subject matter of procurement or procures less than the quantity specified in the Bidding Document due to change in circumstances, the Bidder shall not be entitled for any claim or compensation except otherwise provided in the Conditions of Contract.
- (iii) In case of procurement of Goods or services, additional quantity may be procured by placing a repeat order on the rates and conditions of the original order. However, the additional quantity shall not be more than 25% of the value of Goods of the original contract and shall be within one month from the date of expiry of last supply. If the Supplier fails to do so, the Procuring Entity shall be free to arrange for the balance supply by limited Bidding or otherwise and the extra cost incurred shall be recovered from the Supplier.

3. Dividing quantities among more than one Bidder at the time of award (In case of procurement of Goods)

As a general rule all the quantities of the subject matter of procurement shall be procured from the Bidder, whose Bid is accepted. However, when it is considered that the quantity of the subject matter of procurement to be procured is very large and it may not be in the capacity of the Bidder, whose Bid is accepted, to deliver the entire quantity or when it is considered that the subject matter of procurement to be procured is of critical and vital nature, in such cases, the quantity may be divided between the Bidder, whose Bid is accepted and the second lowest Bidder or even more Bidders in that order, in a fair, transparent and equitable manner at the rates of the Bidder, whose Bid is accepted.

**Government of Rajasthan
Water Resources Department**

TENDER DOCUMENT

VOLUME -II

Procurement Entity Requirement

SECTION-V

For

Construction of Kaliteer Lift Scheme, Dholpur on Engineering, Procurement and Construction Basis (single Responsibility Turn-Key project) and its operation & maintenance for 8 years

January 2023

**Additional Chief Engineer,
Water Resources Zone, JLN Marg, JAIPUR**

Fax No. - 0141-2702353

E-mail - acejpr.wr@gmail.com

SECTION V –A:PROJECT PROFILE

Contents

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PROJECT PROFILE

1. Introduction :-

A careful examination of basin-wise availability and demand for all the river in Rajasthan suggest that only two river basins, namely Chambal and Mahi have surplus water which can be further harnessed for fulfilling various demands such as irrigation, drinking water, industrial water demand etc. It is in this context; it has been suggested to utilize the surplus yield of Chambal during Monsoon season to bridge the water gap between water supply and demand of drinking water needs of the befitted tehsils of Dholpur applying the principles of Integrated Water Resource Management (IWRM).

Dholpur District has seven Dams (Parbati Dam, Ramsagar Dam, Urmilasagar, Talabshahi, Husainpur, RT bundh, Umreh bundh). Presently the stored water of Parbati Dam is being used for providing Irrigation water in CCA of 24,667 Ha and 200 Mcft Water for drinking purpose. While other dams i.e. Ramsagar dam, Urmilasagar dam, Talabshahi are used only for irrigation purpose. Parbati Dam and Ramsagar dam are largest dams of Dholpur district. But due to lack of rainfall in the catchment of these tanks in recent years, these tanks are not being filled up to their full capacity. For irrigation farmers of three tehsils Baseri, Bari, Saipau of Dholpur district are totally dependent on Parbati Dam and Ramsagar dam.

Chambal River forms the boundary between Dholpur district and Madhya Pradesh. In Dholpur district, Chambal River enters in village Jhiri Tehsil Sarmathura and flow out from the district at village Silawat Tehsil Rajakhera. The Chambal River flow in Dholpur district in length of 145 km. The river Chambal originates from the Vindhya ranges near Mahow in the Indore district of Madhya Pradesh. It is the largest tributary of the Yamuna River. It joins the Yamuna near village Sahon of the Etawah district after a total travel of 960 km. The river flows in the northerly direction in its initial reach up to the Madhya Pradesh- Rajasthan border and north eastern direction thereafter up to the village Pinhat in U.P. from where it follows the south eastern direction up to its confluence with Yamuna. The important tributaries Chambal River are Sipra, Chhoti Kalisindh, Kalisindh, Parvati, Banas and Gambhir.

The supply of drinking water in Bari, Baseri, Sarmathura, Saipau Tehsil area is being done by ground water and the ground water is continuously lowering down and Dholpur district is already in dark zone. There is a big problem to provide the drinking water into these areas. At present 200 Mcft water from Parvati dam is kept reserved on priority for drinking purpose and rest of the available water is used for Irrigating the CCA of 24667.0 Ha. PHED has demanded total 1548 Mcft water to meet out the drinking water requirement of the Bari town, Baseri town, Sarmathura town and their villages. Thus additional 1348 Mcft water is required for drinking purpose.

The Gross capacity of Parbati dam is 4269.49 Mcft and of Ramsagar dam is 1088.75 Mcft. As per the study of last 15 years (2004 to 2018) gauge data of Parbati Dam and Ramsagar dam, most of years these dams are not filled up to their full capacity.

As these dams are not filled most of the years, it is not possible to spare 1348 Mcft of water to meet the drinking

water requirement of Dholpur district therefore, it is planned to make integrated project to fill Parvati dam & Ramsagar dam and to save 1348 Mcft by transforming existing command of Parvati dam and Ramsagar dam jointly from flow irrigation to micro irrigation.

Under this lift scheme it is proposed to lift the surplus water available in Chambal River during rainy season and fill the Ramsagar dam and Parvati dam to ensure the availability of 1348 Mcft drinking water at 90% dependability without losing the existing CCA of Parvati dam and Ramsagar dam. Required water is proposed to be saved by transformation of existing command of Parvati dam & Ramsagar dam, from flow irrigation to micro irrigation.

This scheme will ensure availability of 1348 Mcft water for drinking purpose without losing the established command of both the projects. Based on the preliminary study done by WRD and WAPCOS Ltd under the present scheme, surplus run off generated from Chambal River basin will be utilised for Bari town, Baseri town, Sarmathura town and their villages in the district of Dholpur.

In this scheme, it is proposed to lift the flooded water from Chambal River near village Kaliteer, Teh. Sarmathura, P.S. Baseri, district Dholpur (Raj) during only rainy season i.e., from 1st July month to 30th September every year and to fill these tanks through pressure pipes and gravity natural drains.

An intake structure will be constructed in Chambal river and water will be lifted by approximately 176 m and will be released into Bohre ka Taal (a natural pond constructed in state time) through pressure pipe about 8.4 km from Kaliteer village. For RamSagar dam, the water will flow about 17 km through natural drain from Bohre ka Taal and for Parvati Dam, water will flow through pipeline (pressure flow) about 2.6 km ahead from Bohre ka Taal and after that about 15 km through natural drain. It may be worthwhile to point out that Chambal River itself has been declared National Crocodile sanctuary, Intake structure will be in this Sanctuary, Pressure pipelines along with necessary civil structures & inspection roads will also run through forest area therefore necessary approvals need to be taken from wildlife/forest and MoEF. Further, this scheme will require conversion of existing field irrigation system to piped irrigation/micro irrigation order to reduce the irrigation water demand to be subsequently utilized for drinking water needs.

2. OBJECTIVE OF THE ASSIGNMENT

The objective of the proposed project is to provide safe drinking water to targeted population of Dholpur district particularly in Bari, Baseri, Sarmathura, Saipau & Dholpur Tehsil areas by adopting a holistic approach. The proposed scheme not only aims to improve its health and living condition but at the same time ensuring water quality and environmentally sustainable development for the targeted populace. It is with these objectives in mind, some of the structural interventions in the form of Intake structures and water conductor system are proposed for this purpose to augment on the supply side and on the other side making the demand side efficient in order to bridge the deficit.

Note: all the figures and dimensions are tentative to be finalized by the contractor after detailed design, drawing and estimation and will be approved by the competent authority.

INTAKE STRUCTURE	
(a) Location	Near Village Kaliteer, Tehsil –Sarmathura, District -Dholpur
(b) Lat/Long	26° 24' 42.63" N / 77° 29' 32.15" E
(c) Type & Size	Motorized Gated RCC Intake well of about 42.50 x 13.00 meter, with provision of trash rack, gratings etc Floor RL is to be kept about 133.00 m
(i) Intake well cum pump house	
(a) Location	Chambal river Bank near village Kaliteer
(b) Lift	84.00 m Approximately
(c) Pump house floor level	157.00 m approx.
(d) Intake well floor level	133.00 m approx
(e) working hour	maximum 16 hours per day
(ii) 2nd Pump house	
(a) Location	About 7.20 km away from Intake well cum pump house
(b) Lift	92.60 m Approximately
(c) Pump house floor level	217.00 m approx.
(f) HFL river Chambal at Dholpur	146.57 m
(g) No of Pumps	6 (Tentative) at intake pump house and 6+2 at another pump house
(i) Working	4 (Tentative) at intake pump house and 4+1 at another pump house
(ii) Stand by	(50.0 %)
(i) Total discharging capacity of intake pumping station in Cumecs.	20.00 cumecs
TRANSMISSION MAINS	
(a) Type	MS / HDPE pipes are to be used as transmission mains
(b) Size	Max up to 2500 mm
(c) No of Row	2 row of MS / HDPE pipes (as per design)
(d) Length	As per design
(e) Valve Arrangement	As per design and specification

3. SURVEY & INVESTIGATIONS

The following surveys and investigations have been conducted for the purpose of preparation of the project report: -

- 1) The Aerial survey for the Alignment area
- 2) Investigation for Construction Materials

No good sand is available near the project site. Suitable sand (Banas / M sand) can be used for all construction purpose. For useable stones/Aggregates and other material contractor needs to Investigate in the area and will get the approval from the engineer in Charge.

- 3) Seismological Conditions

No earthquake has been experienced as far as per the information available. But the contractor needs to consider the earthquake effect as categorized by B.I.S. or other competent authority as approved by the vetting authority.

4) Geological Study of Intake and Pumping Station Site

Geological investigation for DPR stage was done and conclusions and recommendations have been used for DPR estimation. These investigations are for only DPR stages, and all investigation required for construction stage will be carried out by the bidder.

Available Geological and Soil investigation reports may be seen in division office during office hours. However, all required investigation are to be carried out by the bidder, necessary for project

4. DISPOSAL AREA

The disposal of excavated material its utilization and clearance of site would be an integral part of the work and would be attended by the contractor during execution. and shall be complying with the conditions of MoEF, NBWL

5. CLIMATE AND WORKING PERIOD

The project has hot climate with extremes of temperature variation. In summer extreme temperature goes up to 48°-49° C and in winter the minimum temperature dips to 0° C. During the months of June to Sept. it rains in the project area. The humidity variation is 12 to 90%

6. CONSTRUCTION SCHEDULE

The project is planned to be commissioned in a maximum time period of **30 months** including time required for all infrastructure works and construction facilities etc.

It is proposed to start construction of Intake structure and Pumping station immediately after approval of drawings and initial mobilization of construction equipment Materials workshop facilities etc.

The work on all hydro-mechanical equipment and electro-mechanical equipment's of the project is proposed to be taken up along with the respective Civil work. Construction needs to take up design, drawing, planning, estimation of system accordingly.

7. LAND

Private Land and forest land required for the project falls in Chambal crocodile sanctuary. Department has submitted the proposals for permission for using 4.239 ha land in wildlife sanctuary and required 14.8859 ha. forest land for diversion has been submitted online on MoEF website portal. Although, the online proposal of diversion of forest land and wild life has submitted, but during the process of clearance the necessary documentation logistic support has to be given to department by bidder and that will be the integral part of scope of work also. The necessary documentation/proposal for land acquisition process is to be prepared by bidder

8. INFRASTRUCTURE WORKS

Development of residential facilities for the owner are to be created under this agreement.

A) ROADS

Approach roads to site do not exist. Local roads and haul roads required for the work must be constructed and

maintained by the contractor. However, the site is located within **30 KM** from NH11B.

B) ELECTRICITY POWER

The contractor shall have to make his own arrangement for assured continuous electricity power during construction.

9. ENVIRONMENTAL ASPECT

The proposed structure is not going to have any significant effect in the present ecological balance except some slight disturbance to wildlife during construction and noise creation during operation of pumps.

Therefore, noise control mechanism needs to be adopted for attenuation of noise during operation. Conduction of EIA study of the project will be responsibility of contractor. All stages of EIA study including Clearance from various departments and Ministries will also be a part of scope of work.

10. FOREST LAND

14.8859 ha forest land will be utilized in the construction of all units of the project such as intake structure & pipeline etc. Proposals for the diversion of forest land if required other than above will be submitted by the bidder as and when required. Bidder will also pursue the case of diversion at all stage and will obtain necessary clearance

11. STATUS OF CLEARANCES

- (i) Water Resources Department accorded administrative and financial sanction of the project.
- (ii) Additional Chief Engineer WR Zone Jaipur has accorded technical sanction of the work
- (iii) Forest Clearance is under approval
- (iv) Wildlife Clearance is under approval

SECTION V –B: SCOPE OF WORK

Part-I Design Build Part

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SECTION V-B: SCOPE OF WORK

SECTION VB- PART IST: DESIGN BUILD PART

The Object of this BID is for Planning, designing and Execution of Kaliteer Lift Scheme to lift 20 Cumecs water from Chambal River from 1st of July to 30st September for Every Year. The system is supposed to work 16 hours daily for above period.

To run the project an intake structure in Chambal River near Kaliteer along with Pump House and all necessary HEM works, centrally controlled/ monitored by PLC/SCADA, laying, jointing, commissioning & testing of main pipe line Will Be Executed. After completion of this scheme defect liability period for this scheme is 8 year and Operation& maintenance of the project during defect liability period is also a part of the scope of this work.

The contract is an Engineering, procurement, and construction (EPC) basis with single Responsibility turnkey project. This part describes extent of works and Employer's requirements for works in brief which includes survey, investigation, planning, design, construction, supply, installation, testing, trial run and commissioning of works and thereafter Operation and Maintenance services for 8 years for the entire works from commissioning date to contract completion date and as per the stipulations of the bid document.

The contractor shall ensure the techno economic feasibility of the offer submitted after visiting the site. The Contractor shall be required to design and execute every such item(s) of work(s) which are considered required or necessary for the satisfactory completion and functioning of the entire work during design life of the system. Even if any items of work are not specified in this bid document, but are essential as per standard practices, provisions of relevant Indian and International specifications to complete the works, contractors will execute the same.

The Scope of work includes but is not limited to all necessary topographical survey, sub soil and other geo-technical investigations and other site investigations, detailed design including hydraulic, process & instrumentation, layout plan, structural design, GA & structural drawings, equipment design, development and preparation of detailed structural, working and fabrication drawings for civil, electrical, mechanical, instrumentation system, water pipelines, and detailed structural steel fabrication drawings, preparation of design report of manufacturer and testing, at places of manufacture, painting, packing, transport, delivery, supply, storage, erection, building in, setting to work, commissioning, testing, painting, lining and finishing after erection of all works, including pumps, pumping installations, machinery apparatus, flow meters at various installations, pump station pipe work, lifting, handling and ventilation equipment, electrical equipment, instrumentation, automation including SCADA control, lighting systems, electrical sub-station, earthing and lighting protection systems, materials, articles, fittings and accessories, ancillaries, ancillary works, enabling works of all kind and nature required for the installations, of the highest possible operative standards and for compliance with the standards prescribed in the specification and with the particulars and guarantees given by the contractor. The Contractor shall, to the maximum extent practical and feasible, endeavor to standardize on the manufacturing and supply of Plant and equipment so as to minimize the maintenance requirements. The Contractor shall ensure that his designs are "maintenance friendly" and that all items of Plant and equipment are designed and installed in a manner which will facilitate routine and periodic maintenance operations.

All works, plants, equipment etc. shall also conform to specifications incorporated in the bid / the best Indian/ international standards and latest industrial practices. All materials and services required for procurement of the whole works shall be provided by the Contractor. Thus, the works included under this contract require survey, investigation, planning, design, inspection, supply, installation, and commissioning within 30 months from contract commencement date and Operation and Maintenance for eight years from successful commissioning date till issue

of contract completion certificate.

The Employer/Employers Representative provides details for lump sum works as reference in the Bid. The Contractor shall review Employer/Employers Representative's data, designs and come up with its own designs for the intake structure, siltation well, main pumping station,, electrical equipment, , and all other associated works, based on the design . Once the drawing and design are approved by employer, the changes shall be considered only due to compelling site conditions or unforeseen technical reasons, subject to the revised approval of the Employer/Employers Representative or its authorized representative.

The designs and drawings as formulated by the Contractor shall be subject to approval by the Employer/Employers Representative .The Contractor shall be responsible for any discrepancies, errors or omissions in the specifications, drawings and other technical documents, desired output/performance of the Works, whether specifications, drawings and other documents have been approved by the Employer/Employers Representative or not, provided that such discrepancies, errors or omissions are not because of inaccurate information furnished in writing to the Contractor by or on behalf of the Employer Representative. Contractor shall not deviate from the specifications prescribed by the Employer Representative unless the proposed changes will result in better performance and cost effectiveness.

1. KEY COMPONENTS OF THE SCHEME:

Scope of work of this Scheme include following key components but not limited to:

- i. Survey, investigation, planning of complete scheme identification of land coming under forest and land to be acquired either on temporary / permanent basis as per prevailing Acts / Rules.
- ii. Preparation & submission of the relevant documents including field work for acquiring the land required for project on temporary / permanent basis as per Rajasthan Land Acquisition Rehabilitation and Resettlement Act 2013 or any other prevailing Act. The Department as per the award issued for Land acquisition will pay compensation.
- iii. Bench marking and Water Auditing study for the scheme to be conducted for complete operation period for the parameters / indicators finalized in consultation with EiC. For this work suitable formats in Excel sheet are to be developed and linked with the output data of SCADA.
- iv. Energy audit is to be conduct for the pump house and pump rooms.
- v. Physical model of 8' x 5' of the complete scheme displaying all the features is to be prepared on fibre board or any other suitable material.
- vi. Animated 5-minute walk through video of the complete scheme displaying all features of complete scheme is to be developed on 3DS Max or any other suitable software before starting of work.
- vii. Planning,Design, drawing and estimation of various project components including, hydraulic design of pipe network. Design of Civil, Electrical, Mechanical, and Instrumentation equipment's of the scheme and to get them vetted / approved from the authorized representative of Employer before start of execution of work.
- viii. Intake structure in Chambal River of 20 Cumec discharge carrying capacity fitted with Motorized dual gate arrangement and sludge removal arrangements (Trash rack, SS screens and sludge Pump etc.) including necessary protection works for removing unwanted material like floating material, grit, debris, silt etc.
- ix. Siltation well with sludge removal arrangements adjoining the sump well cum Pump house.

- x. Construction of RCC main Sump well, Intake wall cum pump house & another pump house being to accommodate installation of vertical turbine pumps, motors, control panels and other equipment's & Accessories.
- xi. Supplying, Installation, testing and commissioning of Pumps, Motor including all Hydro, Electro-Mechanical works and instrumentation for both pump houses. Electromechanical works includes main items but not limited to following: -
 - a) Switch yard 33 KV/6.6KV substation
 - b) Pumps and Motors are to be provided for having 50% standby capacity of the pump houses as per design requirement.
 - c) Electrical works include switchgear room/ control room/ metering room, control panel, illumination system, earthing, lightening and other equipment's of pumps, rail track, cable tray, cables, bus trucking, HT jointing kit etc.
 - d) Mechanical works include supplying and fixing of sluice valve, butterfly valve, scour valve, discharge valve, NRV, actuators, dismantling joint, Flow meters, Pr switch, Pressure transmitter, Pressure gauge including supply, fixing all pipe and specials, testing and commissioning of all items under electromechanical works required for Intake well Pumping Equipment's and all electro-mechanical equipment's, auxiliaries complete in all respect.
- xii. Supplying, Trenching, Laying, Testing and Commissioning of MS / HDPE pipe Mains, up to natural drains with suitable dia as per design along with motorized valves, Air Valve, scour valve, Surge control valve, PRV, NRV, Isolation valves, Expansion/ Contraction Joints) / Electromagnetic flow meters, Anchored block, Thrust Blocks, RCC Valve chambers etc. required for safe, efficient, and economical operation.
- xiii. Dia. and Type of material of M.S. and HDPE pipeline will not change substantially from their original/initial drawing enclosed with the bid i.e., starting one and half km length will be of MS pipeline and rest will be of HDPE pipeline. The length of MS pipe may vary approximately 500m depending upon location/design of intake structure.
- xiv. Construction of BT roads 3.75 meter wide for AA class loading, along the pipeline connecting both pump houses, intake well and pump house campus for ease of usability and operation & maintenance
- xv. Construction of 3.75 M CC internal road within both pump house campus connecting pump house to residential and non-residential buildings and other project units.
- xvi. Plantation and landscaping in both campus.
- xvii. Construction of boundary walls with wire fencing.
- xviii. Street lighting on connecting roads and internal roads
- xix. construction of tube well of suitable size along with suitable capacity pumps for providing Drinking water lines to residential and non-residential buildings.
- xx. From 415 Volts substation power shall be made available to residential, non-residential and guest house through LT lines. Contractor must include all the electrical items required.
- xxi. Construction of residential buildings in plinth area of about 2161.00 sqm with A- class specification.
- xxii. Construction of fully furnished non-residential buildings in plinth area of about 4282.00 sqm with A- class

specification.

- xxiii. One more Pump house will be constructed at approximately 7.20 km far from intake well with a water retention tank of requisite capacity of RCC/CC/Block tile as designed for at least 10 minutes retention period, and also required an outflow channel to nearby natural drain/nallah.
- xxiv. Procurement of following vehicles with driver during design build and O&M period:
 - a) Sedan Cars of above 1200 CC -03 no (A/C)
 - b) Innova car or equivalent – 1 no
 - c) Bolero Jeep (A/C)-05 no's, 4x4 gear arrangement is required at site
- XXV.** Bidder shall submit architectural plan prepared by an architect for residential and nonresidential buildings
- xl. Procurement of minimum three sets of tool & tackles as per the list enclosed in the detailed scope of O&M plan and it is to be handed over to EiC at after completion of operation period.
- xli. Operation & Maintenance including of the complete scheme including Civil, Electrical, Mechanical, PLC-SCADA, Instrumentation for eight years commencing after date of commissioning of complete system.

DETAILED SCOPE OF WORK - SURVEY, INVESTIGATION, PLANNING, DESIGN & DRAWINGS

2. SURVEY & INVESTIGATION AND PLANNING

SURVEY WORK: -

Department has already conducted the Aerial survey for project area which includes location of the Intake structure, Pump house etc. Contractor shall be provided this data and digitized cadastral map of surveyed area. as per daily available water (20 Cumecs), total withdrawal time (July to September), efficient functioning of pumps, economical sizes of pipes and over all sustainability of whole system. Based on contour map and digitized cadastral map contractor shall plan/ finalize the location of Intake structures, alignment of piping from intake structure to Pump house, Mains pipe network, If there is any discrepancy or data gap in the available contour map, digitized cadastral map etc., contractor will verify the data from field by conducting survey by total station or aerial survey, data regarding land details such as etc. from revenue department. At the time of execution of work, in case survey of any additional area is required, the same shall be done by the contractor. It all will be a part of scope of work.

INVESTIGATION WORK: -

All types of soil investigations, material test before and during construction shall be done as per requirement of relevant IS and international standards. All available studies and investigation conducted by department so far will be made available to the contractor. SPT/ Plate load test at Intake structure, Pump house and siltation well shall be carried out by the contractor for acquiring the requisite data for designing the structures. For Installation of pipelines, soil conductivity/ resistivity and other tests are also to be conducted.

2.3 PLANNING, DESIGNING DRAWING WORK & QUANTITY ASSESSMENT: -

Detailed engineering including design, drawing, estimation and testing of all structures Like intake structure pump house, pumps, motors, machinery, mains, sub mains, PLCSCADA, all civil, electrical, mechanical and electronics appurtenances shall be done, got vetted from the authorized representative as decided by client and shall be submitted to competent authority for approval. life cycle cost calculation including energy consumption for design period and all recurring costs shall be done for all the electrical and mechanical parts of work and optimum alternative shall be adopted.

Design calculations, drawings and quantity assessment shall be submitted in sequence as per a schedule to be drawn and agreed upon mutually, immediately after submission of the general arrangement drawings. for each component of the System, and for the System as a whole, these documents shall cover :

- Process design, system design and layout of the Intake structure, Siltation well, Sump cum Pump house, and pump house No.1 mains, sub mains, pipe network system including various types of valves, thrust Blocks, anchored blocks, water hammer devices, flow measuring devices, PLCSCADA system for control/monitoring of distribution system and pumps, power system Works, Buildings, roads and related facilities including making provision for future expansions to meet the ultimate design capacity.
- Site plans
- Layout plans
- Architectural Drawings/ Renderings
- Foundation Plans
- Pipeline Plans and L-sections.
- Detailed structural design and good for execution drawings pertaining to all components of the system
- Drawings showing the size, position and other necessary details of all mechanical and electrical equipment and fixtures
- Wiring diagrams, pressure control and motor control gear particulars.
- Details or foundations, position of openings, etc. for the pumps, motors, starting cubicles, LT/HT panels etc.
- Power systems transmission system design from GSS of JVVNL Dholpur 415 V Switch yard in the pump house premise including sub stations/switch yard and associated drawings (e.g., single line diagram GA and sections, etc.)
- Route survey, tower spotting, geo-technical survey, foundation design for different soil types, lattice tower structure design
- Elementary diagram and manufacturer's shop and part drawing for each equipment's
- Service like internal illumination and ventilation, buildings water supply, sanitation and plumbing, service road, landscaping, area lighting, etc.

Any other design and drawings required to comply with the Employer's Requirements, some of the basic design direction for the bidder shall be bidding as under: -

- 1 All the designs and drawings are to be got vetted from any IIT/NIT and will be got approved by the Additional Chief Engineer water Resources Zone Jaipur or any other authority as decided by employer. Any modifications suggested by the competent authority shall be implemented and the contractor is not entitled for any extra payment on account of these changes and the bid price quoted is deemed to have included all these aspects.
- 2 All the design features/ levels shown in the drawings are only indicative; all other parameters shall be finalized in consultation with competent authority after submission of design & drawings by the contractor to client.
- 3 All the works to be executed by the contractor as per Designs & drawings of main components of work are to be approved by the competent authority (Additional Chief Engineer Water Resources Zone Jaipur).
- 4 Whenever and wherever the Employer desires, certain issues for expert technical advice from third party, the relevant memoranda to the effect shall be prepared by the Contractor and he will assist the department in getting it vetted from the desired agency.
- 5 The all concrete, masonry and steel structures shall be designed to withstand seismic disturbances as proposed by BIS & Competent authorities. The Contractor shall be required to incorporate the results of detailed analysis using all reasonably available seismic data and demonstrating the determination of seismic design parameters in accordance with this criterion. If required field tests for determining seismic

parameters shall be conducted by the contractor. The Contractor shall take full responsibility of the Design Seismic Parameters of the Project

LAND ACQUISITION

The proposals for permanent / temporary acquisition of Private land required for laying pipe network, construction of proposed Valve Chambers, , Electric sub stations and other structures are to be prepared by contractor as per Rajasthan Land Acquisition Act 2013 & other prevailing Act and he will assist EIC & LAO in speedy acquisition of land. The query/details desired by the department / Land acquisition authority shall be attended by the bidder in time. Contractor is bound to facilitate land compensation process by providing input and assistance to the Land Acquisition Officer and Department. Proposals for acquirement of land shall be processed by the employer's representative. Similarly, proposal for diversion of forest land required shall also be prepared by the contractor. However, all kind of payment against the award issued by LAO for temporary / permanent Land acquisition shall be made by the department. For laying the Piped network land is to be acquired temporarily and for that proposals for acquisition of land required are to be prepared by the contractor under prevailing act / rules, up to the satisfaction of Engineer-in-charge and Land acquisition authority and cost of such type of temporary land acquisition and crop compensation shall be paid by the department. The execution of work will be subject to land acquisition process within stipulated time period. The work of land acquisition process will also be dealt side by side by the bidder with the pace of execution.

Forest and Wildlife Clearances :-

The forest and wildlife clearance proposals of the work are in under approval with MoEF at an advance stage. The bidder is supposed to be well acquainted about the process and provide necessary logistic and professional support to get an early clearance. This is an integral part of the scope of the work.

3. HEAD WORKS

INTAKE STRUCTURE

The main Head works proposed to be constructed for this scheme are Intake well cum pump house, sump well, pump Houses, retention tank etc. The roof of intake well is to be kept at safe level. It is proposed to construct Intake well at the left bank of Chambal River with appropriate motor operated dual gated inlet arrangement and screening arrangements. Design inlet of Intake structure to carry twice the design discharge capacity of the system i.e 40 cumec. Trash rack, SS Screening and Sludge pump are to be designed and provided accordingly for desilting the Intake structure. Gates should be designed watertight to stop/ minimize entry of silt during idle season

Another pump house will be constructed at approx. 7.70 km far from Chambal river with constructing a retention tank. The capacity of this retention will be equal to the water of at least 20 minutes retention.

SUMP WELL CUM PUMP HOUSE

The proposed sump well/Pump House is proposed on Left bank of the Chambal river near village kaliteer.. For detailed design purpose, block-leveling survey of pumping station sites is to be done at the time of execution. 1st Intake well and pumping station has been proposed at bank of Chambal River, now that area lies under crocodile wildlife centaury and 2nd pump house has been proposed at 7.70 km far from Chambal River

The both pumping stations shall be adequate to accommodate required no. of pumps, valves, SCADA compatible measuring devices and other accessories, panel board, working area for maintenance of pump sets, facilities for proper O&M, cable ducting, pump foundation, pipes support, valve supports, floor drainage arrangement for draining the water from outside the Pump House, delivery pipeline connections, provision is to be made for sufficient ventilation, lighting to Pump House with exhaust arrangement. Access between floors shall be provided

through RCC staircase / ladders. The Pump House shall be designed to maintain the noise level inside the Pump House within the permissible limit and to absorb vibration of pump sets while running. The P.H. bottom level is to be provided considering bottom of suction pit of sump for positive suction. Further as the Pump House, Panel Room shall be adjoining to sump, necessary RCC retaining wall/structure shall be provided to withstand the loads as per design requirements. All the pump activities are to be monitored and controlled through PLC-SCADA. The Pump House should be of RCC frame structure square/circular shape depending on hydraulic performance of pumping constructed in minimum M-25 grade concrete. The grade of reinforcing steel in the sump / suction chamber structure shall be of TMT steel. The design of the Pump Houses and its foundation shall consider the worst combination of loads and forces such as service loads, wind load, uplift forces, seismic loads for the zone, dynamic forces due to vibration of pumps, ensuring total structural safety. One can also opt and design pipe system depending upon specific site condition or otherwise as per the guideline of Hydraulic Institute Standards (HIS), USA with proper pumps. Both pump house and control room is to be well equipped with firefighting arrangement as per IS code provisions.

CONTROL ROOM & OTHER ROOMS

RCC Framed control room for this scheme is to be constructed nearby both pump house for housing the control panel for all pumping units of main pumps and also to accommodate the display panel of PLC- SCADA system for monitoring and control. For fixing the control panel and display panel of PLC- SCADA two separate semi furnished rooms to be constructed. Along with these two rooms minimum four additional rooms to be used as under shall be provided

	Details of rooms
1	Switch Gear Room for control panels
2	SCADA room with AC and furniture
3	Battery room with battery charger
4	Office room with toilet and furniture
5	Store room with adequate no of racks
6	Operators room with toilet and furniture
7	Security cabins at Gates
8	Parking Shades

List of Furnishings for control room & other rooms

ITEM	Nos. Required
Office Pump House	
Executive Table	3
Tables	10
Computer table	6
Printer table	3
Revolving Chairs with arms	7
Visitor Chairs	20
Steel Almirah 1980mm x 915mm x 485mm	14

Filling cabinet	7
Steel Almirah 1270mm x 765mm x 440mm with glass paneled doors	7
Air Coolers with 600mm sweep exhaust fans	11

ITEM	Nos. Required
Room Heaters	7
Wooden Stool	14
Locker Cabinet with minimum 15 compartment - Godrej Make	3
Drawing Cabinet A0 size with racks	3
Control room	
Tables	3
Visitor Chairs	6
Switch gear room near gantry	
Tables	2
Visitor Chairs	4
Ceiling fan	2
Air Coolers	2
Room heater	2
Duty room	
Steel Lockers 8ft X6ft minimum(12 cabinets)	3

4. HYDRO- ELECTRO- MECHANICAL WORKS

As per tentative design it is proposed to install 4 no pumps operating and 2 no. as standby at intake pump house and 5 No Pumps operating 3 No Standby at another pump house. All fitting for suction pipe, delivery pipe and necessary valve / metering arrangements are to be provided to make functioning of this scheme. However, these designs are broadly indicative only, bidder need to do its own design for preparing the financial proposals. It is desired from bidder, that they will adopt most efficient pumps with minimum power consumption and maintenance friendly. Bidders need to submit life cycle cost for pumps during detailed design of system.

The components will include but not limited to Pumping Stations

Required nos. of energy efficient Pumps (working and additional 50% standby) and associated motors at each Pumping Stations.

- 1 Power, control and instrumentation systems, associated accessories and cabling.
- 2 Pump bowl assembly & Pump discharge pipe work, Non-Return Valves, Expansion Bellows, electrically operated butterfly Valves, etc. on pump suction and delivery. The delivery of each pump shall be connected to a common designed dia MS pipe manifold header line.
- 3 Surge & Water Hammer protection devices.
- 4 Necessary RCC blocks to support pipeline with thrust blocks as per requirement.
- 5 Raw water sump with water level indicators & control panel.
- 6 Raw water / suction chamber water level indicator (Physical)

- 7 Emergency push buttons near to HT motors
- 8 Switch gear and accessories
- 9 Capacitors for main pump motors and for Auxiliary LT load
- 10 Connectivity with SCADA for automation and control of electrical, mechanical and hydraulic features.
- 11 Arrangements for receiving power from JVVNL by arrangement of HT overhead line / cabling from the substation developed by State Govt's power company in near premises of pump house to 33/6.6 KV switch yard
- 12 Lighting, earthing and lightning protection system, fire extinguisher & fighting system
- 13 DC system
- 14 Any other equipment like EOT Crane / system not mentioned above but required for satisfactory operation of the Pump Houses.

5. PLC-SCADA FOR AUTOMATION

It is proposed to have fully automatic and fail-safe operation of the pumping stations, to synchronize varied demand and supply of water in most efficient and equitable manner. The scope of work covers conceptualization, design, pre-dispatch inspections, supply, installation, pre-commissioning test, commissioning tests, commissioning, trial run and maintenance of the entire Instrumentation and Control (PLC)/SCADA system for 8 years. The complete system including Head works, Mains network, pump rooms, shall be monitored and controlled through PLC-SCADA. All flow meters, motorized valves, power meters, pressure gauges, pumps, water level sensors at all locations (where monitoring of level is vital for controlling the system efficiently), silt monitor in sump well, intake structure at main pumping station, etc. shall be connected through SCADA to monitor & control the system.

The following equipment's shall be included in SCADA for monitoring and control of the system. The following list is not comprehensive, and the scope of Contract shall not be limited by list but shall include all necessary instruments, hardware, software, cabling, earthing, lightning protection, etc., which shall be required for proper monitoring and control of the complete system including pump stations. The bidder shall submit a MoU with SCADA provider having an experience of at least of one work of similar nature.

- Level measuring system in sump.
- Temperature scanners for motor winding and bearing temperatures and pump bearing temperatures for each pump-motor set.
- Portable temperature measuring system for motor and pump bearing temperatures.
- Pressure measurement system using transmitter for measuring pressure in the pumping main.
- Pressure gauges in the discharge of each pump.
- Flow switches and sight flow glasses for monitoring flow in each motor/pump bearing coolingwater return lines, if required.
- Providing and installing of full-bore electromagnetic flow meters in the each the of MainPumps manifold.
- Portable sound level meter.
- Portable vibration meter.
- PLC based Instrument control panel with all necessary hardware and software for monitoring and control

of the entire scheme. The PLC shall be provided with all hardware and software for interfacing with the SCADA system to be located in the Pump Houses

- Battery and battery charger for the I&C system.
- Instrumentation and control cables

Design of the complete system along with the detailed specifications of the equipment proposed to be installed shall be designed by contractor and submitted for necessary approval of the Department. The design of the system shall adhere to the principles detailed in the subsequent clause of this chapter "Specifications for Automation Instrumentation and Control". The proposed system shall have necessary arrangement to be interfaced for linking it to future expansion and integration with other SCADA system of department. Also, system should be compatible for further automation.

Irrespective of the detailed specifications of the respective items detailed in the chapters of pumping stations pipes and valves, the contractor shall be required to provide all equipment, accessories, cabling, earthing, providing necessary transducers/sensors, system hardware/software, programming logic etc. to achieve the objectives listed below.

Control System (PLC)/SCADA

The entire PLC/SCADA system is required to receive, store and the information From Electrical, Mechanical & Instrumentation Equipment's.

Electrical System:

- i. As input voltage and Amperage of 0.4 KV and input voltage and Amperage to individual motors.
- ii. Power consumption (KW & KWH) and power factor on 0.4 KV system, auxiliary transformers and all LT motors of more than 20 KW
- iii. Status of all breakers/ MCCB.
- iv. Status of all relays used in electrical installations controlling LT motors
- v. Status of all LT motors (on/off)/ & all parameters of Frequency Drives (if provided).
- vi. Winding temperatures and bearing temperature of LT main motors coupled with pumps.

Mechanical Equipment's

- i. Status of all pumps.
- ii. Status (on/off/percentage open) of all Butterfly/slucice Gates, on individual pumps delivery instrumentation equipment's
- iii. Vibration levels of pump and motors coupling shafts
- iv. Thrust Bearing Temperature of pumps

Instrumentation Equipment's

- i. Flow data (instantaneous flow rates and total flow) from the raw water channel and pump house (through flow meter & transducers installed on raw water main.
- ii. Level of water in the sump well.
- iii. Pressures at delivery of each pump & manifold.

Processing of information for Control

- i. Operation sequences of valves/gates & pump for starting and closing, including control over the desired opening of valves/gates after due monitoring of the electrical health of the system.
- ii. Selection of number of pumps required for desired flow.
- iii. Selection of pump operation in reference to sump levels and required raw water flow.
- iv. Closure of pumps valve in case of any abnormal pressure.
- v. Shut down of pumps in case of any non-transient abnormal conditions such as low/high voltage, high current draw and thermal overload, excessive shaft vibrations, earth faults etc.
- vi. Shut down of pumps in case of low or high levels of water in sumps.
- vii. Operation of all butterfly valves / sluice gates to achieve described objective (a) to (h) above.
- viii. Generation of reports.
- ix. Any other control logics required for smooth operation of system.

Alarm Situations

The alarm schedule is indicative of what is required. The Contractor shall provide for the annunciation of all alarms necessary in order to achieve control and monitoring requirements.

Requirement of Instrumentation

To achieve the objectives listed above in scope of work, the contractor shall provide the required numbers of equipment / sensors. Main equipment required is as listed below. The list is not comprehensive, and the scope of contract shall not be limited by list but include all probes, level sensors, input-output modules, interfaces, other sensing elements, cabling, ducting, earthing, providing lightening protection, providing facilities of local display of readings from instruments, etc., which shall be required for automation as desired under scope of work for PLC systems. The main equipment's required are as listed below but not limited to:

- i. Suitable size of ultrasonic flow meter with transmitter and Digital flow Indicator & flow Integrator. –1 No. for inlet pipe.
- ii. Suitable size full bore electromagnetic flow meter with transmitter and Digital Flow Indicator & flow Integrator. on delivery manifold at each PS.
- iii. Sump level sensor ultrasonic type with transmitter and digital Indicator at Main sump at each PS
- iv. Pressure sensors, transmitters and indicators at outlet of manifold and delivery pipes of each pump.
- v. Temperature sensors for all main motors (winding & bearing) and pump bearings.
- vi. Level switches for automatic operation of all dewatering pumps.

In addition to above the following portable meters / equipment (one each) are also to be supplied at each PS:

- Noise meter – 1 No.
- Vibration meter – 1 No

The main works involved are as detailed below. However, the works described in these paras are indicative only. The main object is narrated above. Bidders offer is deemed to include all costs for completing the work and no extra

payment shall be made to contractor to complete above object as per National /International standards and Codes including all investigation, planning, designing, drawings and vetting drawing & design, from Additional Chief Engineering WRD Zone JAIPUR.

The tenderer shall assume full responsibility of Engineering adequacy, coordination and timely completion of investigation, designs, drawings and execution including all other activities with their own modern equipment, manpower and other services so required connected with the work.

The Intake well site & ancillary works are located on Govt. land/private land in wildlife centaury and forest area. The contractor has to abide by the conditions laid down by the Forest department if any & No violation of said conditions shall be permitted.

Power Connectivity

The contractor's scope shall start from the outgoing of HT metering located in the 33/6.6 KV GSS or as per design and app distance from RVPNL and proposed 33/6.6 under this package shall be app 500 m. 33/6.6 KV substation shall be constructed by the contractor of this package and the entire electrical works shall include following major components as defined below but shall not be limited to:

- (i) 33kV Four Pole structure consists of lightning arresters, insulators, ACSR conductor, clamp and connectors with necessary protection arrangement including steel structure.
- (ii) 33kV indoor switchboard consists of two VCB incomers with line PT, one VCB bus-coupler and two VCB outgoing feeders with necessary metering and protection arrangement.
- (iii) 33/6.6 kV, Dyn11, ONAN transformers with OLTC and RTCC panel
- (iv) 6.6/0.433kV, Dyn11, ONAN auxiliary transformers
- (v) Neutral grounding resistor on 6.6 kV side
 - a. kV indoor switchboard with necessary metering and protection arrangement
 - b. kV capacitors
- Soft (reactance) starters for 6.6 kV motors
 - LV switchboard/ distribution board/ lighting panel
 - Battery, battery charger and DCDB
 - HV, MV and LV cables
 - LV capacitors with APFC panel
 - Local Push Button stations
 - Lighting system
 - Cabling system
 - Earthing and lightning protection system

The requisite approval from RVPNL has been taken before execution the work, for which documentation has been prepared by bidder and supervision charges of RVPNL if any, will be borne by the contractor

6. Pipeline Network:

6.1 Main/ sub main pipelines: -

Ensure the equitable distribution of water to both dams by two transmission mains. Pipe network for two main pipelines has been planned. M.S./HDPE Pipe network conforming to IS 8329: 2000 & other relevant IS code / International Code are proposed to be used for Main and Sub main along with required specials, valves etc. for Filling Parvati & RamSagar dams. Every main pipeline and its network shall be designed and optimized based on capitalized cost calculated for 30 years assuming Interest rate of 10 % per annum, life of pumping machines 15 year and energy cost Rs 7.5 per KW.

Supplying, trenching, laying, testing and commissioning of the Mains/ include all fittings and specials required. This also includes supplying and fixing of all safety measures & monitoring instruments viz. valves, meters etc. All civil works required for safety / operation of the network viz including construction of RCC anchor block, thrust blocks, valve chambers, and escape channel for scour valve, concrete pedestals for crossing the depressions or nalla etc. are included with mains/. All the lines are provided with motorized valves and gauges for monitoring and control of flow in efficient and safe manner through SCADA.

6.2 Road Crossings

. Where ever this pipe network will cross the Earthen / BT village road, Major district roads, etc. pipe line is to be laid by open cut & cover method after getting due permission from the concerned department.

7. QUALITY CONTROL AND ASSURANCE

Execution of each and every item of this scheme shall have to be in accordance of specifications laid down in this document or otherwise as per the available Indian standards or International standards. Contractor has to prepare a quality assurance plan in consultation with department and it is to be strictly followed during complete execution and operation & Maintenance of this scheme. For assuring the quality of the materials / works executed or to be executed contractor shall install approved quality control laboratory at site, fully equipped with latest equipment's required for conducting all Q.C. test of all construction material as per relevant Indian, International codes for assuring proper quality of material and executed works and its O&M till completion of work. This laboratory be constructed before start of civil work in an area of about 150.00 Sqm. For verifying the test results from third party, samples shall have to be sent to any laboratory which department deems fit for Quality certification in addition to regular test at field laboratory at the cost of contractor. Frequencies of collection of test samples are to be followed as per the Indian standards or International standards .As far as possible the tests are to be conducted in presence of departmental engineer

8. INFRASTRUCTURE WORKS

Infrastructure development work for the scheme includes the various development activities as under:

8.1 NON -RESIDENTIAL BUILDINGS

This scheme covers the scope for construction of non-residential buildings with A-class specifications complete in all respect in different parts of the scheme in a total plinth area of about 4282 Sqm. All buildings are to be constructed fully furnished as per the details provided in the technical specifications. Construction, operation & maintenance of these building shall include ancillary development works to be carried out in the building premises i.e. construction of pump house campus boundary wall 2.4 m high from plinth level, 0.6 m high fencing, Drainage system, street road, approach road, street light, electric line, drinking water supply, plantation & Lawn development etc.

Supplying and laying of Power Generator of suitable capacity for office / rest house with construction of generator room and providing and fixing of accessories and connections. These buildings are to be constructed on the land provided by the department. Brief about the plinth area of type of the buildings proposed are as under.

S.No.	Type of Building	Nos.	Plinth area per no. in Sqm	Total plinth area in Sqm
1	SE Office Building	1	550	550
2	EE Office building	2	370	740
3	AE Office building	4	200	800
4	Rest house for officers	1	500	500
5	Subordinate Staff Field Hostel	1	360	360
6	Workshop	1	70	70
7	Stores	2	70	140
8	Vehicles shed	1	70	70
9	Canteen	1	120	120
10	Chowkidar hut	4	48	192
11 a	Store Shed (Intake, both Pump House)	3	120	360
11 b	Laboratory of pipe testing at Jaipur of pre-fabricated material	1	140	140
12	DG Shed (Intake, Pump House and Bahure ka Tal)	3	80	240
	Total Plinth Area		Sqm	4282

The rates are to be quoted per Sqm of plinth area & total cost of above-mentioned plinth area is to be mentioned in Bid proposal sheet. The total building area (residential and non-residential) mentioned above is tentative however the exact requirement shall be finalized after approval of building programme by competent authority. Accordingly, the payment shall be made as per the actual area of buildings constructed. Contractor should include cost of construction of 4282 sqm in his quoted rate, but if area exceeds 4282 sqm then extra payment shall be made and if area reduces then proportionate amount will be deducted

LIST OF FURNISHING FOR REST HOUSE AND OTHER BUILDINGS

General requirement	
Curtains on all doors and windows of cost not less than Rs 200 per meter	As required
Ceiling Fans 1200 mm, ISI mark	25
Central Lobby	
10 Seated wooden sofas set	1
Visitor Chairs	20
Wooden with glass top central tables	4
Wooden peg tables	8
Diffused lighting arrangements	As required

Decorative light with central chandelier	As required
42" HD color Television	1
Desert cooler-heavy duty	1
Room heater (fan type).	1

Dining Area	
12 seated wooden dining table with 12 chairs	1 set
Wooden cabinet for crockery	As required
Rooms with dressing (each) (Total 4 Rooms)	
Double bed with mattress, pillow, quilt, bed sheet	1
Center table	1
Study table	1
Easy chairs	2
Study Chair	1

Cupboard	1
Dressing cabinet with stool	1
Split air-conditioner 1.5 ton	1
Reading lamp	1
Heater	1
32" HD color Television	1
Rooms without dressing (each) (Total 6 Rooms)	
Single bed with mattress, pillow, quilt, bed sheet	1
Center table	1
Easy chairs	1
Cupboard	1
Mirror 4'x1.5'	1
Room Cooler	1
Reading lamp	1
Bathrooms	
25-liter Geyser of ISI make	1
CP fittings including bath mixture and shower	As required
Bathroom accessories	As required
Kitchen	
Cooking Platform of black granite with a steel sink.	1
Wooden cabinets	1
Gas burner, ISI mark	1
Water Cooler with RO	1
Ancillary items for functioning of kitchen	As required
Exhaust fan	1
Refrigerator minimum 300 lit cap.	1

ITEM	Nos. Required
Office for SE & EE (Each)	
Executive Table	1
Tables	5
Computer table	3
Revolving Chairs with arms	1
visitor chairs	20
Steel Almirah 1980mm x 915mm x 485mm	5
Filling cabinet	2
Steel Almirah 1270mm x 765mm x 440mm with glass paneled doors	5
Air Coolers with 600mm sweep exhaust fans	5
Room Heaters	2
Wooden Stool	4
Computer with HP Printer & all accessories	4
Photo State Machine HP Laser jet	1

Locker Cabinet with minimum 15 compartment - Godrej Make	1
Water Cooler with RO	1
Drawing Cabinet A0 size with racks	1

ITEM	Nos. Required
Office for AE (Each)	
Tables	3
Computer table	2
visitor chair	11
Steel Almirah 1980mm x 915mm x 485mm with lock	1
Filling cabinet	2
Steel Almirah 1270mm x 765mm x 440mm with lock	2
Air Coolers with 600mm sweep exhaust fans	3
Wooden Stool	1
Computer with HP Printer & all accessories	2

8.2 RESIDENTIAL BUILDINGS

This scheme covers the scope for construction of seventeen residential buildings with A-class specifications complete in all respect in different parts of the scheme in a total plinth area of about 2161.00 Sqm. Construction of these building shall include ancillary development works to be carried out in the building premises i.e construction of Drainage system, street road, approach road, street light, electric line, drinking water supply, plantation etc. These buildings are to be constructed on the land provided by the department. Appropriate Illumination system and no of fans are to be provided in all residential buildings. Brief about the plinth area of type of all residential buildings proposed is as under.

S.No.	Type of Building	Nos.	Plinth area per no. in Sqm	Total plinth area in Sqm
1	Type -I	1	320	320
2	Type-II	2	280	560
3	Type III	4	135	540
4	Type IV	6	48.35	290.1
5	Type V	12	37.54	450.48
		25		2160.58
			Say	2161.00

Note: -The rates are to be quoted per Sqm of plinth area & total cost of above-mentioned plinth area is to be mentioned in Bid proposal sheet. The total building area (residential and non-residential) mentioned above is tentative however the exact requirement shall be finalized after approval of building programme by competent authority. Accordingly, the payment shall be made as per the actual area of buildings constructed. Contractor should include cost of construction of 2161 sqm in his quoted rate, but if area exceeds 2161 sqm then extra payment shall be made and if area reduces then proportionate amount will be deducted

8.3 APPROACH ROADS

Construction of Approach Road 3.75 meter wide as per IRC specification (including CD works) from Madanpur village nearby state/district road to both Pump houses as per site for providing the passage for movement of heavy vehicles for supplying & Installation of materials/ machineries required during construction as well as operation. Construction of 3.75 m wide BT Roads to connect intake, pump house, office building and residential buildings as per IRC specification in. Construction of black topped approach roads to connect Valve Chambers with nearby public road as per IRC specification in 3.75 m wide wherever required.

8.4 CAMPUS DEVELOPMENT

In this scheme development of main campus for both Pump houses/ Control room/ Residential/ Non- residential buildings area are to be developed which includes-

- Construction of 2.40 m high boundary wall from plinth level with barbed wire fencing of 0.6 m above it all around the pump house campus and building campus,
- Drainage system in the entire building campus,
- Street line along all the internal roads and approach road, and power supply line to all buildings
- Drinking water supply system (including tube well and pipeline) to all residential and non-residential buildings,
- Plantation and lawn development in the open area as decided by engineer in charge.

Construction of site camp office (temporary till main office building is constructed) for department officials, equipped with all office facilities such as furniture, computer, photo state machine, Color photo state machine cooling system, high speed internet facility, printer, electricity supply etc. be completed within 45 days from date of start of work. (The furniture will be later on shifted to main office buildings)

8.5 MISCELLANEOUS WORKS

The item infrastructure works shall include all costs for personnel, procurement, supply, furnishing, transport,

erection and installation, operation and maintenance, supplementing if required all plant and construction equipment and auxiliary equipment, materials, tools, all temporary installations such as workshops, offices, laboratories, equipment for testing of all construction material, stores, houses and all other facilities required for Contractor's personnel and for the execution of the works and for the fulfillment of the Contractor's obligations laid down in the Contract. the above items shall also include works such as site roads (including all auxiliary works, e.g., maintenance, crossings, drainage, etc.), parking areas, storage areas, auxiliary buildings and structures, supply of electric power, drinking and industrial water supply, sewage disposal, waste disposal, medical facilities, construction workers and supervisors housing and community facilities and all other similar works required for the safe and efficient execution of the works of Civil Works, as also procurement, supply, erection, testing and commissioning and installation, operation, and maintenance of infrastructure for the Hydro-mechanical, instrumentation work. contract as per section given in the drawing.

9. INSPECTION VEHICLES

Three Desire A/C cars of minimum 1250 CC engine capacity of reputed make, One Innova car or equivalent and 5 Nos A/C Bolero (4x4 gear) are to be procured by the contractor at his cost in the name of Engineer In charge for the inspection of the project work and invoice is to be submitted to department. These vehicles are to be handed over to department for inspection/ monitoring of project activities within one month of award of the contract. All vehicles shall be made available with driver (cost of providing driver during design build and O&M period shall be borne by the contractor). Insurance P.O.L, maintenance of vehicles & toll tax during construction period as well during operation and maintenance period shall be borne by the department.

10. PRE-DISPATCH INSPECTIONS INSIDE OR OUTSIDE THE EMPLOYER'S COUNTRY

The equipment and machines which requires pre dispatch inspection in the premises of Supplier in presence of Employer or his representative (either regular employee or designated third party), Contractor shall have to arrange and provide for the cost of travel to the Manufacturer 's place, accommodation, local transport and food for three representatives of the Employer. Such costs will be incorporated in the tendered cost of such items and no separate payment will be made for the same.

11. SAFETY ASSURANCE

The Contractor shall take all measures required to maintain highest safety standards on the site. The measures taken will include all but will not be limited to the relevant provisions of the Indian Standards. The Contractor shall prepare a safety plan for the project and have it approved from the Employer's Representative. The Contractor shall deploy a safety officer on each important site to ensure compliance.

12. OPERATION & MAINTENANCE OF SCHEME

The contractor shall provide all the necessary operating staff and maintenance personnel to operate and maintain the works for eight years Operation and Maintenance contract period under the contract. Contractor will conduct camps for training for WRD staff. The contractor shall provide a detailed proposed staffing schedule covering all categories of his staff with duties, responsibilities, qualification, experience, and their salaries, etc. The staffing schedule shall be prepared on assumption that the system will be operated on a 24 hour per day basis with three equal shifts of 8 hours each for the period. The inspection vehicles and staff required for the maintenance and operation of the pipeline shall also be considered for three equal shifts of 8 hours. For pump houses and other residential / non-residential campuses watch and ward is to be provided throughout the year. Electrical charge for both pumping station electricity charges is to be borne by department. During operation and maintenance, the contractor shall be responsible for all activities for functioning of the system. Detailed scope of work under operation and maintenance of project has been cover under separate Chapter "Operation and Maintenance.

13. TESTS ON COMPLETION OF WORK

The Contractor shall carry out the tests on completion before taking over at the time of commissioning as stipulated in elsewhere in the document.

14. INSURANCE

Contractor shall take Insurance of following category

- Works and contractor's equipment's for entire contract duration for adequate insurance premium.
- Insurance injury to persons and damage to property.
- Insurance for contractor's personals

SECTION V –B: SCOPE OF WORK

Part-II Operation & Maintenance Plan

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SECTION VI-B: PART IInd OPERATION AND MAINTENANCE PART

1 GENERAL

This section applies to the specifications of materials used for operation and maintenance, the workmanship, period for routine maintenance, maintenance of records, and responsibilities during operation and maintenance period.

The Contractor shall operate and maintain the entire Kaliteer lift scheme Project/ Water Transmission System including intake pumping plant, the raw water mains pipeline, and surge protection system, the instrumentation system, communication system, substations, the PLC systems, all ancillary buildings, campus area, roads and ancillary civil structures along pipeline and road, for the entire period specified in the Contract.

2. SPECIFICATIONS

The specification of materials used for repairs shall be the same as have been used in the original work. Specifications for any materials which were not used during construction shall be approved by the Employer's Representative prior to commencement of the operation and maintenance period and must be incorporated in the O&M manual. Without being limited by this clause, during O&M period the Contractor shall use appropriate material for repairs even if material required for such repairs has not been approved earlier, and no delay in making such repairs shall be subjected to such limitation. However, subsequent to use of such material the Contractor shall submit proposals for the approval of specifications of such material. The approved material will subsequently form a part of the O&M manual.

3. ACTIVITIES General

Within the framework of the Contractor's responsibilities given above, the Contractor shall carry out the following activities. However, these shall not limit the requirement for other activities which otherwise are required as per term and conditions of Contract or to fulfill the Contractor's responsibilities or are essential as per good industrial practices. The Contractor shall be responsible for, but not limited to, the following:

- a) Drawing 20 Cumec water from Chambal River and supplying into mains up to natural drains with design pressure head and discharge and Maintenance of system.
- b) The contractor will be responsible for the proper functioning of the pumping and pipe distribution system to ensure design pressure head and discharge including maintenance of entire system.
- c) Monitoring and controlling of the complete network through PLC -SCADA effectively and ensuring equitable distributing of water as per schedule and Maintaining design pressure and discharge at both outlets.
- d) Keeping routine preventive watch and ward of complete system and regular checking for detecting any leakage, theft from pipeline network and ensuring safety of whole pipe network including all specials, valves, metering arrangements.
- e) Providing the required staff, but not less than the minimum specified numbers/ level, during operation and maintenance period and additional staff as per requirement during periodic maintenance and in emergencies.
- f) Liaison with DISCOM to ensuring uninterrupted power supply as per requirement.
- g) Providing all required consumables required for functioning of plant and equipment except powercharges.

- h)** Maintenance of pump houses, electric substations, etc., at the pumping station, official buildings,, and their campus, staff quarters and their surroundings, etc.(all works constructed in this Contract) in neat and clean condition.
- i)** Entering AMC contracts with system / equipment suppliers, as necessary. It is mandatory to enter into an agreement for an 8-year maintenance contract with the PLC and SCADA system supplier or the authorized system integrator, whosoever has executed the work for this project.
- j)** Maintenance of the lighting fixtures and the lighting system of all areas and replacement of all non-functional lighting fixtures within 24 hours.
- k)** To maintain the valve chambers along the pipeline in clean and dry conditions.
- l)** Providing continuous on-the-job training regarding operation and maintenance of the system to WRD engineers for capacity building.
- m)** Maintaining.
 - Repair history of all mechanical, electrical and instrumentation control equipment in pumping station, water transmission mains and communication instruments.
 - Logbooks through PLC system.
 - Everyday power availability, input voltage and current, frequency, power factor, kWh meter readings and kW reading for Substation and raw water pump house.
 - Everyday water pumping quantity at main pump house at an interval of 15 minutes.
 - Everyday water availability outlet on hourly basis and its deviation from quantum decided for the Chak., in formats decided as per directions of engineer in charge.
 - Daily log of water diverted to natural drains.
 - Daily log of operations of all the important equipment electrically actuated valves, etc., with time tag.
 - Daily start–stop operation of pumps with every hour readings for operating voltage, amperage, and power factor.
 - Hourly readings of pressure on the manifold, flow rate in manifold and integrated quantity of water.
 - Hourly levels of sumps.
 - Daily list of alarms with time tag.
 - Logbook format and the data to be included in the logbook shall be decided during commissioning in consultation with department.
 - Last periodic maintenance done for all equipment/buildings of the system.
 - Observations made during patrolling of the pipeline and roads.

In addition to maintenance of above logbooks the Contractor is required to maintain one inspection book at both pump house. The complaints entered in the complaint register must be investigated and remedial measures must immediately be taken.

- h)** Providing required spares and maintaining adequate inventory of required accessories or equipment itself for repair of system so that the electrical, mechanical, instrumentation and control system, pipe and pipe appurtenances and surge system and the communication system can work efficiently as per the guarantees given or minimum required efficiencies asked for in the Contract, without any additional costs to department. The Contractor may use spares and tools and tackles supplied with the Contract as required by him. However, at the end of the

Contract the Contractor shall hand over the full spares, tools and tackles as supplied with the Contract by replacing the used items with fresh supplies of the same specifications.

- i) Providing manpower for the required repairs of all facilities along with the manpower and materials for repair of the roads, buildings, and campus area utilities.
- j) Maintaining the drinking water supply facilities/ electricity power supply in both pump house building campus and all its units, and other buildings.
- k) Maintaining stores for the electrical, mechanical and instrumentation and control equipment. The maintenance of stores will include but shall not be limited to:
 - Loading / unloading of materials received and issued for works.
 - Proper arrangement of material in stores to ensure its safety and easy availability.
 - Maintaining store areas in a neat and tidy condition.
 - Keeping records and accounting for the incoming materials,
 - Keeping records and accounting for the consumed materials.The Contractor shall be solely responsible for the safety and security of the goods in the store and will be responsible for any loss or damages in stores for any reason. He may opt for insurance cover against the value of the goods to be stored without any additional costs on the Department.
- l) Daily patrolling of the water pipelines in entire project area, to identify and report the damages / defects of pipe and pipe appurtenances, CD works, en-route structures.
- m) Periodic and routine maintenance as per the manufacturer's recommendations and recommended schedules, as well as emergency (breakdown) maintenance as and when required. Maintaining a fleet consisting of at least one JCB or other equivalent or superior hauling machine, sufficient inspection/patrolling vehicles and material hauling vehicles and any other vehicles/ machinery/ equipment for adequate and timely repairs and/or for routine/ periodic maintenance/ patrolling of the system.
- n) Periodic routine maintenance of structures/buildings of pumping station and others built in the Contract, campus area of pumping station(s). Such maintenance must ensure adequate cleanliness, ventilation, illumination, and structural safety. In addition to this, the general hygienic standards must be maintained and adequate plantation, horticultural activities must be taken up to maintain the total environment of the campus / building pleasant.
- o) Providing adequate manpower for watch and ward of both pump house.
- p) Providing transportation facilities between various areas.
- q) Updating and periodic submissions of the operation and maintenance manual as defined in specifications for O&M works. The Contractor shall take up all periodic maintenance works provided in the approved O&M manual.
- r) Submission of monthly report.
- s) Co-ordination with other agencies such as Electricity Supply Company.
- t) Providing all machinery like JCB, generator, drain pumps, crane, welding machine, etc., as required for proper and timely maintenance activities.
- u) Insurance: The Contractor shall, without limiting his or the Employer's obligations and responsibilities, ensure.

- I. The work together with material and plant for incorporation therein, to the full replacement cost (term "cost" in this context shall include profit).
- II. The Contractor's equipment and other things brought onto site by the Contractor, for a sum sufficient to provide for their replacement at the site.
- III. The insurance shall be in the joint names of the Contractor and the Employer at the Contractor's cost and shall cover the Employer and the Contractor against all losses or damages from whatsoever cause arising from the start of the O&M until the date of completion of O&M in respect of the facility or any section or part thereof as the case may be.
- IV. Any amount not insured or not recovered from the insurer shall be borne by the Contractor
- V Ensuring redundant communication network with two no of GSM network for fail proof working SCADA.

4. STAFFING

Contractor shall provide skilled staff for all operation and maintenance period, with adequate qualifications and sufficient experience of similar works. CV of General Manager, Shift-in-charge, Plant Supervisors will have to be got approved from the Employer. The following Table 12.1 describes the minimum levels of staffing, and their minimum qualifications and experience in similar works, theta the Contractor will be required deploy for carrying out the O&M functions:

Table 12.1: Minimum Requirements for Staff and Qualifications (During Operation Period)

S.No	Designation	Qualification	Experience	No			
A. General Staff (common for the whole project)							
1.	General Manager	Graduate Engineer (E/M)	10 years	1			
2.	Engineer-Electrical.	Diploma	5 years	1			
3.	Engineer-Mechanical	Diploma	5 years	1			
4.	Engineer-Civil	Diploma	5 years	1			
5.	Instrumentation Technician	ITI Instrumentation	5 years	2			
6.	Helpers	10th Pass	-	2			
S.No	Designation	Qualification	Experience	Nos. Shift-1 Shift-2 Shift-3 8-4pm,4pm-12,12-8am	Total		
B. Intake Pumping Station and Pump House campus I & Pump housell							
1.	Shift-in-charge	Graduate (Elect/Mech.) OR Diploma (Elect/Mech.)	5 years 10 years	2	2	2	6
2.	Electrician	ITI (Elect.)	5 years	2	2	2	6
3.	Helpers	8th Pass	-	4	2	2	8
4.	Security Guards	8th pass	-	2	2	2	6

5	Attendant Rest House.	-	-	2	-	-	2
6	Cook cum Chokidar	-	5 years	2 for 24 hours			2
		Total		14	8	8	30

E. Minimum Requirements for Staff and Qualifications (During Non-Operation Period)

S.No	Designation	Qualification	Experience	Nos.
1.	General Manager	Graduate Engineer (E/M)	10 years	1
2.	Helpers	10th Pass	-	4
3.	Cook cum Chokidar			2 for 24 hours
4.	Security Guards	8th Pass	-	4 for 24 hours (2 at each pump house)

Note:

1. The above requirement is minimum only. The Contractor will arrange extra work force, as and when required, so as to smoothly run the operation and maintenance including preventive maintenance, repairs etc. and general cleanliness of the installations.
2. The Contractor will have to maintain adequate transportation facilities for daily patrolling of the pipeline and will ensure regular watch on pipeline.
3. The above staff strength is exclusive of leave reserve required for different category of staff. The Contractor shall ensure availability of the personnel given in the above table for all seven days in a week.
4. The Contractor shall make appropriate arrangements for maintenance of items like road work, buildings, arboriculture, patrolling and maintenance of civil structures, vehicle operations and other activities defined to fulfill its obligations under O&M Contract.

5. PUMPING STATIONS

- (i) Operation of plants on 24x7 basis during July to September or as per schedule decided by Engineer-in-charge, including provision of required manpower for routine operation of pumping station.
- (ii) Maintaining the pumping station PLC, including hardware and software along with all instruments, in proper working condition. The downtime of the control system shall not exceed 2 hours. During the downtime, the Contractor shall continue to operate the pumping station in manual mode using the local panel controls and the readings from local instruments.
- (iii) Routine and periodic maintenance of the entire control system and instruments as per the manufacturer's recommendations
- (iv) Replacement of damaged control, communication cables, and power supply cables
- (v) Repair or replacement, as required, of all instruments such as flow meters, pressure sensors, pressure gauges, level sensors, float level switches, temperature scanners, vibration sensors, noise meter, data loggers along with all other equipment. The down time of any individual instrument as referred above shall not exceed 24 hours.
- (vi) Periodic site calibration of all measuring/metering equipment at every 6 months minimum or as recommended by the manufacturer. The calibration at the manufacturer's works/

independent laboratory shall be carried out only in case of major failure of the instrument.

- (vii) Preparation and submission of daily and monthly customized reports, produced from the local SCADA system
- (viii) Repair or replacement, as required, of damaged electrical equipment/ parts for proper functioning of electrical system
- (ix) Maintenance of the cooling and lubricating systems
- (x) Routine maintenance of the pumps/ motors as per recommendation of the manufacturer.
- (xi) Replacement of bearings, damaged impellers, and other damaged parts so that the operation of pumps ensures the guaranteed efficiencies with desired noise and vibration levels.
- (xii) Routine and periodic maintenance of the EOT cranes as per the manufacturer's recommendations.
- (xiii) Breakdown maintenance of all electrical, mechanical, instrumentation and control equipment, EOT crane, etc.
- (xiv) Re-painting of the exposed mild steel components of pipe line, ladders, railings etc. in the pump house in the 3rd, 5th and 8th year of O&M to keep them in good shape.
- (xv) Maintaining the surrounding areas of the pumping stations free from shrubs, weeds, grass and other unplanned vegetations.
- (xvi) Routine monitoring of substation equipment and taking preventive measures as required
- (xvii) Keeping the hourly records of:

- Status of pumps
- Current
- Voltage
- Frequency
- Active and reactive power
- Water level at suction reservoir
- Suction and delivery gauge readings
- Rate of flow
- Pump head
- Keeping daily records of:
 - Total number of hours of operation
 - Total quantity pumped
 - Total energy(kWh) consumption

- (xviii) Specific requirements of pumping station maintenance are as listed in the following Table 12.2:

Table 12.2: Maintenance Schedule for Pumping Stations

Activity	Frequency
Removal of clogged materials from screens	Daily 6 times
Temperature of WTI/OTI w.r.t ambient temperature	Daily 4 times
Oil level in the conservator	Daily

Oil level in the bushing	Daily
Temperature of RTD, BTD in motors w.r.t. ambient temp.	Daily
Watering garden around plant, if provided	Daily 2 times
Checking of disconnectors' operation	Weekly
Operation of crane for all motions	Weekly
Cleaning of level sensors	Weekly
Housekeeping plant and its surroundings (Includes removal of dust, dirt, cobweb etc)	Daily
Checking vibration and noise level of pump sets	Daily
Fully closing and opening of sluice gates and valves	Monthly
Submission of report on maintenance to Employer	Monthly
IR and PI values of motors	Monthly
Condition of silica gel in breather and replacement (if required)	Monthly
Replacement of bearings	Within a day of breakdown
Replacement of bulbs, lamps etc.	Within a day of breakdown
Tightening of gland	When leakage increases beyond acceptable limit
Greasing, oiling	As per manufacturers recommendation
Attending breakdowns	As and when it occurs
Preparation of list of spares for satisfactory operation	Half-yearly
Transformer oil sample checking	Half-yearly
Inspection of switchboard, cable box, etc. (i.e., visual inspection, tightness of nuts and bolts, IR values, earthing contacts, checking tightness of terminal block, etc.)	Half-yearly
Measurement of earth resistance	Yearly

Activity	Frequency
Checking of relays/ alarm (through secondary injection)	Yearly
Condition of gasket and replacement (if required)	Yearly

- (xix) Disposal of screened material.
- (xx) Providing all consumables such as grease, oil, stationery, water for gardening, etc.

- (xxi) Providing office furniture for operating and maintenance staff.
- (xxiv) Providing safety accessories such as gloves, shoes, first aid box etc.
- (xxv) Ensuring safety of plant and equipment.
- (xxvi) Furnishing required information to Employer.
- (xxvii) Any compensation charges levied by Vidyut Nigam towards low power factor, overloading or any other such penalties will be borne by the Contractor.
- (xxviii) Contractor will be given a minimum of 15 days advance notice by the Employer's Representative for changing the impellers when required.

6. LUBRICATION

The Contractor, in the operation and maintenance manuals, shall furnish a complete schedule of recommended oils and other lubricants. The number of types of lubricants shall be kept to a minimum. In case of grease lubricated bearings for electric motors, lithium base grease is preferred.

The Contractor shall indicate the brand name of indigenously available equivalent lubricants, with their complete duty specifications, in the O&M manual. The Contractor shall also furnish the schedule of quantities for each fill, frequency of filling and annual requirement in O&M manual.

Where lubrication is affected by means of grease, preference shall be given to a pressure system which does not require frequent adjustment or recharging. Frequent, for this purpose, means more than once in a month. Where more than one type of special grease is required, a grease gun for each special type shall be used. All lubricant systems shall be designed so as not to cause a fire or pollution hazard. The Contractor shall supply flushing oil for such lubrication system when an item of plant is ready for preliminary running.

7. SPARE PARTS

All spare parts used for the equipment in the maintenance of the system must be from the manufacturer of the equipment or, if the equipment itself has been made with parts from other manufacturers, the parts must be of the same make as used in the equipment supplied and installed.

All spare parts shall be packed for long storage under the climatic conditions prevailing at the Site. Each spare part shall be labeled on the outside of its packing with its description, number and purpose and, if more than one spare is packed in a single case, a general description of the case contents shall be shown on the outside and a packing list enclosed.

8. PARTICULAR REQUIREMENTS DURING O&M

The workmanship observed for all repair and maintenance work must be in accordance with "Good Engineering Practices". O&M of electric substation shall be included in the scope, including but not limited to the following items:

- (i) Maintenance of electric substation at Pump House
- (ii) Routine monitoring of substation equipment and taking preventive measures (as required)
- (iii) Fortnightly patrolling for monitoring of transmission/ tower/pole line
- (iv) Preventive and breakdown maintenance of substation (as required)

9. PIPE LINE

The rubber gaskets/rings, nut, and bolts, etc., to be used shall be as per the specifications given for

therespective items.

After each repair the damaged coating of pipes must be repaired and, if in trench conditions, the trench must be filled with approved soil, well compacted to its original density, up to the existing ground level. Stretches along pipe alignments where cover is washed out or removed due to other reasons must be rehabilitated so that the minimum cover required is always maintained.

All cracks in pipe supporting structures, valve chambers and their edges must be raked, filled, and made good with cement sand mortar 1:2.

The repairs may include but not limited to items: -

- a) Repair of leaks, damaged portion of road, embankment, pipe and pipe appurtenances, CD works, and en-route structures identified during patrolling.
- b) Emergency repair(s) of burst(s) for maintaining regular supplies.
- c) Operation of all motorized valves quarterly to check its proper functioning electrically as well as for manual operation. Maintenance of all valves in leakless conditions. Quarterly inspection of, expansion joints and surge protection equipment/system, insulating joints and repairs if required. Contractor shall submit quarterly reports of all such activities done.
- d) Maintenance of inventory for repair of pipe leak(s) and burst(s), valves (air valve, sluice valves, butterfly valves), expansion joints, surge protection devices, anti-corrosion devices or any other pipe appurtenances or equipment(s) installed.
- e) Quarterly lubrication of all motorized gear boxes along the alignment.
- f) Maintaining the valve chambers along the pipeline in clean and dry conditions.
- g) Maintaining portable generating set for operation of valve actuator and dewatering of scour valve chambers and dewatering in case of burst/repair of pipe.
- h) Maintaining the soil cover on the pipe damaged due to rains, runoff or any to other reason.
- i) Repair of damaged coatings during maintenance operations.
- j) Maintaining clean conditions at saddle and ring girder supports and oiling/greasing of all supports.

No water losses are admissible in the transmission system.

10. PUMPING STATION AND ALL OTHER BUILDINGS

The Contractor shall carry out ordinary repairs to buildings during the O&M period. The repairs may include but not limited to the following items:

- (i) Easing of doors and windows, monsoon repairs to roofs, attention to drains, rainwater spouts, attention to plinth protection.
- (ii) External white or color wash, external or internal painting, internal distempering, renewal of approach roads within the campus.

The frequency of repairs must not be less than as specified below:

Sr.No.	Nature of Repair	Frequency of repair for Residential Buildings	Frequency of repair for other Buildings
1	External finishing (color washing) after attending minor repairs such as damage to plaster, etc.	Once in a year	Every two year

2	Internal finishing (distemper / painting) after attending minor repairs such as damage to plaster etc	In 3 rd , 5 th and 8 th year of O&M	In 3 rd , 5 th and 8 th year of O&M
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Following repairs prior to onset of monsoon are essential:

1. Any faults in the electric installation, leakages, earthing, exposed wire ends and any hazards on this account to the users/inmates of the buildings, should be taken care of suitably; wiring, which is damaged or outlived, should be replaced.
2. Damaged sanitary lines should be replaced and choked lines cleared.
3. Proper drainage of the area around the building should be ensured to avoid stagnation of rainwater/ house effluent, in order to prevent malarial conditions. Where courtyards exist in the buildings, their drainage into the outer drains should be ensured. Any choked drains should be cleared properly.
4. Leaking roofs should be attended to immediately with suitable repairs/ treatment. The rain waterspouts should also be cleared of blockages, etc. The roof should be swept clean of leaves, debris, etc., if any.
5. The plaster on outer walls of the building, which is exposed to weather, should be repaired before rains in order to prevent dampness inside. Where plinth protection has been provided, it should be checked and the damaged portions, if any, should be repaired before rains.
6. Damaged flooring should be repaired/ replaced as per requirement, in order to prevent dampness inside the rooms, etc., during rains.
7. Periodic repairs of damaged floors, door/window fittings, water taps, water coolers, furniture, desert coolers, electric circuits, must be taken up on complaints using the material of same quality as used during construction.

11. ROADS

General

The works shall be carried out in conformity with the relevant Specifications to the required level, grade and lines using approved materials. The works shall be carried out using light duty machinery or manual means provided the quality of the end product does not suffer. In execution of maintenance works, a reference is made to the IRC publications: "Manual for Maintenance of Roads" for guidance and compliance wherever applicable. Wherever the Specification is not clear, good Engineering practice shall be adopted in the construction to the satisfaction of the Employer's Representative.

Maintenance Work of Road During O&M Period: -

- Repairing potholes and undulations found in the roads and road cuts.
- Repairing edges of the pavement.
- repairs to shoulders at least 1.5 m on either side of road and to maintain them in proper gradient

i.e., 3%.

- Ensuring that the pavement and the shoulders at least 1.5 m on either side are kept clear of any obstruction.
- Keeping a check on the encroachment and damage to the Government property.
- Cleaning and repairing of roadside and catch water drains.
- Jungle clearance to have proper site clearance.
- Cleaning of roads by removing dead animals, fallen trees, stones etc.
- Maintaining the kilometer stones, road signs and caution boards, drums etc. fixed on the road in a good state of repairs. This will generally involve the following activities:
 - i) Fixing of dislocated boards and stones.
 - ii) Periodical painting
 - iii) Repairs to boards such as welding or tightening of nuts and bolts.
 - iv) Fixing of new boards where necessary.
- Maintaining all diversion in good condition.
- Maintaining speed humps nicely.
- Maintenance of cross drainage (CD) Works: This will generally involve the following activities:
 - i) Clearing of the silt of waterway.
 - ii) Repairs to the damaged portions of the CD works.
 - iii) Repairs to cut off walls, apron, parapet walls etc.
 - iv) Painting of culverts and bridges.
 - v) Reporting of any serious abnormality and conditions to the Executive Engineer.
 - vi) Maintaining the u/s and d/s of waterway clean by cutting of vegetation, excavation etc.
- Maintenance of Signs:

The signs along with the posts shall be maintained in proper position and kept clean and legible at all times. Damaged signs shall be replaced immediately. All signs shall be inspected at least twice a year. Special care shall be taken to see that weeds, shrubbery, mud etc. are not allowed to obscure any sign.
- Maintenance of arboriculture: This will generally involve the following activities:
 - i) Watering of plants at required intervals.
 - ii) Re-plantation without any additional cost in place of dead plants or damaged plants
 - iii) Intercultural operation such as hoeing and weeding etc.
 - iv) Pruning and trimming and cutting of old big trees for required growth.

12. RESTORATION OF RAIN CUTS

Earthwork for restoration of rain cuts in embankments (including balancing reservoir) and shoulders shall be made using suitable material and compacting the same.

Materials

The material used for restoration of rain cuts shall be got approved from Employer's Representative and shall in general be as specified for earth work in embankment in section 3.

Construction Operation

The area affected by rain cuts shall be cleared of all loose soil and benched. The width of the benches shall be at least 300 mm and they shall extend continuously for a sufficient length. The height of the benches shall be in the range of 150-300 mm. Fresh material shall be deposited in layers not exceeding 250 mm loose thickness and compacted so as to match with the benching at moisture content close to the optimum. Compaction shall be carried out using suitable equipment such as plate compactors and rammers or by suitable implements handled manually. The finished work shall conform to alignment, levels and slopes as indicated in the approved drawing.

13. MAINTENANCE OF EARTHEN SHOULDER

Scope

The work of maintenance of earthen shoulder shall include making up the irregularities/loss of material on shoulder to the design level by adding fresh approved soil and compacting it with appropriate equipment, or stripping excess soil from the shoulder surface, as required.

Material

The material to be added to the shoulder, if required, shall be select soil as specified for shoulder works

Construction Procedure

- 1) Making up of the earthen shoulder by adding extra soil and compacting the same; and/or
- 2) Stripping a layer of soil to achieve the required grade and level

Wherever extra earth is required to be added, the earthen shoulder shall be stripped and loosened to receive fresh soil. The deficiency of thickness shall be made up in layers of loose thickness not exceeding 250 mm. Water shall be added, if required, to attain the optimum moisture content and the layer compacted by 80 to 200 kN smooth wheel roller, vibratory roller, hand roller, plate vibrator or hand rammer to obtain at least 94% maximum dry density in accordance with IS:2720 (Part 8). The finished surface shall have the specified cross slope and line in accordance with the drawing. The side shall be trimmed to the required slope with the help of grader or manual methods using hand tools. Wherever the earth is required to be excavated from the shoulder, this shall be done either using equipment like grader or by manual means using hand tools. The resulting surface shall be uniform and have a field density of at least 94% maximum dry density obtained in accordance with IS:2720 (Part 8). If the surface is not uniformly compacted, it shall be excavated to a depth of 150 mm and the soil mixed with water if required and compacted at moisture content close to the optimum to achieve 94% of maximum density as stated above.

14. MISCELLANEOUS WORKS

The Contractor under this scope of work is also required to maintain the road in a clean condition, which includes the cleaning of stones, fallen trees, dead animals, etc., as, and when noticed by the patrolling teams or as directed by the Employer's Representative. The pipe culverts and the other cross drainage structures built or rehabilitated under the Contract will be regularly inspected and suitable cleaning, grading works will be done to ensure against impounding near the structures. The structural damages will be repaired or dismantled and re-constructed considering the extent of damage as per directions of Employer's Representative.

The Contractor will also take up the works required for yearly maintenance of the sign boards, hectometer, kilometer and five-kilometer stones and road marking, ensuring that they are in good shape and suited for the purpose for which they are installed.

15. OPERATIONS AND MAINTENANCE MANUAL

The comprehensive manual shall be submitted before the operation and maintenance period, as specified. It shall be periodically updated to incorporate the “best practices” experience gained while carrying out the O&M activities, broadly on the principals listed below:

1. Updating any changes in the procedures set out in the O&M manual, as deemed necessary based on any limitations observed during the maintenance period, including incorporating additional procedures for maintenance of other repairs/break downs not incorporated in the maintenance manual but faced during O&M period.
2. Procedures for repair of leaks/burst in different types of pipes must be provided, with supporting drawings. The O&M manual must be updated if any differences are observed during O&M period.
3. Frequency of spares used in maintenance of valves (air-valve, sluice valves and butterfly valves), expansion joints, equipment installed for surge protection and protection against corrosion must be recorded for updating the contents of the manual.
4. Records of trouble shooting points and details of events causing troubles (break down's) during maintenance of pumps / motors / measuring equipment(s), / electric panel and accessories there in must be maintained and used for updating the contents of the manual.
5. Records of locations and type of damages observed during maintenance of road which are of recurring nature must be used in updating the manual.
6. Records of trouble shooting points and details of events causing trouble (breakdowns) during maintenance of electric substations, etc., must be maintained and used for updating the contents of manual.
7. Records of Inventory used must be maintained and the relevant portion of O&M manual must be updated to list out the inventory requirements for maintaining the system for 12 months.
8. The provisions in the manual must incorporate every aspect of good industrial practices even if not elaborated here or in other parts of the bid document. The provisions in the approved operation and maintenance document shall be valid and binding for both the parties during operation and maintenance along with the additions and deletions made.
9. The manual so prepared must be updated after the end of every year of operation and maintenance, giving effect to the experience gained and the observations made by the Department during the maintenance period.
10. At the time of handing over after completion of O&M period, all the equipment, including standby equipment, must be in good working order.

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TECHNICAL SPECIFICATIONS

SECTION-I

GENERAL

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SECTION – I**GENERAL**

THE SPECIFICATIONS CONTAINED UNDER DIFFERENT SECTIONS IN THIS DOCUMENT ARE FOR GENERAL GUIDANCE. IN CASE OF DISAGREEMENT BETWEEN THE SPECIFICATION OF THE DEPARTMENT AND STANDARD PRACTICES BEING FOLLOWED AND/OR SPECIFICATIONS NOT PROVIDED SPECIFICALLY, THEN RELEVANT SPECIFICATIONS UNDER LATEST INDIAN STANDARDS, CWC GUIDELINES & “MANUAL ON WATER SUPPLY AND TREATMENT” PUBLISHED BY CENTRAL PUBLIC HEALTH AND ENVIRONMENTAL ENGINEERING ORGANISATION (CPHEEO), MINISTRY OF URBAN DEVELOPMENT, GOVERNMENT OF INDIA, RELEVANT REGULATIONS OF JVVNL, JVPNL AND APPROVED MANUFACTURER SPECIFICATIONS SHALL PREVAIL.

A. EXTENT OF WORK

1. GENERAL

This Technical Specification relates to “Execution of Kaliteer Lift Scheme with intake point near village Kaliteer Tehsil Sarmathura in the district of Dholpur on “EPC –Turn Key” basis including power system connectivity and Operation & Maintenance of complete commissioned scheme for eight years.” the scheme is proposed to lift water from Chambal river and release it into two separate natural drains which join two Ramsagar and Parvati dam. The off-take release point is approximately at 8km distance from Chambal River, the system is proposed to be operated During July to September on 24x7 basis every year. The Basic Project Profile and scope of work of execution of the l i f t scheme has beendetailed in volume –I of the bidding documents.

I. Details of works covered in the Scope of Work for this Lift Scheme is as below:

- A.** Detailed Engineering, conducting Survey, Investigation, Planning and component designs and preparation of estimates, drawings of the scheme, power connectivity of the scheme, establishment of and other ancillary units conducting testsetc.

B. Civil Works

- i. Constructing Intake works near riverbank with open canal approved and its connecting pipe to Pump house including all river protection works, approach works etc.
- ii. Constructing Pump House, I & pump house II with Panel Room & Operating rooms, PLC-SCADA Control room etc.
- iii. Approach roads to Pump House
- iv. Construction of official (Furnished) and residential buildings with all electrical and sanitary amenities.
- v. Construction of two Pump Room,

C. Mechanical Works

Pumping Machinery & all related mechanical equipment’s and pipeline.

D. Electrical Works

Electrical Equipment’s including supply, execution, testing, commissioning, and O&M

Instrumentation Works

Supply, installation, testing, commissioning, and O&M of Instrumentation Equipment’s required for Pump House, Pump Rooms and for monitoring and control system with PLC – SCADA

E. O & M for Civil, Mechanical & Electrical Works for 8 years

O&M for Civil, Mechanical, Electrical & Instrumentation Works for 8 yrs.
Mandatory Spares, Tools & Tackles required for after Operation & Maintenance period of 8 yrs.

F. Miscellaneous Works

ROU (Right of Use)/ROW, Land acquisition processing, forest & wildlife & other statutory clearances.

II. Details of works covered in the Scope of Work for Power System Connectivity to the whole Lift Scheme is as below:

HT/LT Power will be made available with the help of state Power Transmission/Distribution Company in the near vicinity to the Pump House and Pump Rooms. The contractor has to make arrangements for connection of the Pump House, Pump Rooms machines and other facilities with the available S/S under the scope of this contract.

2. PUMP HOUSE COMPLEX

A. Intake Works

- I. Water shall be drawn from the river through intake well
- II. The Intake works shall be constructed to draw required quantum of water with provision of arrangement for trash racks, gates and hoists for operation & maintenance. The maximum velocity in the intake works should be designed for Minimizing losses and silt entry.
- III. Necessary earthwork & Protection works in the river are to be constructed.
- IV. In case of RCC construction of Intake Works will be with minimum M-25 grade concrete as per design requirements. TMT reinforcement bars and all other ancillary civil work shall be as per the detailed specification in the same volume
- V. Any suitable type of intake system/Well can be chosen by the EPC contractor depending upon site condition with proper justification and detailed design to be approved by the competent authority of the WRD, Rajasthan.

B. Construction of intake cum Pump House I & pump house II Building

The Pumping Station shall be adequate to accommodate required no. of pumps, valves, accessories, panel boards, PLC-SCADA system, battery and battery charger, working area for maintenance of pump sets, facilities for proper O&M, cable ducting, pump foundation, pipes support, valve supports, floor drainage arrangement for draining the water from outside the Pump House, delivery pipeline connections, interconnection of delivery pipe lines at suitable locations, provision is to be made for sufficient ventilation, lighting to Pump House with exhaust arrangement. Access between floors shall be provided through RCC staircase / ladders. The Pump House shall be designed so as to maintain the noise level inside the Pump House within the permissible limit and to absorb vibration of pump sets while running. The P.H. bottom level is to be provided considering bottom of suction pit of sump for positive suction. Further as the Pump House, Panel Room shall be adjoining to sump, necessary RCC retaining wall/structure shall be provided to withstand the loads as per design requirements. Construction of some isolated residential and official buildings for technical staff, watchman and operator etc. in the pumping station complex or at GSS campus required for distribution network is within the scope of the contract along with peripheral works. The details of plinth area of these building have been provided in detailed scope of work however the exact plinth area of these official and residential buildings to be constructed will be finalized after approval of building plan during execution.

The components will include but not limited to Pumping Stations

- a) Required nos. of Pumps (working and additional 50% standby) and associated motors at Pumping Stations.
- b) Power, control, and instrumentation systems associated accessories and cabling.
- c) Pump bowl assembly & Pump discharge pipe work, Non-Return Valves, Expansion Bellows, electrically operated butterfly Valves, etc. on pump suction and delivery. The delivery of each pump shall be connected to designed dia. MS pipe manifold header/s line.
- d) Surge & Water Hammer protection devices.
- e) Necessary RCC blocks to support pipeline with thrust blocks as per requirement.
- f) Raw water sump with water level indicators & control panel.
- g) Raw water / suction chamber water level indicator (Physical)
- h) Emergency push buttons near to HT motors
- i) Switch gear and accessories
- j) Capacitors for main pump motors and for Auxiliary LT load
- k) Power system connectivity.
- l) Lighting, earthing and lightning protection system, fire extinguisher
- m) DC system
- n) Any other equipment like EOT Crane / system not mentioned **above** but required for satisfactory operation of the Pump House
- o) Each pump shall be provided with stainless steel name plate indicating following detail as minimum requirements.
 - a) Rated capacity : $M^3/hr.$
 - b) Total Head : MWC
 - c) Speed : RPM
 - d) Rated power : KW at 50 Hz
 - e) Test pressure : Kg/cm^2 or Kg/m^2
 - f) Make & Model
 - g) Manufacturer Sr. No.:
 - h) Weight of pump:
 - i) Material of casing and impeller:
 - j) Detail of bearing with grade of lubricants:
- p) Each drawing shall bear the signature of the Authorized Project Manager and concerned design engineer on behalf of the contractor to the effect that the drawing (whether his own or from any other source) has been checked by the contractor before submission to the Engineer-in-Charge.
- q) Each revision shall be properly recorded to show the number, date, specific description of revision/s carried out, and signature of the Project Manager and design engineer in the revision block. The contractor shall be responsible for incorporating all the comments issued by the Engineer-in-Charge

Design Considerations

The Pump House may be of RCC frame structure square/circular shape depending on hydraulic performance of pumping constructed in minimum M-25 grade concrete. The grade of reinforcing steel in the sump / suction chamber structure shall be of TMT steel. It shall be a R.C.C. vertical wall for P.H. up to plinth level and RCC framed structure with brick masonry walls, above the roof of the Pump House shall be of RCC slab with waterproofing.

The design of the Pump House and its foundation shall take into account the worst combination of loads and forces such as service loads, wind load, uplift forces, seismic loads for the zone, dynamic forces due to vibration of pumps, ensuring total structural safety. One can also opt for

“CAN pipe” system depending upon specific site condition or otherwise as per the guideline of Hydraulic Institute Standards (HIS), USA with proper pumps

3. RAW WATER TRANSMISSION MAINS

General arrangement of lifting raw water for the desired quantity and designated maximum discharge has been detailed in subsequent sections of the document.

The contractor has to Survey, plan, design most economical transmission line of MS Pipe & HDPE pipes as per scope of work

The technical requirements of different type of valves are as per the designed technical specifications – under Indian Standards or International Standards for the related items of the valves and appurtenances.

4. PUMPING PLANT AND DESIGN PARAMETERS

The plant shall be designed, selected, and installed taking into account site ambient conditions

5. POWER SYSTEM CONNECTIVITY TO THE WHOLE LIFT SCHEME

As described in detailed scope of work.

6. EQUIPMENT & OTHER ANCILLIARY WORKS FOR RAW WATER PUMPING SYSTEM FOR PUMP HOUSE

The equipment's shall include but not limited to:

- a. Piping, valves, fitting, and all accessories within or in connection with system units and ancillary structures.
- b. Mechanical and other equipment's such as trolleys, pallets, and hoists for handling, storing, and lifting of plant items concerned.
- c. All pipelines including connections, interconnecting pipe works including making connections, tapping where necessary, procurement of all materials, fabrication of pipes, bends, tapers, flanges, manholes, fittings, valves, flushing connections, washouts, flexible couplings, dismantling / expansion joints, linking, finishes, pipe protection, supports, anchorblock, thrust block etc.
- d. Painting, lining, finishing after erection of all plants required for water pumping plant, commissioning tests and performance tests, operation, and maintenance of raw water pumping plant during entire O & M period of 8 years.
- e. The surge control devices are to be provided as per contractor's own design and approved by Department.

7. EQUIPMENT & OTHER ANCILLIARY WORKS FOR RAW WATER PUMPING SYSTEM FOR PUMP ROOMS AT CHAK OUTLETS

The equipment's shall include but not limited to:

- a. Piping, valves, fitting, and all accessories within or in connection with system units and ancillary structures.
- b. Mechanical, Electrical, and other equipment's including Pumps, control panels, Filters, pressure gauges etc.
- c. All pipelines including connections, interconnecting pipe works including making connections, tapping where necessary, procurement of all materials, fabrication of pipes, bends, tapers, flanges, fittings, valves, flushing connections, washouts, flexible couplings, dismantling / expansion joints, linking, finishes, pipe protection, supports etc.

- d. Painting, lining, finishing after erection of all plants required for water pumping plant, commissioning tests and performance tests, operation, and maintenance of raw water pumping plant during entire O & M period of 8years.

8. ELECTRICAL SYSTEMS

All supply and installation works required for appropriate functioning of the plant.

9. SUPERVISORY /ANNUNCIATION SYSTEMS

Instruments, indicators, measuring and transmitting devices, meters (flow meters) at pump house, gauges, gauge plates, consoles, annunciation panels / cubicles, stands, connections, cabling, and wiring and other equipment's, material and accessories necessary for interconnection of earthing and lighting with starter grids.

10. SERVICE WATER INSTALLATIONS

Pumps, motors, valves, station pipe works and all accessories necessary for service water systems for water supply for plant.

11. GENERAL UTILITIES

Other utilities necessary for the proper functioning of the proposed works which shall be included under this Contract but not limited to the following for Pumping Stations are:

Site development includes ecological development, boundary wall of whole Pumping station campus including all related residential and official buildings, all installations related to functioning of this scheme with suitable gates. Site development also includes raising/lowering GL at Pumping Station by selected excavated earth/excavation including proper ramming, watering, consolidation of earth work, etc. The finished ground level of the plot shall be brought to Level at least one meter above the local Flood Level. The filling shall be done in uniform layers of 15 cm. to 20 cm. thick and shall be well watered and well compacted with suitable power roller. Internal roads & approach roads required to Head Works from existing road, etc. Electric substation and distribution of power supply to all necessary points.

12. **OPERATION & MAINTENANCE STAFFING FOR LIFT SCHEME:** The contractor shall provide all the necessary operating staff and maintenance personnel to operate and maintain the works for eight years Operation and Maintenance contract period under the contract. The contractor shall provide a detailed proposed staffing schedule covering all categories of his staff with duties, responsibilities, qualification, experience, and their salaries, etc.

staffing schedule shall be prepared on assumption that the system will be operated on a 24 hours per day basis with three equal shifts of 8 hours each for the period of July to September. The inspection vehicles and staff required for the maintenance and operation of the pipeline shall also be considered for three equal shifts of 8 hours.

13. APPLICABLE STANDARDS

Reference to all the standards shall be meant for the latest revision of relevant IS standard, international, and industrial standards for all the equipment's as per approval of engineering in Charge. However, deviation from approved make shall be done only in rarest case with valid justification of engineering in charge.

14. Trial Run & Commissioning of the System

After execution of the works the Contractor shall make trial runs of the individual components and commissioning of the whole system as detailed in the section 8 "Trial Run

15. Operation and Maintenance

The Contractor shall be responsible for operation and maintenance of the System for the period specified in this contract, and as described in section 10. Notwithstanding the above, the Contractor will be required to rectify any deficiencies which are attributable to defects in the workmanship or quality of materials, Plant, or equipment during the Contract Period.

16. List of Specified makes/vendors

A list of specified makes has been attached with this document. Only items/components of the makes from the list shall be opted for this contract. For the item not found in the list prior approval for the item from the Engineer in-charge shall be taken

B. SUBMISSIONS TO BE MADE ON DETAILED ENGINEERING OF THE LIFT SCHEME

1. DRAWINGS, DOCUMENTS, CERTIFICATES, MANUALS

. The Detailed Survey & Investigation works, Planning and Design Works can be taken up simultaneously. The detailed scope of services for Survey & Investigation and Design & Engineering has been explained in section – 2.

Submission and review of Engineering Documents

The contractor will submit within 30 days from award of contract, the following specifications, designs and drawings for review and approval of the Engineer In-charge generally in the sequence given below:

- a. General layout plan of the entire scheme
- b. Vendor details and specification of electrical, mechanical and instrumentation plants and equipments for approval from engineer in charge.
- c. Designs and drawings for all electrical, instrumentation and mechanical equipmen
- d. General arrangement drawings for all units of works
- e. Structural design calculations and drawings for all units of work shall be prepared and signed by registered structural engineer. As far as possible all structural drawings shallbe drawn with the appropriate scale, neatly giving all the sections and details necessary for the easy understanding of structural details and smooth execution of the work. All the structural design shall be given in excel format and drawings shall be given in AUTOCAD format.
- f. Architectural drawings for all buildings and landscaping for entire plant plumbing and electrical drawings.

1.1.2 After review by the department/ consultant of the department, Engineer–in-Charge will convey comments, within 15 days from receipt of details from contractor, which the contractor shall incorporate by modifying designs and drawings accordingly.

1.1.3 In no case will design, calculations / drawings be considered complete or acceptable, if

- a. They are not duly signed by respective Architect/ Civil/ Structural/ Electrical/ Mechanical Design Engineer(s).

- b. They are not thoroughly checked and duly signed in the appropriate places by contractor.
 - c. Design calculations are not accompanied by supporting engineering, drawings or appropriate sketches.
 - d. Design calculations are not in appropriate format for understanding by the department. Design calculations are incomplete or not fulfilling the design requirements or are shabbily done or are without adequate reference, or other necessary back-up data.
 - e. Any comments previously made are not incorporated on revised drawings / Calculations.
- 1.1.4 Such unaccepted drawings / designs as described above shall be summarily rejected and contractor will be informed in written. Contractor shall arrange to resubmit the same duly checked, revised, and signed within 10 days. No claim from contractor for extension of time or for extra cost on this account will be entertained under any circumstances.
- 1.1.5 The review of civil design calculations and drawings shall be carried out only in respect of correctness of Centre-to-Centre distances, elevations, important / typical details, orientation and sizes of important members, general design principles and approach, adherence to requirements of the relevant IS or other statutory codes, compliance with the Technical Specifications, general or specific notes and with the requirements of good engineering practice and whether the details shown on drawings conform to design calculations. Check for any interference and taking remedial action is the responsibility of the Contractor.
- 1.1.6 No check will be specifically carried out by the Consultant / Engineer-in-Charge to verify arithmetical / numerical accuracy of the calculations, which shall remain entirely the Contractor's responsibility, irrespective of any approval that may have been accorded thereto by the Consultant / Engineer-in-Charge.
- 1.1.7 All values / dimensions / elevations, etc. without supporting back-up data adopted / assumed by the contractor in his calculations / drawings shall be taken by the Consultant / Department to be correct unless they are specified.

1.2 Form of Drawings

- 1.2.1 All drawings submitted for approval shall be ISO standard size sheets, prepared on computer with Auto CAD latest version. All command are plan and l sections shall be ARC GIS

10.3.1 compatible. Every drawing shall have a title block in the bottom right cornershowing:

Drawing Title:

Job:

Client: ADDITIONAL CHIEF
ENGINEERWATER
RESOURCES ZONE JAIPUR

Consultant: As decided by Engineer in

ChargeContractor:

Designed by

Kaliteer lift Scheme

Checked by

Drawn by

Drawing

Number:

Revision Number:

Date:

1.2.2 Drawings / Documents

Drawings & Documents to be submitted are as per in addition the following list.

- a. Preliminary outline drawings indicating details of pump, motor, civil foundation, clearances etc.
- b. Cross sectional drawings of all equipment's showing bill of material & relevant standards.
- c. Test reports for chemical analysis of Major components like impeller, shaft, casing etc.
- d. All performance test reports.
- e. O. & M Manual & spare part list
- f. Quality assurance plan to be submitted for approval.
- g. Start / Stop instructions.
- h. Dimensional similarity / interchange ability certificates.

1.2.3 Each pump shall be provided with stainless steel name plate indicating following detail as minimum requirements.

- | | |
|--|---|
| • Rated capacity | : $\text{M}^3 / \text{hr.}$ |
| • Total Head | : MWC |
| • Speed | : RPM |
| • Rated power | : KW at 50 Hz |
| • Test pressure | : Kg / cm^2 or Kg / m^2 |
| • Make & Model | |
| • Manufacturer Sr. No.: | |
| • Weight of pump: | |
| • Material of casing and impeller | |
| • Detail of bearing with grade of lubricants | |

1.2.4 Each drawing shall bear the signature of the Authorized Project Manager on behalf of the contractor to the effect that the drawing (whether his own or from any other source) has been checked by the contractor before submission to the Engineer-in-Charge.

1.2.5 Each revision shall be properly recorded to show the number, date, specific description of revision/s carried out, and signature of the Project Manager in the revision block. The contractor shall be responsible for incorporating all the comments issued by the Engineer-in-Charge/ Consultant in the subsequent revision.

1.3 Programme of Submission

- 1.3.1 The contractor shall furnish an activity wise programme for submitting all designs, drawings, and documents to Engineer-in- Charge within three weeks of award of Contract for pre - construction review. The program shall make reasonable provision for resubmission of unapproved designs, drawings, and documents and for the time needed to review and transmit such designs, drawings, and documents. No designs, drawings and documents will be accepted for review until the programme for submission has been approved by Engineer-in-Charge. The Engineer In-charge will approve / convey his comments on the submitted programme within one week from receipt of programme by him.
- 1.3.2 The contractor shall provide six copies of all submissions for review / approval. One copy will be returned to the contractor with comments / approval.
- 1.3.3 The review period of pre-construction documents shall be as per conditions of contract.
- 1.3.4 After approval, the contractor shall submit to Engineer-in-Charge one tracing, soft copy of design & drawings and minimum six copies of all approved drawings with the date of approval marked. Depending on requirement of use in the project the contractor shall provide additional copies as requested.

1.4 Approval of Designs and Drawings

- 1.4.1 EPC contractor shall ask manufacturer to submit the Quality Assurance Plan (QAP) for the equipment manufactured by them. The QAP will clearly indicate the tests to be carried out at manufacturer's works which will be as per I.S. and as specified in technical specifications of the tender documents. The QAP shall be approved by Employer. The Engineer-in-charge can depute third party inspector /consultant's representative / Client representative to witness the tests as per approval given for quality assurance Plan and technical specifications of the equipment given in the tender.
- 1.4.2 Approval from Engineer-in-Charge to the Contractor's design or drawings shall not relieve the contractor of any of his contractual obligations or liabilities under the Contract or his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, performance particulars and conformity of the suppliers with the Indian statutory laws as may be applicable, nor does it limit the Engineer-in-Charge's rights under the Contract.
- 1.4.3 Should it be found at any time after approval has been given by Engineer-in-Charge that any designs, drawings or documents submitted by the contractor are not consistent with any design, drawings or documents submitted or approved previously or deviate from any major aspect of the Contract Document or standard specifications, then such alternations or additions as may be deemed necessary by the Engineer-in-Charge shall be made therein by the contractor and the works carried out accordingly for which no extra payment shall be made.
- 1.4.4 No revision shall be made by the contractor after design, drawings or documents are "approved" by the Engineer-in-Charge. In case the contractor desires to incorporate any minor amendments in the "approved" drawing, he shall resubmit the same for formal approval. Contractor shall not make any

revision in design / drawings, which is not related to the comments conveyed by Engineer-in-Charge.

- 1.4.5 The design would have to be got approved from department & authorized agencies. All compliance of technical requirements is to be fulfilled.

1.5 Certificates

- 1.5.1 Where certificates are required by the Specification or relevant Reference standard, the original and one copy of each such certificate shall be provided by the Contractor.
- 1.5.2 Manufacturers and supplier's test certificates shall be submitted as soon as the tests have been completed and in any case not less than seven calendar days prior to the time that the materials represented by such certificate are needed for incorporation into the Works.
- 1.5.3 Certificates of test carried out during the construction or on completion of parts of the Works shall be submitted within 7 days of the completion of the test.

1.6 Instruction Manuals

- 1.6.1 The contractor shall submit to the Engineer-in-Charge prior to the delivery of all major items of Plant to Site, five copies of instructions appropriate to the erection, commissioning, testing, operation and maintenance of that item of plant. These instructions shall form a draft of the relevant parts of the Instruction Manual and their submission and approval by the Engineer-in-Charge shall be a condition precedent to the issue of a Taking over Certificate for that section of the Plant. During erection, commissioning and testing, draft instructions and associated diagrams shall be checked against the plant and amended as necessary to relate accurately to the Plant as installed.
- 1.6.2 The manuals shall cover the setting to work, commissioning, testing, Operation and Maintenance of the works. The greatest importance is attached to completeness and clarity of presentation.
- 1.6.3 Information supplied by sub-Contractors and manufacturers employed by the contractor shall be coordinated into the comprehensive manual. The instruction manuals shall describe the installation as a whole and shall give a step-by-step procedure for any operation likely to be carried out during the life of each item of Plant, including erection, commissioning, testing, operating, maintaining, dismantling and repair.
- 1.6.4 Maintenance instructions shall include charts showing lubrication, checking, testing and replacement procedures to be carried out daily, weekly, monthly and at longer intervals to ensure trouble-free operation. Where applicable, fault location charts shall be included to facilitate tracing the cause of malfunction or breakdown.
- 1.6.5 A section dealing with procedures for ordering spares shall also be included in the manual.
- 1.6.6 Six draft copies of the manual shall be submitted to the Engineer-in-Charge prior to commissioning the works. Ten final copies of the amended and corrected manuals and drawings shall be provided by the contractor at the commencement of the Period of Maintenance.

1.7 Operating Instructions

The instructions shall be written in a simple language. Wherever possible, instructions shall be presented in a tabular form easy to understand.

1.7.1 General Instructions

- a. List of Plant alarms, giving possible causes for alarm initiation and sequence of remedial actions to be taken.
- b. Instructions on monitoring of Plant performance and sample log sheets for each plant item, to be filled by Operators on a routine basis.
- c. Safety precautions to be taken in the handling of equipment's, action to be taken in case of accidents, including first aid instructions.
- d. Basic maintenance procedures such as flushing of pumps, cleaning of tanks after use and washing down of spillage.
- e. Dos and don'ts in Plant operations. Operators' attention shall be drawn to all operations considered to be dangerous to operators or likely to cause damage to the Plant.
- f. A detailed description of Plant start-up and shutdown procedures supported by Process and Instrumentation Drawings.
- g. A detailed description of day-to-day Plant operation procedures.

1.7.2 Maintenance Instructions

A. maintenance manual in four copies shall be provided as a supporting document to the equipment manufacturer's instructions.

1.7.1.1 Maintenance Manual

- i. Checking, testing and replacement procedures to be carried out on all Mechanical and Electrical plant items on a daily, weekly, and monthly basis or at longer intervals to ensure trouble free operations.
- ii. Fault location and remedy charts to facilitate tracing the cause of malfunctions or breakdown and correcting faults
- iii. A complete list of recommended lubricants, oils, and their charts.
- iv. A spares schedule which shall consist of a complete list of itemized spares for all Electrical and Mechanical items with ordering reference and part numbers.
- v. A complete list of manufacturer's instructions for operation and maintenance of all bought out equipment.
- vi. Preventive maintenance details.

1.7.1.2 Manufacturer's Instructions

Manufacturer's instructions for Operation and Maintenance of all bought out equipment's shall be provided. The instructions shall be supplied complete with Electrical / Mechanical drawings.

C. CRITERIA FOR DESIGN AND CONSTRUCTION OF CIVIL STRUCTURES

1. INTRODUCTION

This section forms the engineering design basis for structural design. The content of these documents is to form the guidelines for engineering design of Structures and to provide information about other disciplines concerned. This is technical specification summarizes the concept and relevant IS codes (Latest Revision) to be followed for buildings and water retaining structures.

2. PUMPING PLANT AND DESIGN PARAMETERS

The plant shall be designed, selected and installed taking into account local site ambient conditions.

3. LIFE EXPECTANCY OF WORKS

The contractor shall design the works for a life expectancy as follows:

Concrete Structures	60 Years
Mechanical Plants	15 Years
Electrical Plants	25 Years
Buried Earth Electrical System	50 Years
Control Panels	25 Years
External Instrumentation Systems:	15 Years
HDPE/MS Pipeline	30 Years

The design life of all structures and buildings shall be minimum 60 years.

4. GEO-TECHNICAL INVESTIGATION

The contractor will be responsible for the geo-technical exploratory survey to obtain accurate information about soil condition at the site. The depth, thickness, extent, composition of each stratum and the depth of ground water shall be determined. Provide a geo-technical report based on survey data which includes boring logs, field and laboratory test results, interpretation of data, building foundation and earthwork recommendations.

5. BASIC ENGINEERING DATA: DATUM AND SITE LEVELS.

The Plinth Level of the Pump House and other Building and Electrical works shall be fixed depending on Local maximum flood level with a minimum Plinth Height above Finished Ground Level - 0.6m or otherwise specified

6. DESIGN STANDARDS

All designs shall be based on the latest Indian Standard (I.S.) Specifications or Codes of Practice. The design standards adopted shall follow the best, modern, and sound engineering practice in the field based on any other international standard or specialist literature subject to such standard reference or extract of such literature in the English language being supplied to and approved by the Employer's Representative.

All the designs of reinforced concrete structures shall generally confirm to the recommendations made in the following publications (latest versions) of the Bureau of Indian Standards:

- i) IS: 456: Code of Practice for plain and reinforced concrete
- ii) IS: 875: Code of Practice for design loads for buildings and structures other than Earth Quake loads (Part 1 to 5).
- iii) IS: 3370: Code of Practice for concrete structures for the storage of liquids (Part I to IV)
- iv) IS: 1893: Criteria for earthquake resistant design of structures.
- v) IS: 2974: Code of Practice for design and construction of machine foundations (Part 1 to 4)
- vi) IRC: 6 Part II: Standard specification and Code of Practice for road bridges Loads and Stresses
- vii) SP: 34: Handbook on concrete reinforcement and Detailing.

All structural steel design shall generally conform to the following recommended latest publications of the Indian Standards Institution:

- i) IS: 800: Code of Practice for general construction in steel
- ii) IS: 806: Code of Practice for use of steel tubes in general building construction

7. DESIGN LOADS

All buildings and structures shall be designed to resist the worst combination of the following loads/stresses under test and working conditions, which includes dead load, live load, wind load, seismic load, stresses due to temperature changes, shrinkage and creep in materials, dynamic loads

a. Dead Load

This shall comprise loads arising due to all permanent construction including walls, floors, roofs, partitions, stairways, fixed service equipment's and other items of machinery. In estimating the loads of process equipment all fixtures and attached piping shall be included but excluding its contents. The minimum Dead Loads shall be as per IS: 875 (Part 1).

b. Live Load

Live loads shall be in general as per IS: 875 (Part 2). However, the following minimum loads shall be considered in the design of structures:

- i. Live load on roof: 1.50 kN/m^2
- ii. Live load on floors supporting equipment such as pumps, blowers, compressors, valves etc.: 10.00 kN/m^2
- iii. Live load on all other floors, walkways, stairways, and platforms.: 5.00 kN/m^2

In the absence of any suitable provisions for live loads in I.S. Codes or as given above for any particular type of floor or structure, assumptions made must receive the approval of the Employer's Representative prior to starting of the design work. Apart from the specified live loads or any other load due to storage of materials, any other equipment loads or possible overloading during maintenance or erection/construction in part or full, most critical condition shall be considered in the design.

c. Wind Load

Wind loads shall be as per IS: 875(part 3).

d. Earthquake Load

This shall be computed as per IS: 1893. The project area falls in seismic zone 2.

e. Dynamic Load

Dynamic loads due to working of plant items such as pumps, blowers, compressors, switch gears, travelling cranes, etc. shall be considered in the design of structures.

8. Joints

Movement joints such as expansion joints, complete contraction joints, partial contraction joints and sliding joints shall be designed to suit the requirements. However, contraction joints shall be provided at specified locations spaced not more than 7.5 m in both directions right angle to each other for walls and rafts.

Suitable gap at the location of expansion joints placed at a suitable interval not more than 30m shall be provided in walls, floors and roof slabs of all structures.

Construction joints shall be provided at right angles to the general direction of the member. The locations of construction joints shall be decided as per convenience of construction. To avoid segregation of concrete in walls, horizontal construction joints are normally to be provided at every 2 m height. Approved PVC water-stops of 150 mm width shall be used for walls and 230 mm width for base slabs.

Expansion joints for non-liquid retaining structures shall be provided as per IS 3414.

9. Partly / Fully Underground Liquid Retaining Structures- Basis for Design

All underground or partly underground liquid containing structures shall be designed for the following conditions:

- i) liquid depth up to full height of wall and free board: no relief due to lateral soil pressure from outside to be considered.
- ii) Reservoir empty (i.e., no liquid or any material inside the storage area): full lateral earth pressure at rest due to surrounding saturated soil and surcharge pressure as applicable, shall

Kaliteer lift Scheme

be considered.

- iii) partition wall between dry sump and wet sump to be designed for full liquid depth up to full height of wall.
- iv) partition wall between two compartments to be designed as one compartment empty and other full.
- v) Structures shall be designed for uplift in empty conditions considering the depth of the highest water table recorded in the area.
- vi) walls shall be designed under operating conditions to resist earthquake forces developed due to mobilization of earth and dynamic water loads.
- vii) Underground or partially underground structures shall also be checked against stresses developed due to any combination of full and empty compartments with appropriate ground/uplift pressures on the base slab. A minimum factor of 1.2 shall be ensured against uplift or floatation.

a) Special Consideration for Steel Structures: Steel Stairs

All steel staircases shall normally have clear width (back to back of stringer) of 1000 mm and maximum inclination with horizontal of $35^{\circ}75'$. However, in case of space restriction, minimum clear width up to 750 mm and slope up to 45° may be provided with prior approval.

The vertical height between successive landings shall not exceed 2.75 m. Channels (min. MC 150) shall be provided at stair stringers. Treads shall be minimum 250 mm wide made of chequered plate/ grating, with suitable nosing and spaced equally so as to restrict the rise to maximum 180 mm.

b) Steel Ladders

Ladders shall be provided to platforms, walkways, instruments, and equipment's that do not require frequent access. Ladders shall preferably be vertical and its angle with vertical shall not exceed 5° . Ladders shall be minimum 450 mm clear width with 20 mm dia. MS rungs spaced at 300 mm (maximum)

Ladders of more than 4.5 m height shall be provided with safety cage. However, safety cages to start at 2.5 m above the lower landing level.

c) Platforms and Walkways

All steel platforms above grade shall be constructed with kick plates at edge of platform to prevent tools or materials from falling off. It shall consist of 8 mm thick steel plate projecting 100 mm above the platform surface. Kick plate shall be painted with the same type of coating as the material to which it is attached.

10. Foundations

- i) The minimum depth of foundations for all structures, equipment's, buildings and frame foundations and load bearing walls shall be as per IS: 1904.
- ii) Care shall be taken to avoid the interference of the foundations or any other component of the new building with the foundations of adjacent buildings or structure. Suitable adjustments in depth, location and sizes may have to be made depending on site conditions. The Employer's Representative shall accept no extra claims for such adjustments.
- iii) Special attention is drawn to danger of uplift being caused by the ground water table. Base raft for underground structure shall be designed for uplift forces that are likely to be developed.
- iv) Where there is level difference between the natural/ existing ground level and the foundations of structure or floor slabs, this difference shall be filled up in the following ways:

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- In case of non-liquid retaining structures, the natural topsoil shall be removed till a firm stratum is reached (minimum depth of soil removed shall be 500 mm.) and the level difference shall be made up by compacted backfill as per specifications. However, the thickness of each layer of the backfill shall not exceed 150 mm. The area of backfilling for floor slabs shall be confined to prevent soil from slipping out during compaction. The safe bearing capacity of this well compacted backfilled soil for design calculations shall not exceed 100 KN/sqm.
- In case of liquid retaining structures, the natural topsoil shall be removed as described above and the level difference shall be made up with Plain Cement Concrete (1:5:10)

11. **For all civil works only Banas Sand shall be used.** Contractor has to ensure testing of all the material proposed to be used for civil structures from the laboratories as per the instructions of Engineer in Charge

12. General Requirements for Concrete Works

The following are the design requirements for all reinforced or plain concrete structures:

- a) All blinding and levelling concrete shall be a minimum 100 mm thick with minimum concrete M10 grade.
- b) All structural reinforced concrete other than for water retaining structures shall at least be of M20 grade with 20 mm size downgraded coarse aggregates, for all structural members.
- c) The minimum grade of concrete for water retaining structures shall be M25 having minimum cement content of 300 kg/m³ with 20 mm size downgraded coarse aggregates.
- d) All design for water retaining structure including roof shall be based on limited crack width of 0.2mm as per BS: 8007.
- e) The minimum clear cover to all reinforcement including stirrups and links shall be 40 mm for all water retaining structures including the bottom of roof. For other structures the minimum clear cover shall be as specified in IS: 456.
- f) Any structure or pipeline crossing below roads shall be designed for a minimum of Class A of IRC loading.
- g) The bridges and supporting structure (for clarifiers etc.) shall be designed to safely withstand the loadings such as loads and torque transmitted through scrapper blades, motor etc. depending on the arrangement offered besides other loads.
- h) All pipes and conduits laid below the structural plinth and road works shall be embedded in reinforced concrete of grade M15 having minimum 300 mm thick concrete cover all around.
- i) Approved quality water proofing compound (chloride free) shall be added during concreting of all liquid containing structure, in the proportion specified by manufacturer.
- j) For walls of liquid retaining structures, the following shall be considered.
 - Minimum reinforcement shall be as per BS: 8007.
 - Maximum length of panel to be concreted considering partial construction joints shall be 7.5 m. The adjacent panels shall be poured with a minimum time gap of 4 days. Height of pour shall not exceed 2 m.
- k) The following minimum thickness shall be used for different reinforced concrete members, irrespective of design thickness:

(i)	Walls for liquid retaining structures	:	200 mm
(ii)	Roof slabs for liquid retaining structures	:	150 mm
(iii)	Bottom slabs for liquid retaining structures	:	200 mm
(iv)	Floor slabs including roof slabs, walkways, canopy slabs:		150 mm
(v)	Walls of cables / pipe trenches, underground pits etc.	:	125 mm
(vi)	Column footings	:	300 mm
(vii)	Parapets, hajji	:	100 mm

- l) For all concrete work steel shuttering & centering shall be used and finish of the concrete shall be of F1 grade.

13. General Requirements for Building Works

Unless otherwise specified, all the building works shall generally comply with the following Employer's Requirements:

- a) All buildings shall have reinforced concrete framework.
- b) 75 mm thick RCC Damp Proofing Course in M15 shall be provided to all building walls.
- c) Anti-termite treatment as per IS: 6313 part-III-1971 with injection of chlorpyrifos emulsifiable concrete (1%) timber care ground treatment chemically emulsion 1:3 and creating a chemical barrier under and around the column pits, wall trenches, basement excavation, top surface of plinth filling, junction of wall and floor along the external perimeter of building, expansion joints, surrounding of pipes and conduits etc.
- d) All brick masonry shall be in class A bricks. All external walls shall be in 230 mm thick brick masonry built in cement mortar in (1:5).
- e) All internal partition walls except for toilets shall be in 230 mm thick brick masonry built in cement mortar 1:5. All half brick walls, and Toilet partition walls shall be in 115 mm thick brick masonry built in cement mortar 1:4.
- f) All external masonry surfaces shall be plastered with sand faced cement plaster in cement mortar (1:4) and shall have total thickness of 20 mm. Waterproofing compound of approved make and quality shall be added to the cement mortar in proportions as specified by the manufacturer.
- g) Bathroom/ W.C. floor slab shall be sunk and filled with brickbat coba (broken bricks set in lime) and provided with waterproofing as per the specifications of an approved specialist waterproofing company. The finished floor level in Bathroom / W.C. areas shall be normally 12 mm below the finished floor level on the outer side.
 - i) The toilet facilities shall include at least:
 - (i) 1 No. Water closet with white porcelain Orissa pan minimum 580 mm long with PVC flushing cistern of 10 liters capacity.
 - (ii) 1 No. Urinal of sizes 610 mm x 400 mm x 80 mm flat back type in white porcelain separated by a Kota stone partition of size 680 mm x 300 mm shall be provided outside toilet.
 - (iii) 1 No. Washbasin of size 510 mm x 400 mm in white Porcelain with inlet, outlet with bottle trap.
 - (iv) 1 No. Mirror of size 400 mm x 600 mm PVC moldings wall mounted type fitted over washbasins.
 - (vi) 1 No. Chromium plated brass towel rails minimum 750 mm long.
 - (vii) All stopcocks, valves and pillar cocks shall be of chromium-plated brass, heavy duty.
 - (viii) All fittings such as 'P' or 'S' traps, floor traps, pipes, down-take pipes etc.
 - (ix) The sewage from toilet blocks shall be led to a septic tank with soak pit. The Contractor, at a suitable location, shall provide a septic tank having appropriate capacity, as per specifications.
- j) Wherever specified, staircases shall be finished with 25 mm thick Kota Stone treads and 20 mm thick Kota Stone skirting. The rise of stairs shall not exceed 170 mm and minimum width of the tread shall not be less than 275mm. All steps shall have 20mm nosing. R.C.C. stairways shall be provided to permit access between different levels within buildings. All roof tops and tops of overhead tanks shall be made accessible with ladder provision. Vertical ladders fitted with landing point extensions will be permitted where considered appropriate by the Employer's Representative to access areas not frequently visited.

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- k) All floors cut outs and cable ducts, etc. shall be covered with pre-cast concrete covers in outdoor areas and G.I. chequered plates of adequate thickness in indoor areas. All uncovered openings shall be protected with G.I. hand railing fixed with two rails. Top railing and vertical of the G.I hand railing shall be 32 mm dia. G. I. Pipe of Class-A. The lower railing shall be 25mm dia. G.I. pipe of Class A.
- l) All staircases shall be provided with steel railing with PVC cover or wooden handrail.
- m) The reinforced concrete roofs shall be made waterproof by application of approved cement/ lime based waterproofing treatment, guaranteed for 10 years. The finished roof surface shall have adequate slope to drain quickly the rainwater to R.W down-take points.
- n) For roofing drainage, cast iron rainwater down-takes with khurra and door bend with C.I. grating at top shall be provided. For roof areas up to 40 sqm. minimum two nos. 100 mm diameter down-take pipes shall be provided. For every additional area of 40 sqm or part thereof, at least one no. 100 mm dia. down take pipe shall be provided. The RW pipes shall be concealed.
- o) Top surfaces of chajjas and canopies shall be made waterproof by providing a screed layer of adequate slope or application of an approved roof membrane and sloped to drain the rainwater.
- p) Building plinth shall be minimum 450 mm above average finished ground level around building.
- q) All buildings shall have a minimum 1.0 m wide, 100 mm thick plinth protection paving in M15 grade concrete finished with stone slabs/ tiles. All plinth protection shall be supported on well-compacted stratum.
- r) All concrete channels and ducts used for conveying liquid shall have smooth finish from inside. The width of concrete channels shall not be less than 500 mm. All open channels shall be provided with G.I. hand railings.
- s) Kerbs to be provided below the hand railing on the catwalks/pathways should be as per relevant sections of the Factory Act.
- t) All rooms in the Pump house and office buildings shall be provided with appropriate signboards indicating the function of the rooms involved.
- u) Wherever equipment and machinery is required to be moved for inspection, servicing, replacement etc., suitable movable gantry of required capacity shall be provided.
- v) The design of buildings shall reflect the climatic conditions existing on site. Buildings shall as far as possibly permit the entry of natural light.
- w) Emergency exit doorways shall be provided from all buildings in order to comply with local and international regulations. Stairways and paved areas shall be provided at the exit points.
- x) Toilet blocks in Pump House, office and rest house building shall be provided with two drinking water taps of 12 mm size and sink with appropriate drainage.
- y) All chequered Plates shall be hot dip galvanized.
- z) All types of opening such as doors, windows and ventilators shall be minimum 25% of the floor area.
- aa) Glass shall be minimum 5 mm thick, pin headed or opaque.

14. Concrete Reinforcement

All major structures, buildings, pump house, Pump Rooms, Intake Structure, river bank protection structures and all water retaining structures in the Contract will use TMT Fe 415 (procured from TISCO/ SAIL /RINL or equivalent as approved by Employer's Representative) for concrete reinforcement.

Other concrete works like, thrust blocks, pillars etc. may use HYSD steel bars (procured from TISCO/ SAIL /RINL or equivalent as approved by Employer's Representative). The decision on HYSD or TMT steel will be made by the Engineer in Charge.

15. Grouting

Non-shrink flowable grout shall be used for under pinning work below base plate of columns. Non-shrink cum plasticizer admixture shall be added in the grout. For grouting of base of machine foundation high strength ready mixed non-shrink flowable grout shall be used. Crushing strength of the grout shall generally be one grade higher than the base Concrete. Minimum grade of grout shall be M 25. Nominal thickness of grouting shall be at least 50mm for columns and pedestals of major equipment. For secondary posts, stair, and ladder base, etc. grouting shall not be less than 25mm thick.

16. Soil Bearing Capacity

The contractor has to assess soil bearing capacity for all works at his own cost and design the structures on the basis of data received after investigation. The soil investigation report has to be submitted to Department.

D. QUALITY ASSURANCE

1. GENERAL OBLIGATIONS OF THE CONTRACTOR

The Contractor shall establish staff, equip and operate a comprehensive quality assurance organization at the site during the full period of the Works. The principal responsibility and duty of this organization shall be to ensure that all work carried out and materials produced or supplied by the Contractor shall comply fully with the Specifications as well as with all relevant Indian or other standards.

SECTION – II

SURVEY, INVESTIGATION, PLANNING, DESIGN AND DRAWING
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SECTION – II

SURVEY, INVESTIGATION, PLANNING, DESIGN AND DRAWING

1. DEFINITIONS:

Definitions of most of the terms used in the Contract document are as follows: -

- a. **RISING MAIN/ MAIN LINE:** Main pipeline taking off from the Pump house for carrying water under pressure to the Natural drains

2. SCOPE OF WORK:

The scope of work to be carried out for **the Lift Scheme** shall be as under: -

2.1 Survey and Investigation

2.1.1. Department has already conducted survey for the PUMP HOUSE location and about area of pipeline this scheme. Therefore, digitized contoured cadastral maps will be provided to the contractor by the department. If there is any further requirement arises at the time of Planning, design & execution of the scheme, the additional area will be surveyed by the contractor. Contractor has to establish permanent Benchmarks and temporary benchmarks in the project Area. Contractor have to utilize this data for planning, design and estimate of Lift Irrigation Scheme having components of Intake Works, Pump House, Rising main, Survey work will be used for preparation of land acquisition cases, operation and maintenance manual.

2.1.2. Preparing a General Arrangement Plan for whole scheme with Planning of rising mains, Sub mains. At least three alternative alignments/ General arrangements proposal should be submitted. After getting approval of the alignment from the competent project authorities for the most economical and feasible alignment from the competent project authority Contractor has to furnish the following details

- A.** Kilometer wise L-section and design statements of rising mains with apex details, location of CD works, detailed designs of curves, part village map showing the alignment of that KM, cross sections at 150 M. interval on alignment for complete rising mains on village maps. Sub Main /Lateral alignment map with apex details, kilometer wise L-section, location of control works, detailed designs of curves, cross sections at 90 M. interval on alignment Final location survey including marking of pipeline alignment on revenue village maps with contours at 50 cm intervals, showing of B.M etc. Preparation of land acquisition cases in required proforma and sketch on revenue village maps as per Rajasthan Land Acquisition Act.

B. Details to be surveyed

The objective of the survey is to provide sufficient detail to enable the design of the whole Lift scheme. The survey shall include, but not be limited to the following:

- I.** Establishment of a system of benchmarks. Existing monuments should be used wherever possible, and their accuracy confirmed. In addition, where control point or benchmarks are not available, new points are to be established. Where the distance between these points exceeds 2.0 Km, intermediate point are to be established.
- C.** After getting approval to the alignment from the project authorities, the contractor has to fix the chainage stone at 100 m interval along alignment on central line and apex stones at every deviation of alignment duly indicating apex No .and chainage. The chainage stones and apex stones shall be of size 20x20x75 cms. Projection of the stone

above ground level will be 25cms.

- D.** Permanent Benchmarks with values should be furnished on site. The permanent benchmark (PBM) shall have to be established by the contractor at the Pump House along the rising main, along Sub Mains/Laterals in scheme by double levelling and cross checking. Their location shall however be decided in consultation with the project authorities.

2.1.3. Design and drawing of rising main and related works

Design of rising mains, economical diameter and all components should be as per **IS, CPHEEO, MOST/ Departmental and other prevalent norms**. Contractor has to prepare and get approved Longitudinal Sections, Design Statement of rising mains and Sub Mains/Laterals of entire package length which should be furnished duly considering losses including head losses. Cut off statement should be reach-wise and designed discharge, discharge required, roughness coefficients with respect to type of pipe selected. For design of Pipelines, detailed hydraulic calculations, water thrust etc., should be analyzed, suitable water hammer reducing majors and devices to be designed and transition curves and smooth joints should be designed and got approved.

2.1.4. For Power System Connectivity

The work related to power Supply connectivity will be done by State Power Company up to the extent detailed in detailed scope of work under this contract. Thereafter Power connectivity will be done by the contractor.

2.1.5. Preparation of Schedule of quantities

Estimate and Schedule of quantities should be furnished separately for entire project. Item of work should be in accordance with the specification and rates mentioned in the current "Schedule of rates" of the state of Rajasthan and prevailing market rates for non-scheduled items supported by rate analysis and quotations from manufactures of selected material. The detailed estimates in triplicates set and also in soft copy which shall include detailed report, estimates and detail survey sheets.

3. CONSTRUCTION OF BENCHMARK STRUCTURES

3.1 The contractor will collect the details of Survey of India benchmarks in the area or shift new benchmark with nearby GTS BM. With this as a datum additional network of Temporary Benchmarks (TBMs) shall have to be established by the Contractor. Their locations shall however be decided in consultation with department. Contractor shall fix temporary benchmark preferably on permanent structures in the command area. Values of such benchmarks shall be fixed with reference to the Permanent Benchmark established by SOI as indicated by the Engineer-in-Charge. A plan to a scale of 1:15000 indicating location and levels of all PBMs established in the command area shall be prepared and submitted to the Department.

3.2. Construction of Permanent Benchmarks (PBMs):

The PBMs shall be constructed at location as may be directed by Engineer- In-Charge. This should be located preferably at one corner of the field or field boundary, Govt./no man's land which will not hamper the agricultural operations or as instructed by the Engineer-in-charge. A 10 mm dia anchor about 300 mm in length with steel plate 120 x 120 x 6 mm. Shall be embedded in the concrete, and the top of the steel plate shall be 100 mm below the top level of concrete and truly horizontal. The level of PBM shall be established on top of steel plate. Adequate care shall be taken by the Contractor for curing the concrete laid for the PBMs. The PBMs shall be numbered in oil paint for identification. Where black cotton soil is met with the foundation will have to be taken to extra depth and filled with M-10 c.c. & standard

4. FIELD SURVEY FOR BLOCK CONTOURING AND PREPARATION OF VILLAGE MAPS SHOWING CONTOURS AND FIELD DETAILS:

I. Department has already conducted survey for the PUMP HOUSE location and about project pipeline of this scheme. Therefore, Survey data will be provided to the contractor by the department. If there is any further requirement arises at the time of Planning, design & execution of the scheme, the additional area will be surveyed by the contractor. Contractor has to establish permanent Benchmarks and temporary benchmarks in the project Area. Contractor have to utilize this data for planning, design and estimate of Lift Scheme having components of Intake Works, Pump House, Rising main, associated appurtenant. Survey work will be used for preparation of land acquisition cases, operation, and maintenance manual.

II. The BMs shall be constructed as per standard specifications. All the BMs shall be connected by double levelling accurately. Every day's work shall be closed on any one of the benchmarks mentioned above and the accuracy of the day's work checked by Engineer's representative present throughout the activity.

III. Survey Accuracies

a) General

The Contractor will be required to ensure the various minimum levels of accuracy outlined below until such time as he can demonstrate supplemented with codal provisions or in vogue with examples to the satisfaction of Engineer-in-charge in the best interest of the work and this variation of accuracies should be at no additional cost to the Employer.

IV. Co-ordinate System

A local grid system, based on the WGS 84 projection, shall be established for scheme such that all co-ordinates within the scheme are positive. This shall be agreed with the Contractor at the start of the Contract and linked to the Survey of India (SOI) grid where suitable coordinated control points are identified, and the Contractor advised of the corresponding offsets. Where applicable, suitable azimuth control will be applied, and the methodology adopted outlined in the report. The geographic information or geographical information system (GIS) software should be used for preparation all maps, plans and depiction of topography. Modern GIS technologies rely on digital information, for which there are a number of collection methods. The most common method of data creation is digitalization, where a hardcopy map or survey plan is transferred into a digital medium through the use of a CAD program, and geo referencing capabilities.

V. Collection, Storage and Processing of Field Data

All field measurements together with their relevant field codes are to be automatically stored in electronic data-loggers either within the field instrument or attached to field instruments and downloaded from storage remotely or directly to computer for processing. Recording by hand and transcription of field data is not considered appropriate for this project given the time frame available and will not be permitted. GIS application should be used.

5. **Surveying**, Planning, Designing, and estimation including preparing land plans and schedules for land acquisition and also collecting data of roads and cart tracks in the command area for

a) Marking alignment on SOI Maps:

Besides marking the Intake works, pump house of scheme, the alignment of pipeline, are to be marked and boundary of block for which the contractor is required to plan, design, and estimate distribution network shall be indicated on The Survey of India Maps to a scale of 1:50000/1:10000 with contours. These maps should be prepared in ARC GIS.

b) Rising Main

Following broad principle shall be followed while fixing the initial alignment

- i. On the contour map valley lines and ridge lines should be marked.
- ii. The alignment of the rising mains, sub mains should be marked.
- iii. The alignment shall be straight as far as feasible. Smooth curves shall be provided where necessary to minimize head loss.
- iv. Alignment should be away from village site by about 50 m.
- v. Major crossing of railways, roads and drains should preferably be at right angles.
- vi. Have minimum number of road or cross drainage works.
- vii. Permanent structures such as wells/tube wells, house etc. should as far as feasible be kept away from alignment.

5.2. Final layout:

- a) After approval of the preliminary layout as provided above, the contractor shall proceed with the work of longitudinal sections of the alignments, collecting the field data for the approved pattern.
- b) The survey work should commence from an established TBM and end on established TBM only at the end of the day's work. The closing error should not exceed the permissible limit.
- c) The contractor shall submit final layout prepared as stated above to the Engineer-in-Charge for approval. The Engineer-in-charge shall scrutinize the proposal and convey his observations to the contractor within one month. The contractor shall promptly comply with the remarks and/or if necessary, discuss the proposal made by him with the Engineer-in-charge and sort out differences. The Engineer-in-charge shall convey the final approval within one month.
- d) Checking of works done by contractor:

The department officer posted at works site shall concurrently check the work of transfer of PBM and TBM surveying & levelling by arithmetical checking plotting of survey work on village map checking of contours, pipeline alignment marked on village maps & verifying same actually at site also.

6. DESIGNS AND PREPARATION OF PLANS & ESTIMATES:

After receiving approval to the final layout, the contractor shall proceed with the task of preparing final designs of Intake Works, Pump House, and appurtenances, rising mains. its detailed designs, fixing permanent benchmarks along the alignment of intake works, pumping station, rising main, and preparation of plans and estimation of the complete system. All system shall be designed using relevant IS codes and prevalent practices. Contractor shall also furnish details of land to be used for rising main, Sub mains and drainage lines in prescribed format after marking land width and curves on village plans in consultation with engineer in charge. Contractor shall construct and establish permanent benchmarks along whole scheme. the approved alignment of rising main, sub mains/ laterals. Contractor shall prepare estimates for earth work and pipelines based on description of the items on current schedule of rate and present market rates for non-scheduled items. Separate sub-estimate for different heads as directed by Engineer-in-Charge shall be prepared. Contractor shall also furnish a consolidated

estimate of all the sub estimates for the whole scheme assigned to him.

7. DETAILED DESIGN OF THE SYSTEM

OVER DESIGN FACTOR

The actual system design capacities for main & sub main would be increased above the computed capacities to allow for inaccuracies in design, data collection and post construction. The increases would be as supplemented with existing practices for similar type of irrigation works. The minimum 5% as over design factor should be considered over the overall flow estimated including losses for derivation of discharges with over design factor. The pipeline with detail demand statement should be worked out. The demand statement for mains, sub mains should be worked out and total pumping capacity should be finalized.

8. SURVEYING, COLLECTING, PLOTTING, PREPARING DESIGNS DRAWINGS AND ESTIMATES OF STRUCTURES FOR IF ANY AS PER APPROVED PLANNING AND DESIGN

- a) Intake Works
- b) Pump house Design of pumps and electrical accessories.
- c) Rising Mains
- d) All related components detailed under the power system connectivity

The hydraulic and structural design for all the structures shall be done as per latest guidelines provided in 'Manual on Water Supply and Treatment' published by Central Public Health and Environmental Engineering Organization (CPHEEO), Ministry of Urban Development, New Delhi, Hydraulic Institute Standards and relevant latest I.S./International/MOST code and practices in vogue for such type of irrigation works.

However, the latest version of the codes shall prevail for the detailed planning, design and execution. Unless otherwise specified, the design will be carried out by working stress method.

9. ADDITIONAL POINTS:

- Standardized notation should be got approved from the Department along with the format for drawings (dimensions, lettering, name plate etc.)
- Though design details have been supplied or referred to, the Contractor will be responsible of design of a workable and operationally feasible system.

10. ADDITION/MODIFICATIONS:

Should circumstances arise which call for addition/modifications in the design criteria, the department shall intimate the additions/modifications to the contractor. These additions/modifications will have to be taken into account. On approval of the proposal, contractor shall submit final presentation. All drawings shall be prepared in computer. Separate layers should be used to depict different details in Auto CAD drawings.

- Index map to the scale of 1:15000 showing alignment of rising main, sub mains, important roads, railways, major drains, and village boundaries etc.
- A combined contour map to a scale of 1:15000 shall be prepared showing alignments of, type and location of structures, link/ main drains, roads, and cart tracks, S.O.I. benchmarks and permanent benchmarks constructed in one mosaic.
- Contour maps of whole scheme in villages to a scale of 1:4000 (village map) showing thereon alignments of mains, sub mains, inline fixtures, layout alignment of drainage network any type and details of structures provided thereon, location of permanent bench marks, kachha and pucca roads, ditches, wells, houses, railway lines, high tension line, electric poles, telephone poles, irrigation pipe lines, Water

Supply pipe lines, ONGC/IOC pipe line and all other important prominent features

- Cross section of laying details of rising mains
- Detailed drawings of structures to a scale of 1:50. In case of layout etc. the scale can be 1:100 and in case of details of components the scale can be 1:25.
- Line diagram of pipelines
- Pipeline wise land plan schedule.
- Alignment strip plans and land width of pipeline networks on village map to a scale of 1:4000 m showing apexes, tangent lengths, curve lengths, land width required to be acquired etc.
- North lines for plans shall be in same direction.

Note:

- In case where all the details cannot be accommodated in one volume there can be two or more sections but, in such case, care should be taken that complete details of an item is covered in one section.
- Where map cannot be accommodated in one drawing, the overlap of 5 cm on all sides shall be provided.
- A uniform block shall be provided on the right- s i d e bottom corner as per the details given by the Engineer-in-charge.
- Drawings: All drawings, map plans should be computer printed on transparent sheet by plotter. A proper numbering system should be used. Each such tracing should be accompanied by 5 legible ammonias print on superfine paper / photocopy taken out from it.
- Estimate and Statements: 3 legible copies of estimates/statements/design notes/reports etc. typed on computer and its printout in laser jet printer.
- Land acquisition proposals in the formats as per requirement of revenue department in six legible copies typed on computer and its laser print out.
- The Contractor shall submit original tracing and field books. The contractor shall also return the documents furnished by the Department.
- All above record in CD and one hard disc with operating software. Submission of complete animated proposal in Media Player or in Flash showing all components of work and working animated model so as to give terrain depiction, showing villages, towns, boundaries, river, intake works, pumping station, water conductor systems virtual working model.
- Operation and maintenance manual draft of the project with master control.

11. Specifics

- i. Survey work will be handed over to the Departments in Auto CAD format drawings, separate layers will be used for each attribute and standardized blocks will be used to portray repeated features such as telegraph poles. A list of such layers and corresponding line-types and blocks as the Contractor proposes shall be agreed prior to the commencement of drawing production.
- ii. Drawing shall be prepared at a scale of village map and shall include a map location legend and scale bar not each sheet.
- iii. Drawing shall be on standard A 1 sheets. All drawing shall have a 20 mm border on all sides. The title block shall be in the bottom right-hand corner of the page and the title block area above it shall be 100 mm wide. No part of the model space drawing shall extend into the title block margin above it all notes, scale bars and legends shall be located in the margin above the title block.
- iv. All survey data shall be presented in model space (with Auto CAD, GIS) and all other non-spatial data and constructions (title block, legend, frame etc) shall be located in

- v. Each drawing shall include a 100 m x 100 m grid with clearly referenced co-ordinates using GIS along the drawing border.
- vi. Where these occur within limits of drawings, the drawings shall show the location of benchmarks and control points used during the survey. Each shall be fully referenced, and its details included in the report.
- vii. Each drawing shall show the details agreed with the Departments, the remaining layers though present in the drawing file, shall remain hidden.

12. SURVEY & INVESTIGATION FOR SYSTEM CONNECTIVITY

Survey And Marking:

The preliminary Survey: - Walk over survey, theodolite survey, and profile survey (if required) shall have to be carried out to establish the Route alignment by the Contractor for new lines. Survey shall cover all crossings like railways, roads including NH, power lines, telecommunication lines (under P&T Deptt), rivers, forest area, proximity to buildings etc. and should be clearly indicated in the route map. Rly crossing shall be indicated clearly by colour code or by bold letter. Route alignment shall be plotted on Survey of India topographical maps [size (1:25,000) or (1:50,000) wherever available. Preliminary Survey Reports: Three copies of the alignment reports along with other information, if any, shall be submitted in report form, to Executive Engineer in charge of the Division with copy marked to A.C.E, Water Resources Zone, Jaipur for approval.

The detailed survey: - It should be taken up only after the route map is approved. Preliminary route alignment in respect of the proposed line may undergo changes due to alteration of place and other unavoidable constraints. Detailed survey shall be covered by the following general guidelines:

- Route of the electric line shall be as short as possible.
- The line is as near as possible to the available roads in the area. Difficult and unsafe approaches are avoided
- Good farming areas, religious places, forest, civil and defence installations, aerodromes, public and private premises, ponds, tanks, lakes, gardens, and plantations are avoided as far as practicable.
- Involvement of Forest land should be least & restricted as far as possible.
- The line should be far away from telecommunication lines as reasonably possible. Parallelism with these lines shall be avoided as far as practicable.
- Angle points in the route shall be minimized. Railway and road crossing shall be minimum on the line route and in case it is not possible to avoid the same the crossings at right angles shall be preferred but the crossings shall not be less than 600 in any case.
- The survey shall be conducted along the approved alignment only.
- Relevant drawings & data shall be furnished to the appropriate authorities and obtain statutory clearances for Railway crossings, Highway/Roads, Telephone/ Power line crossings etc. All such clearances are the responsibility of the contractor.
- Contractor shall arrange all required consent/approvals including civil aviation, road, river, railway, canal, power line crossings and environmental and forest clearance etc. from the concerned authorities
- After completing the detailed survey, the contractor shall submit the followings along with compliance reports, if any, to Executive Engineer in charge of the Division with copy marked to A.C.E, Water Resources Zone, jaipur for final approval by WRD.
- After approval, the contractor shall submit six more sets of the approved documents along with a soft copy for record purpose and submission to concerned Distribution Licensees.

Way-leave and Tree cutting

Way-leave permission which may be required by the contractor shall be arranged at his cost. While submitting final-survey report for approval, proposals for wayleave right of way shall be submitted by the contractor. Do WR may extend help/ facilitate to get the permission within a reasonable time for which due notice shall be given by the contractor in such a way so that obtaining permission from appropriate authority do not hinder the continued and smooth progress of the work. The employer shall not be held responsible for any claim on account of damage done by the contractor or his personnel to trees, crops, and other properties. The contractor shall take necessary precaution to avoid damage to any ripe and partially grown crops and in the case of unavoidable damage, the employer shall be informed, and necessary compensation shall be paid by the contractor. All the documents required for application to the statutory authorities must be prepared by the contractor & submitted to the employer for submission of the application towards approval of Railway Crossing etc. However, the responsibilities lie with the contractor to get the clearance. Trimming of tree branches or cutting of a few trees en-route during survey is within the scope of survey to be done by the contractor with appropriate permission. Contractor shall arrange for necessary wayleave and compensation in this regard. During erection of the line, compensation for tree cutting, damage caused to crops, actual cutting and falling of the trees including way-leave permission for such route clearance shall be arranged by the contractor at his cost. The contractor will identify the number of trees and detail of obstructions to be removed for erection of the line and intimate the employer well in advance in case of any help. Other related works like construction of temporary approach roads, etc. as required, shall be done by the contractor and the same will lie within the scope of contractor's work and such cost shall be considered to be included in the rates quoted by him.

Check survey

The contractor shall undertake the check survey during execution on the basis of the alignment profile drawing and pole/ structure schedule approved by DoWR. If during check survey, necessity arises for minor change in route to eliminate way leave or other unavoidable constraints, the contractor may change the said alignment after obtaining prior approval from the authorized Engineer, WRD.

13. Work Ownership

Following completion of the survey work and final payment of all dues the survey work including all data and computations satellite imagery and drawings shall become the property of the Employer. The Contractor shall not distribute copies of the Work to third parties except the Departments, without the prior written consents of the Employer.

14. Backup Copies

The Contractor shall submit all records with licensed software in Compact Discs (DVD) in 5 copies with proper referencing and interlinking of data with references so as to access data as web page. The data shall also be supplied in an appropriate capacity hard disc with all operating software used. The data shall also be available with contractor till the expiry of defect liability period and if required by department the same shall be supplied in soft copies.

B. LAND ACQUISITION

The Land Acquisition Cases are to be Prepared and submitted in formats prescribed by the revenue authority component to pass the awards. Rajasthan Land acquisition Acts, Rules, and Regulations in respect of land acquisition as enforced from time to time are to be strictly followed. The Contractor has all the responsibility regarding field work, surveys, paperwork, and other activities related to land acquisition accept payment of compensation. After passing of award for compensation payment will be made by department accordingly.

Section -III**TECHNICAL SPECIFICATION FOR CIVIL WORKS**

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1	A. EXCAVATION/EARTH WORK IN EMBANKMENT	
2	B. DRILLING & BLASTING	
3	C. DEWATERING	
4	D. DRILLING & GROUTING	
5	E. BUILDING WORKS	
6	F. TRASH RACKS & GATES	

A. EXCAVATION/EARTH WORK

- 1.1 Scope of work.
- 1.2 Clearing the site.
- 1.3 Layout.
- 1.4 Excavation.
- 1.5 Excavation in rock.
- 1.6 Removal of loose rock etc.
- 1.7 Maintenance of slopes in excavation.
- 1.8 Slips Responsibility.
- 1.9 Use of excavated stuff.
- 1.10 Deposition of excavated stuff, clear off traffic lines etc.
- 1.11 Surplus Materials
- 1.12 Stacking in stock and Waste piles.
- 1.13 Use of excavated materials
- 1.14 Silting of excavation.
- 1.15 Silting due to flood.
- 1.16 Excavation in wet condition and dewatering.
- 1.17 Contractor to dewater whenever required
- 1.18 Preparing and testing of foundation.
- 1.19 Scaling and trimming of foundation.
- 1.20 Treatment of weak local spots.
- 1.21 Final finished surface of foundation.
- 1.22 Testing for soundness
- 1.23 Excavation outlines.
- 1.24 Earth Work in Embankment
- 1.25 Blasting.
- 1.26 Observing rules regarding blasting.
- 1.27 Storing of explosives.
- 1.28 Restrictions of blasting.
- 1.29 Excavation in hard strata with chiseling and/or controlled blasting.
- 1.30 Excavation in hard strata.
- 1.31 Chiseling manually or excavation by pneumatic rock breakers.
- 1.32 Alternative technique approved by the Engineer-in-Charge.

EXCAVATION

1.1. SCOPE OF WORK:

The item shall include clearing site, excavation for Pump house & similar other.

All the excavation and removal of excavated material and its disposal in a manner hereinafter specified the rate for the item of excavation shall also include.

- Clearing of site.
- Setting cut works, profiles etc. according to sanctioned plan, or as directed by Engineer-in-charge and setting up benchmarks and other reference marks.
- Providing and subsequently removing shoring and strutting if and when necessary.
- Necessary protection including labour, materials and equipments to ensure safety and protection against risk or accident.
- Supply of facilities for inspection and measurements at any time to the concerned Govt. officials.
- Compensation for injury to life and damage to property if any caused by contractor's operations connected with this item

1.2. CLEARING THE SITE:

The site of excavation shall be cleared of all grass vegetation, fencing, bushes, and trees as directed by the Engineer-in-charge. The materials, obtained from such clearance shall be the property of the Govt. and shall be stacked as directed by the Engineer-in-charge so as not to cause obstruction to the work.

1.3. LAY OUT:

All materials such as pegs, bamboos and strings and templates for marking out slopes, and tools required for line out shall be provided by the Contractor at his own cost. The Centre line of excavation shall be clearly marked by pegs or by stones at each chain or change of direction or at shorter intervals on curves, in the beginning. The final line out will be done by fixing reference stone at suitable distances on either side of the centre line, so that they are not disturbed during the construction period. The position of these stones will be marked on the cross section. No change in the sanctioned plans and designs is permissible without the written permission of Engineer-in-charge. Before starting the work, the Contractor shall have to sign the field books and plans showing the working longitudinal sections and cross sections of the portions of the alignment, that he has to tackle. If the Contractor fails to sign them within three days of being called upon to do so, the levels and sections as recorded by Engineer-in-charge, or his Assistant will be final & binding on the Contractor. Contractor shall provide and maintain the quarry roads and temporary roads required for conveying and transport of materials at his cost. For the points, which are not covered by these specifications, the instructions given by the Engineer-in-charge shall be final and binding on the Contractor. The material available from all excavation and remaining surplus after use on the work from adjacent work etc. can be used by the Contractor free of cost provided these materials are used solely for the specific contractor work and prior approval of the Engineer-in-charge is taken.

1.4 EXCAVATION

Section shall be excavated as shown on the drawings or as directed by the Engineer - in - charge. Suitable arrangements for drainage shall be provided to take surface water clear of excavation during the progress of work.

Excavation may be carried out by manual labour or by excavating machine

1.5 EXCAVATION IN ROCK:

Excavation in rock shall be mostly controlled blasting so as not to endanger surrounding structures. All sharp points of rock are chipped off. Blasting in a manner, which is likely to produce over breakage, which in the opinion of Engineer-in-charge is excessive, shall not be permitted. Special care shall be taken to prevent over-breakage or loosening of materials on bottom and side slopes. Excavation in excess of the prescribed section shall not be permitted and no payment will be made for such excess excavation. The material excavated shall be stacked on either side as specified on the drawing or as directed by the Engineer - in - charge. The Excavation shall be carried out according to the design with side properly slopped as shown in the drawings and as directed by the Engineer - in - charge. The cross section adopted in cutting is likely to change inside slopes according to the depth of different strata during actual excavation. The Contractor therefore shall get clear instructions from Engineer - in - charge, before commencing any cutting work. No claims for any variations in quantity of excavation resulting from the deviation from the instructions of the Engineer - in - charge shall be accepted. In portions where deep cutting of more than 6 m. is to be done, the mode of excavation to be followed must be got approved from the Engineer - in - charge, before starting the work. The excavation shall actually be carried out in steps. The steps shall have such width and depth that after they are cut, the required final side slopes is attained. Cutting of steps shall be done when altered level is reached and after one monsoon.

1.6 REMOVAL OF LOOSE ROCK ETC:

Before any work of excavation is taken up all loose rock, semi-detached rock in /or close to the areas to be excavated, that is liable to fall or otherwise endanger the workmen on the project shall be stopped. The methods employed shall be such as will not shatter or render unstable and therefore unsafe any rock that was originally sound or safe. Any material not requiring removal as contemplated herein, but which may later become loosened or unstable shall be promptly and satisfactorily removed. The cost of such clearing shall be deemed to have been included in the unit rates accepted under the different items under excavation.

1.7 MAINTENANCE OF SLOPES IN EXCAVATION:

Any shoring and strutting required during excavation and afterwards shall be deemed to be covered by the rates quoted for the items.

1.8. SLIPS:

Slips shall be avoided, but if any slips occur on account of any reason, the excavation shall be promptly restored to stability. No extra claims shall be entertained for such slips. The Contractor shall have to make good the work at his cost.

1.9 USE OF EXCAVATED STUFF:

Excavation shall be done systematically. Only those excavated stuff, which will be permitted for use, shall be used.

1.10 DEPOSITION OF EXCAVATED STUFF CLEAR OFF TRAFFIC LINES ETC.

Disposal of all material from excavation shall be as per approved disposal plan of instructions of Engineer - in - charge, regarding the location and deposition of the stockpiles, spoil banks of embankment. Before any excavation is started the deposition of spoil shall be carefully planned so as not to obstruct normal traffic and traffic lines required for the construction materials, and shall be dumped sufficiently clear off the edges of the excavation so as not to endanger stability of the slopes of the excavation and also to permit ample space for lorry paths, installation and lifting of dumping devices, stacking construction materials etc.

1.11 SURPLUS MATERIALS:

The excavated materials, if not required shall be stacked in spoil banks with neatly made stable slopes at top and a suitable berm being left between the toe of bank, and edge of excavation, as directed.

1.12 STACKING IN STOCK AND WASTE PILES:

After sorting is done, useful materials of various types shall be stacked in stockpiles and rest may be disposed of as directed by the Engineer - in - charge.

Useful material shall be stacked in separate area as directed with reference to the nature of the material. Stockpiles shall be of regular shapes allowing for easy measurement No stockpile shall measure less than 60 m. length and 5 m. height unless specially permitted by the Engineer - in - charge

The excavated material shall be stacked within the area approved by the Engineer - in - charge. If the excavated material is deposited in unauthorized land, such work will not be measured for payment unless suitable action as may be directed by the Engineer - in - charge is taken by the contractor. In addition to non - payment of such work suitable amounts as directed by the Engineer - in - charge will be recovered from the Contractor as directed towards any extra cost which may have to bear on account of the Contractors un-authorized action.

1.13 USE OF EXCAVATED MATERIALS

All the materials available from excavation will be the property of Govt. and shall be deposited as directed by the Engineer - in - charge. The Material of approved quality may be used by the Contractor in the item of work included in Schedule of requirement of the tender or on ancillary for preparatory work free of charge. Prior approval of the Engineer - in - charge for such free use shall however be taken.

1.14 SILTING OF EXCAVATION:**1.15 SILTING DUE TO FLOODS, EMPLOYER NOT RESPONSIBLE:**

If excavated pits get silted due to intervening floods, slips or any other cause, till completion of the work, the Contractor shall excavate and restore the pits and section to the required shape and dimensions without any extra cost.

1.16 EXCAVATION IN WET CONDITION AND DEWATERING:

Unless otherwise specified no distinction will be made as to whether the material being excavated is dry, moist or in wet condition.

1.17 CONTRACTOR TO DEWATER WHENEVER REQUIRED:

The area under all the works pertaining to this tender and adjoining area as necessary shall be maintained free of water. The area shall also be maintained free of water after any part of the work is completed for inspection, safety and installation for any other reasons determined as necessary by the Engineer - in - charge. The sumps shall be well lighted and shall be readily accessible for inspection. The Contractor shall pump out all water from the site and appurtenance works and shall keep the foundation free of water, while excavating, concreting and placing masonry and continue to keep the works free of water for a period as may require from proper setting of mortar or concrete or otherwise required for the completion of work. The Contractor shall have to construct and maintain during construction of structures, cofferdams, diversion channels and other diversions or protective works as necessary after approval from Engineer-in-charge. The Contractor shall not be entitled to pay claims or damages on account of or by reason of any amount of leaking through under or around cofferdams, diversion channels and either diversion or protective works of overtopping of diversion works.

1.18 PREPARING AND TESTING OF FOUNDATION:**1.19 SCALING AND TRIMMING OF FOUNDATION:**

After excavation to the required depth is completed scaling and trimming operations for the removal of all pieces loosened during excavation or partly separated from main rock mass by seams or cracks shall be carried out to the satisfaction of the Engineer-in-charge.

1.20 TREATMENT OF WEAK LOCAL SPOTS:

All weathered or partly decomposed pieces of rock shall be removed so as not to leave on the foundation any rock other than that which is an integral part of rock mass. Areas of low bearing capacity, steep inclined seams, faults, and Crushed zone in an otherwise good foundation, if permitted to be kept shall be cleared out to a sufficient depth and refilled and plugged with masonry or concrete as directed by the Engineer-in-charge.

1.21 FINAL FINISHED SURFACE OF FOUNDATION:

The finally prepared foundation shall present a rough surface in cross section to give added resistance to sliding. All smooth surfaces shall be roughened artificially to give a good bond. The surface shall be free from steep angles and the edges of benches shall be chamfered approximately to 45°. Pinnacles of sharp projection shall be knocked off and prominent knobs flattened.

1.22 TESTING FOR SOUNDNESS:

The finally finished foundation rock shall be tested by striking with a heavy hammer and if loosed portion of foundation rock is revealed by a hollow sound, it shall be excavated further (without blasting) till a clear ringing sound is obtained.

1.23 EXCAVATION OUT LINES:

All excavation shall be performed in accordance with the lines, grades, levels and dimensions shown in the drawing or established by the Engineer-in-charge. The dimensions shown in the drawing are tentative. During the progress of work, it may be necessary or desirable to vary the slopes or the dimensions of excavation from those specified in the drawing. The side slopes of the excavations shall be as steep as would stand with safety as decided by the Engineer-in-charge. If the slopes established are found to be steeper and likely to slip, they shall be made flatter by removing the additional material and introducing suitable berms if possible and stable faces established.

1.24 EARTH WORK IN EMBANKMENT**(A) General:**

- (i) Sufficient number of references Bench marks for facilitating setting out works and taking levels shall be established.
- (ii) Permanent reference lines and check profiles at suitable intervals for checking the execution of all slopes, steps and elevation of the profiles of the approved drawings, shall be established.
- (iii) The entire area required for setting out, shall be cleared of all tree stumps, roots, bush wood, rubbish of all kinds, loose and all objectionable materials.

(B) Stripping:

- (i) The work area shall be stripped of the surface soil, including vegetation, overlying grass, organic matter, bushes, roots and other perishable or unsuitable material before commencing of the excavation. It shall be done as per the requirement or to a depth of 0.30 m or as specified or as directed by the Engineer-in-charge.
- (ii) Prior to starting the stripping, initial cross-sections shall be taken at suitable interval of 10 m to 30 m, or as specified or as directed by Engineer-in-charge and shall be recorded in ink directly in the field books.
- (iii) After the work of stripping in the embankment width is completed, detailed cross sections shall be taken as specified or as directed by Engineer-in-charge to form the base for computing the quantities of excavation or embankments.

(C) Borrow Area:

- (i) In case when the materials required for construction of different zones of embankment and backfill around the structures are not available from dam excavation foundation excavation, the same are to be obtained from the approved borrow area, designated within the reasonable lead or as directed by the Engineer in charge.
- (ii) Borrow pits, along the dam shall be operated in special case only after due approval of the competent authority keeping in view the hydraulic gradient line. This should not impair the usefulness of soil, the appearance of any part of work or any other property.
- (iii) The stripping of borrow areas shall be done as per "B (i)" above.
- (iv) Necessary grid lines with base line at suitable intervals shall be marked prior to and after stripping to take the levels of the cross-sections to compute the quantity of stripping and the materials borrowed from the borrow area.
- (v) Necessary sample from the different depth shall be collected and got tested for their suitability in different zones of embankment / backfill prior to commencing the borrow area.
- (vi) The required moisture as determined by the laboratory test shall be introduced in to the borrow area itself, by watering well in advance of the excavation to ensure uniformity of moisture content.
- (vii) Moisture control register shall be maintained looking to the day-to-day initial moisture content of borrow area's material and the optimum moisture content of the respective material obtained from proctor tests.
- (viii) The depth of cut in all borrow areas and borrow pits shall be designated by the Engineer- in-charge. Each borrow area shall be fully exploited to avoid haphazard exploitation. The borrow area excavation shall be carried out in such a way so as to produce the required uniformity mixture of materials for the embankment with the available excavation machinery.

(D) Embankment:

- (i) This may be in the reaches of dam in partial cutting and partial or in full with or without bed.
- (ii) Before commencement of the work, it shall be ensured that the materials of different zones for a particular section based on laboratory tests are available.
- (iii) Stripped ground shall be scarified and loosened by using plough or ripper.
- (iv) The base-seat for embankment to receive earth shall be watered to the required moisture content and shall be compacted with suitable type of compactor so as to attain 95% of MDD or as specified.
- (v) The layers for the embankment portion shall be placed continuously and approximately in horizontal layers of thickness varying from 15 to 23 cm in 110 depths, in the respective zone, to the full width of the embankments, including slopes at the respective level.
- (vi) Construction of embankment shall begin at toe of the fill and in no case material shall be dumped from the top, to widen the embankment.

- (vii) Each layer shall be tested for FDD and FMC as per the frequency stipulated in the tender specifications.
- (viii) No fresh layer shall be laid until the previous layer is properly watered & compacted as per requirement.
- (ix) For proper bond of the embankment done in the previous season with new embankment, care shall be taken as under:
 - a. In case of the bank to be extended horizontally, it shall be cut to a slope not steeper than 1 in 3 and the surface so prepared shall be scarified and made loose at least for a depth of 15 cm. Necessary watering shall be done. Earlier surface shall be thus prepared to receive new embankments. The bank material shall be laid in layers of 15 cm to 23 cm thickness or as specified and compacted to the required degree of compaction to have proper bond with the old one.
 - b. If the old bank is to be raised vertically, vegetation shall be cleared followed by scarifying, watering, and placing of new earth layer as specified above.
 - c. The rain cuts, if any, shall be made good with due care by filling with proper / selected soil duly watered and compacted with suitable compactors or tempers.

(E) Important Features

- (i) Laboratory testing of soil to be used shall be done well in advance.
- (ii) Borrow areas to be identified looking to the suitability of soil available for different zones of the embankment.
- (iii) Water content control to be exercised rigorously either by borrow area watering or spreading it uniformly over loose layer before rolling.
- (iv) Proper roller should be selected for compaction, looking to the type of soil e.g., pad foot / sheep foot roller for cohesive soil, vibrator / random roller for cohesion less soil.
- (v) Thickness of layer shall be controlled (a) Initial, layer shall be of 15 cm to 20 cm thick. (b) Thickness of subsequent layers can be increased depending on the equipment used after trial runs / results and on approval of the Engineer -in -charge.
- (vi) Regular tests for field density and Moisture control shall be taken as per provisions.
- (vii) No fresh layer shall be laid until the previous layer is properly watered and compacted as per requirement and tests are taken and recorded.
- (viii) In case of cohesion less soil, where compaction test for MDD/OMC is not feasible, it shall be compacted to at least 65% of RD or as directed by the Engineer -in -charge.
- (ix) When the filters are to be provided filter material to be used shall be checked for gradation curves and filter criteria provided in tender. Compaction shall be done as specified.

(F) Records to be maintained

- (i) Date of Earth work as indicated in Design note and drawing of embankment section.
- (ii) Record of properties of soil available from dam excavation and Borrow area.
- (iii) Confirmatory tests of soil being used for embankment (during construction)
- (iv) Compaction test results of each layer and base seat of embankment.
- (v) Data for proctor test for each type of material used.

- (vi) Moisture control (before spreading @ NMC comparison with OMC)
- (vii) Layer wise R.L. Location etc.
- (viii) Daily & Monthly Progress report.
- (ix) Record for filter material used shall be maintained such as Filter Criteria, Gradation Curve, Compaction / Watering etc.

1.25 BLASTING:

1.26 OBSERVING RULES REGARDING BLASTING:

In conducting blasting operations proper precautions shall be taken for the protection of person, the work and property. All Government laws relating to the design and location of magazine, transport and handling of explosives and other measures for the prevention of accident shall be strictly observed. Warning signs shall be prominently displayed on the magazines, and warning signs given for each blast. Specifications for blasting given under the separate section shall be carefully and rigidly observed.

1.27 STORING OF EXPLOSIVES:

Explosives shall be stored in a safe place at sufficient distances from the work and under the special care of watchman so that in case of accidents no damage occurs to the other part of work. Explosives, detonators and fuses shall be each separately stored. No Objection Certificate from District Magistrate or inspector of Explosives shall be obtained as required by the Contractor.

1.28 RESTRICTIONS ON BLASTING:

- (A) Blasting which may disturb or endanger the stability safety or the quality of the foundation will not be permitted.
- (B) Blasting within 30 meter of masonry work in progress of a permanent structure shall not be permitted.
- (C) Blasting operation shall be monitored so as not have peak practical velocity near important structures to exceed 10 ppv.
- (D) Progressive blasting shall be limited to two third of the total remaining depth of excavation.
- (E) No large scale blasting operation shall be restored to when the foundation excavation reaches the last half meter. Only small charges preferably black powder may be allowed so as not to shatter the foundation
- (F) Rules of blasting are as appended.

1.29 EXCAVATION IN HARD STRATA WITH CHISELLING AND / OR CONTROLLED BLASTING:**1.30 EXCAVATION IN HARD STRATA:**

Where the excavation in hard strata is involved, since usual blasting operations are likely to damage the adjoining houses, transmission lines or hinder the traffic on important roads. The excavation for a good length is required to be done under controlled blasting conditions and / or chiseling. The item will include excavation in hard strata to correct sections as shown in the drawings with chiseling and / or controlled blasting and depositing the excavated stuff as and were directed The Contractor shall obtain written permission of the Engineer - in - charge before undertaking the work under this item for specific reaches. The holes for blasting shall be drilled for a depth of only 40 cm thus increasing the number of holes and correspondingly decreasing the charge required for each hole. The holes as far as possible shall be slant. All the holes after charging will be covered by grill of steel rods which shall be suitably loaded by gunny bags filled with sand or Murom. The steel grill shall be so lowered over the holes that it does not to cause any damage to the (use wire or charges and care shall be taken to see that the fuse wires remain free. The loading shall be sufficient to prevent the overthrow of rock after blasting in addition to the above loading; the steel grill shall be securely anchored to the adjoining rock by chains. The steel grill shall extend at least 3 meters beyond the area to be blasted. Chiselling manually or excavation by pneumatic rock breakers shall be restored to as directed by Engineer --in - charge where blasting cannot be permitted. Any alternate technique approved by the Engineer- in - charge may be used, but approval to execute the work by the above mentioned method or alternate technique would not relieve the Contractor of the responsibility of damage to the power line and properties.

B.

DRILLING AND BLASTING

- 2.1 General
- 2.2 Materials
- 2.3 Personnel
- 2.4 Storage for explosives
- 2.5 Use of explosives
- 2.6 Disposal of Deteriorated Explosives
- 2.7 Preparation of Primers
- 2.8 Charging of hole
- 2.9 Blasting.
- 2.10 Electrical firing
- 2.11 Precautions after blasting and misfire

DRILLING AND BLASTING

2.1 GENERAL

Blasting where required will be permitted only when proper precautions have been taken for the protection of persons and property in accordance with IS 4081-1967 (Indian standard specification for safety code for blasting and related drilling operations). While carrying out excavation, adequate precautions in accordance with IS 3764-1966 (Indian standard specifications for safety code for excavation work) shall be taken. Explosives such as gelatine, prilled ammonia nitrate detonators and fuse coils etc required for the rock blasting are to be procured by the contractor at his cost. The contractor has to purchase the blasting materials on the name of work and on the name of contractor. The materials without mentioning the above two names on the bill will not be accepted. It shall be the responsibility of the contractor to store the explosives purchased by him in accordance with the rules of the explosives act and other rules framed by Government of India. He should possess/acquire proper license for transport of explosives, portable magazines for possession and use of explosives and shot fires as per revised act 1983. He shall also furnish the following details of portable magazines & transport vehicles:

Capacity	License No. and date	Validity period

The contractor shall acquaint himself with all the applicable laws and regulations concerning storing, handling and use of explosives. All such laws, regulations and rules, as prevalent from time to time shall be binding upon the contractor. The Provisions detailed in the specification are supplementary to the above laws, rules and regulations, are also applicable. Further, the engineer may issue modifications, alterations and new instructions from time to time. The contractor shall comply with the same without these being made a cause for any claims. A list of I.S code applicable is furnished below: IS 4081-1986: Safety code of blasting and related drilling operations IS 3764-1966: Safety code for excavation work. In addition to the above I.S. codes, the specification of O.S.S and manual for quality control and inspection shall also be complied with.

2.2 MATERIALS:

All the materials such as explosives, detonators, fuse coils, tamping materials etc. that are proposed to be used in the blasting operations shall have the prior approval of the Employer. Only explosives of required make and strength are to be used. Black powder and safe explosive shall be used wherever possible. Explosives with nitroglycerine shall be used where the above explosives are not effective.

The use of fuse with only one protective coat is prohibited. The fuse shall be sufficiently water resistant as to be unaffected when immersed in water for thirty minutes. Rate of burning of the fuse shall be uniform and not less than 4 (four) seconds per 26 millimeters of length with 10% (ten percent) tolerance on either side. The fuse known as instantaneous fuse shall not be used. The fuse shall be inspected before use and the moist, damaged or broken ones discarded. The rate of burning of all new types of fuses shall be examined. When they have been in stock for a long time they shall be treated before use. The detonators used shall be capable of producing effective blasting of the explosives.

2.3 PERSONNEL:

Excavation by blasting will be permitted only under the personal supervision of competent and licensed persons and trained workmen employed by the contractor at his cost. All supervisors and workmen in-charge of makeup, handling, storage and blasting work shall be adequately insured by the contractor. The person in charge of the explosive magazine shall be very reliable and his deployment shall be approved by the Employer. The contractor shall make sure that his supervisor workmen are fully conversant with all the rules to be observed in storing, handing and use of the explosives. It shall be assured that the supervisor in charge is thoroughly acquainted with all the details of handing and blasting operations.

2.4 STORAGE OF EXPLOSIVES:

The contractor shall build a magazine or make suitable permanent arrangements at his cost for safe storage of the explosives. Contractor shall provide portable magazine for carrying the explosives to work-spot from the magazine at his cost. The site of the magazine, its capacity and design shall be subject to approval by the Inspector of Explosives before the construction is taken up. As a rule, the explosives should be stored in a clean, dry, well ventilated, bullet proof and fireproof building on an isolated site. The contractor shall provide armed guard security of required number for explosive magazine or while transporting to work site as per rules in force at his cost. The explosives detonators and fuse coils shall each be separately stored. A careful and day to day account of explosives shall be kept by the contractor in a register in manner prescribed by the employer. The employer may also pay surprise visits to the storage magazine. In case of any unaccounted storage pay surprise visits to the storage magazine. In case of any unaccounted storage of the explosives or if the account is not found to have been maintained in a manner prescribed by the engineer, the contractor shall be liable to be penalized in which case he shall not be entitled to any compensation for the losses etc. The action taken under this clause shall be in addition to that which might be taken by the competent civil authorities in the court of law. The magazine shall at all times be kept scrupulously clean. No unauthorized person should at any time be admitted inside the magazine. A notice shall be hung near the storage prohibiting entrance of unauthorized persons.

The magazine on no account be opened during or on the approach of the thunderstorm and no person shall remain in the vicinity of the magazine during such periods. Magazine shoes without nails shall at all times be kept in the magazine and a wooden tub or cement trough about 300 millimeters high and 460 millimeters in diameter filled with water shall be fixed near the door of the magazine. Persons entering the magazine must put on the magazine shoes which shall be provided by the contractor for the purpose and be careful. Not to put their feet on the clear floor unless they have the magazine shoes on. Not to allow the magazine shoes to touch ground outside the clean floor. Not to allow any dirt or grit to fall on the clean floor. Person with bare foot shall, before entering the magazine, dip their feet in water and then step direct from tub over the barrier (if there be one) on the clean floor. A brush or broom shall be kept in the lobby of the magazine, for cleaning the magazine on each occasion it is opened for the receipt, delivery or inspection of explosives. No matches or inflammable material shall be allowed in the magazine. Light shall be obtained from the electric storage battery lantern. No person having articles of steel or iron on him shall be allowed to enter the magazine. Oily cotton, rags, waste and articles liable to spontaneous ignition shall not be allowed inside the magazine. Workmen shall be examined before they enter the magazine to see that they have none of the prohibited articles on them. No tools or implements other than those made of copper, brass, gun metal or wood shall be allowed inside the magazine. All tools shall be used with extreme gentleness and care. Boxes of explosives shall not be thrown down or damaged along the floor and shall be stacked on wooden trestles. Where there are white ants, the legs of trestles should rest in shallow copper, lead or brass bowls containing water. Open boxes of dynamite shall never be exposed to the direct rays of the sun. Empty boxes or loose packing materials shall not be kept inside the magazine. Magazines shall be inspected at least twice a year by any officer representing the engineer. He shall see that all the rules are strictly complied with. The magazine shall have a lightning conductor which should be got tested at least once a year. The contractor shall comply with all the recommendations made by the officer testing the lightning conductor and also rectify the defects notified to him within 16 days failing which the engineer shall be entitled to comply with the same at the contractor's expense which shall not be open to question. The engineer may take any action that he may consider fit at the cost of the contractor.

The following shall be hung in the lobby of the magazine.

- a) A copy of rules both in English and in the languages which the worker concerned are familiar with.
- b) A statement showing the stock in the magazine on that day.
- c) A certificate showing the last date of testing of the lightning conductor.
- d) A notice that "smoking is strictly prohibited".

2.5 USE OF EXPLOSIVES:

For the transport of the explosives and detonators between the store and the site, closed and strong containers made of soft materials such as timber, zinc, copper, leather shall be used. Explosives and detonators shall be carried in separate boxes. For the conveyance of primer, special container shall be used. The boxes and containers used shall be kept closed. Explosive shall be stored and used chronologically earlier received shall be used first. A makeup house and used chronologically earlier received shall be used first. A makeup house shall be provided at each working place in which cartridges will be making up by competent and licensed men as required for the work. The makeup house shall be separated from other buildings. Only electric storage battery lamps shall be used in this house. No smoking shall be allowed in the makeup house or generally while dealing with explosives.

2.6 DISPOSAL OF DETERIORATED EXPLOSIVES:

All deteriorated explosives shall be disposed of in an approved manner; the quantity of the deteriorated explosives to be disposed of shall be intimated to the engineer prior to its disposal.

2.7 PREPARATION OF PRIMERS

The primers shall not be prepared near open flames of fire. The work of preparation of primers shall always be entrusted to the same personnel. Primers shall be used as early as possible after they are ready.

2.8 CHARGING OF HOLES:

The work of charging of holes shall not commence before all the drilling work at the site is completed and the contractor's supervisor shall satisfy himself to that effect by actual inspection. While charging, open lamps shall be kept away. For charging with powered explosives, a naked flame shall not be allowed. Only wooden tamping rods, without any kind of metal on the rod shall be allowed to be used. The tamping rods shall have cylindrical ends. Bore hole must be of such size that the cartridge can easily pass down them, they shall not however be too big. Only one cartridge shall be inserted at a time and gently pressed into the hole with the tamping rods, the sand, clay or other tamping materials used filling the holes completely shall not be tamped too hard.

2.9 BLASTING

Blasting shall be carried during the fixed hours of the day which shall have the approval of the engineer. The hours once fixed shall not be altered without prior written approval of the engineer. The site of blasting operation shall be prominently demarcated by red danger flags. The order to fire shall be given only by the contractor's supervisor in charge of the work and this order shall be given only after giving the warning signal three times, so as to enable all the labour, watchmen etc., to reach safe shelters. A whistle / bugle with distinctive note shall be used to give the warning signals. The whistle/bugle shall not be used for any other purpose. All the labour shall be made acquainted with the sound of the whistle/ bugle and shall be strictly warned to leave their work immediately at the first warning signal and to move for safe shelters. They are not to leave the shelters until all clear signals have been given. All the roads and footpaths leading to the blasting area shall be watched. In special cases, suitable extra precautions shall be taken. The Engineer may however permit blasting for underground excavation, without restriction of fixed time, provided that he is satisfied that proper precautions are taken to give sufficient warning to all concerned and that the work of other agencies on the site

is not hampered. For lighting the fuse, a lamp with a strong flame such as a carbide lamp shall be used. The contractor's supervisor shall watch the required time for firing of the fuses and shall see that all the workmen are under safe shelters in good time.

2.10 ELECTRICAL FIRING

Only the contractor's supervisor in charge shall possess key of the exploder and short firing accessories and he shall keep it always with himself. Special apparatus shall be used as a source of current for the blasting operations power lines shall not be tapped for the purpose. The detonators shall be checked before use. For blast in series, only detonators of the same manufacture and of the same group of electrical resistance shall be used. Such of the electrical lines as could constitute danger for work of charging shall be removed from the site. The firing cables shall have a proper insulating cover so as to avoid short circuiting due to contact with water metallic parts or rock. The firing cables shall be connected to source of current only when nobody is in the area of blasting. Before firing the circuit shall be checked by a suitable apparatus. After firing with or without an actual blast the contact between the firing cable and the source of current shall be cut off before anyone is allowed to leave the shelters. During storm/rain, the blasting operations shall be suspended.

2.11 PRECAUTIONS AFTER BLASTING

After the blast, the contractor's supervisor must carefully inspect the work and satisfy himself that all the charges have exploded. After the blast has taken place in the under-ground works, workmen shall not be allowed to go to the place till all the toxic gases are evacuated from the face.

MISFIRES:

If it is suspected that part of the blast has failed to fire or is delayed, sufficient time shall be allowed to elapse before entering the danger zone. When fuse and blasting caps are used a safe time should be allowed and then the contractor's supervisor alone shall leave the shelter to see the misfire. None of the drillers are to work near this hole until one of the two following operations has been carried out by supervisor. Either i) the supervisor should very carefully (when the tamping is of damp clay) extract the tamping with a wooden scraper or jet of water or compressed air (using pipe or soft materials) and withdraw the fuse with the primer and detonator attached after which a fresh primer and detonator with fuse should be placed in this hole and fired out or (ii) the hole may be cleared of 300mm, of capping and the direction then be ascertained by placing a stick in the hole. Another hole may be drilled at least 226mm away and parallel to it. Then balance of the cartridge and detonators found in the muck shall be removed. Before leaving his work, the contractor's supervisor should inform the supervisor of the relieving shift of any case of misfires and should point out the position with red cross denoting the same, also stating what action if any, he has taken in the matter. A register of misfires and their location and how they are dealt with shall be maintained by the contractor.

The contractor's supervisor should also at once report at the contractor's office all cases of misfires, the cause of the same and what steps were taken in connection there with. The names of the day and night shift supervisors of the contractor must be noted daily in the contractor's office. If misfire has been found to be due to a defective detonator or dynamite the whole quantity of box from which the defective article was taken must be returned to the contractor's office for inspection and shall be disposed off. Drilling holes not completed exploded by blasting shall not be permitted. The contractor should produce his firer's/Blaster's license and furnish the particulars in the following statement.

Sl. No.	Name	No. of firer's/Blaster's license & date	Validity period

Blasting operation, when considered necessary shall be resorted to only with the written permission of the Engineer. Prior inspection shall be carried out for the safety of the public and property. Blasting operations in the proximity of over-head power lines, communication lines, utility lines or other structures shall not be carried out until the operator or the owner or both of such lines have been notified and precautionary measures deemed necessary have been taken.

C.

DEWATERING

- 3.1 Scope of work.
- 3.2 General.
- 3.3 Contractor responsible for diversion etc.
- 3.4 De-silting.
- 3.5 Repairs & removal of diversion channels bunds, etc.
- 3.6 Disposal of water. .
- 3.7 Item to include.

DEWATERING**3.1 SCOPE:**

The item shall include all dewatering during construction work of intake structures, Pump House & pipeline etc. and diversion work required in a manner hereinafter specified.

3.2 GENERAL:

The area of work shall be kept dry by resorting to pumping or in combination with manual labour for bailing cut water with buckets, etc., or any other satisfactory method to be adopted shall be entirely left to the choice of the contractor provided dewatering is carried out satisfactorily and the scheduled programme is adhered to. The contractor shall plan, construct, and maintain satisfactorily, safe and full proof arrangement for dewatering to ensure safe condition excavation and laying concrete and masonry in the dry condition. The contractor shall supply details of his proposals for approval of the Engineer, but such an approval will in no way release the contractor from his responsibility for the adequacy of dewatering arrangement and for the quality and safety of the work, for all of which the contractor shall be solely responsible. Other approved methods may be used by the Contractor at his discretion and cost to prevent or reduce seepage and to protect the area to be excavated if the soil is porous.

PUMPING:

Adequate pumping arrangement shall be made for dewatering and keeping the same dry while laying pipes or concreting is in progress. Pumps of required capacity and required number and stage shall be provided to ensure the above. Pumping shall be done from a sump inside the excavation as necessary, in such a manner as to preclude the possibility of movement of water through any fresh concrete or masonry and washing away parts of concrete or masonry pumping shall be allowed during laying of concrete or masonry and for a period of at least 24 hours thereafter unless it is done suitable sump shall be separated from concrete or masonry by effective means. Pumping shall be done in such a way as not to cause damage to the work or property blow subsidence etc. The contractor shall make his own arrangement for necessary labour, materials pumps, engines, well points and other suitable machinery and devices required for successful execution of item of dewatering.

3.3 CONTRACTOR RESPONSIBLE FOR DIVERSION ETC:

The Contractor shall plan, construct and maintain satisfactorily necessary diversion channels and other temporary diversion and protective works and furnish, install, maintain and operate all necessary pumping and for dewatering the various parts of the works and maintaining the work site as free from water as required for approved construction operations.

ADEQUACY OF DIVERSION:

All bunds diversion of flow and other arrangements proposed to be made shall be by prior discussion and approval by the Engineer. On approval, they shall be constructed and maintained at the Contractors cost. Approval of the plans for the diversion works will not relieve the Contractor of the responsibility for the adequacy of diversion and dewatering arrangements.

CONTRACTOR TO DEWATER WHENEVER REQUIRED:

The area under all works as necessary shall be maintained free from water. The areas shall also be maintained free of water after any part of the work is complete for inspection, safely and or for any other reasons determined as necessary. The Contractor shall pump all water from the site of the works and shall keep the work area free of water while excavating, concreting and continue to keep the works free of water for periods as may be required for proper setting of concrete or otherwise required for the completion of works. The Contractor shall not be entitled to any claim or damages an account of or by reason of any amount of water leaking through under or around the bunds, diversion channels and other diversion or protective works or overtopping.

3.4 DESILTING:

If channel excavation is filled due to accumulation of surface flow during the progress of the work or during rainy season or due to any other cause, all pumping required for dewatering the pits and removing silt shall be done without extra cost.

3.5 REPAIRS AND REMOVAL OF DIVERSION CHANNEL, BUNDS ETC.:

After having served their purpose the temporary bunds shall be removed to the extent directed by the Engineer from time to time. The diversion channel, bunds etc. are likely to be damaged due to floods or due to any other reason. If they are so damaged, they shall be redone as directed without extra cost to the Department. Such removal or repair work shall be done in such a manner as not to damage any permanent works. This shall be done at Contractor's cost.

3.6 DISPOSAL OF WATER:

The water from the excavated area shall be disposed off in the manner detailed below or in any other manner in conformity with the rules in force and approved by the Engineer. In undeveloped areas such as countryside where sewerage system has not been introduced the water may be led to the nearest natural drain or pond through properly laid and dug channels or through pipes. Disposal of water shall in no case cause inconvenience or nuisance to the inhabitants of the area or cause damage to property and structure nearby. Government regulations shall be complied with the rights or private landowners shall be respected regarding disposal of water. Contractor shall be responsible for all the incidental like obtaining permission of local bodies and persons concerned to lead the water to the open channels, making use of lands and properties owned by private persons or public bodies etc. and for the damage caused in the operation of this item.

3.7 ITEM TO INCLUDE:

- A. All Labor materials, pumps, plants, equipment's, staging, shoring, strutting, sumps and other arrangements necessary for dewatering during excavation and construction of other item requiring dewatering.
- B. Dewatering construction area and keeping the same dry while excavation, masonry and concrete work is in progress and till the work comes above the water level and till the Engineer consider that the mortar or concrete has sufficiently set.
- C. Dewatering till all the items requiring dewatering are fully complete. This shall also include time required for final section of structure and taking measurements of all the items requiring dewatering.
- D. Removing stuff of any sort which might find access into the trenches by blowing, slip or due to any other cause whatsoever from the sides of bottom, of the excavation or from elsewhere during or after or due to dewatering,
- E. Leading water to the nearest natural or artificial drains, with all incidental requirements concerned any compensations etc.
- F. Compensation for the injury to the workmen and the public or damage to the nearby properties during and on account of dewatering and disposal of water.

D. DRILLING AND GROUTING

- 4.1 General
- 4.2 Drilling Grout holes
- 4.3 Testing and preparation of holes
- 4.4 Clearing holes
- 4.5 Pressure grouting
- 4.6 Grouting equipment
- 4.7 Method of applying grout
- 4.8 Test for grouting work
- 4.9 Keeping Records of drilling and grouting operations
- 4.10 Grouting
- 4.11 Finishing
- 4.12 Calibration of pressure gauges and water meters etc.

DRILLING AND GROUTING**4.1 GENERAL:**

This includes drilling and exploration of holes, installation of grout pipes and fitting, pressure grouting and sealing of foundation etc during construction work.

4.2 DRILLING GROUT HOLES:

In such areas, as may be designated holes shall be drilled to a minimum size of 38 mm in diameter and to maximum depth of 15 meter. Drilling pattern shall be generally indicated on drawings. However, the drilling pattern may be varied according to the situation and shall be taken as directed by the Engineer - in - charge. Holes for consolidation grouting of foundation rock shall be drilled by jackhammers, wagon drills etc. i.e., by the percussion method. Each hole shall have uniform diameter throughout its length. Miscellaneous drilling in concrete or masonry or rock or combination of these for local drainage or shallow grouting shall also be done by percussion type drilling method. Grout holes for consolidation of the foundation will be of varying depths into rock as directed. The consolidation grouting may be proposed to be done after the construction of masonry or concrete of required height for having adequate load on foundation rock. All holes shall be drilled with equipment of the type specified most suitable for the particular job as approved by the Engineer-in-charge. The depth and the requirements of the drill holes indicated are approximate and may be altered as per actual needs at the time of foundation excavation and the actual experience of washing and grouting of holes. The grout holes shall be drilled normal to the surface of rock, or if so, directed to any inclination, the directed as may be indicated without any extra cost. As the construction work progresses the development of leakages or the unusually poor condition of surrounding foundation might require additional drilling and grouting of area which may have earlier been drilled, grouted, and even covered by concrete masonry. Re-drilling required, if any, in case of incomplete holes because of the contractor's failure to clear the holes before the grout has set or for any other reason shall be performed at the contractor's expense. After the drilling of grout holes has been completed it shall be temporarily capped or plugged until it is grouted. Any hole that gets checked before it is grouted shall be opened to the satisfaction of the Engineer-in-charge and at the expense of the contractor,

4.3 TESTING AND PREPARATION OF HOLES:

The contractor shall furnish necessary equipment and shall make other pressure tests as directed by the Engineer-in-charge. The equipment shall have sufficient capacity to test grout holes and in the specified manner as directed. A suitable pressure gauge and water meter shall be installed to indicate pressure and water leakage from hole. The contractor shall maintain a proper data as approved by the Engineer-in charge for all testing of drilled holes.

4.4 CLEARING HOLES:

Before grouting and when a suitable small group of holes has been drilled, all but three holes (consecutive or as otherwise considered suitable for the purpose of clearing) shall be pumped under pressure as determined by the Engineer-in-charge, into two holes and allowed to escape from third until all possible loose material and mud etc. has been washed out of communicating seams or other passageways, if any. Combination of these holes at the time shall thus be clean before applying any grout into the holes. Suitable valves shall be used to permit alternate or continuous Injections of air and water and for quickly switching of the flow from one hole to the other so as to produce turbulent action necessary to dislodge the softer materials. The water and air connections shall be interchanged at frequent intervals to cause water flow in every possible direction. The operation should be continued till reasonably clean water emerges out of the holes. In general, the pressure of water and of air shall be such as to maintain the minimum possible velocity but sufficiently low to prevent heaving and movement of rock. The normal pressure should be about 2.75 kg/cm^2 . High pressure shall be used where so directed by the Engineer-in-charge. The connected holes shall be blown clear of any detritus that might have settled in the seams therein, washing; shall be so timed as to immediately precede the grouting. Before the grouting of a hole is taken up, the adjoining holes shall be kept clear so that they are ready for grouting in case they are found connected to the hole under grouting.

4.5 PRESSURE GROUTING:

The proportion of cement and water will be as determined by the Engineer-in-charge. Cement and water shall be of the same quality as specified masonry and concrete in the dam. The grout shall be applied as a low pressure (as may be specified by the Engineer-in-charge) initially and gradually but within the time as specified by the Engineer-in-charge, increased up to the maximum pressure specified at which it shall be maintained for maximum period of about 10 minutes Thereafter, care shall however, be taken to release the pressure immediately should there be signs of any movements of any part of heaving rock, which might amongst other observations, be indicated of sudden and erratic fall in pressure- If grout appears at the surface, the cracks should be filled by lead wool, calling the same tightly in the cracks. At the time when grouting has just been commenced in any hole, it is found that the grout has been freely flowing too far or fast from the hole at low pressure, grout shall be immediately thickened in order to block the leakages in sufficient distance from the hole and thus localize the area to be grouted for any particular hole or series of holes. As a hole approach refusal, the grout shall progressively be thinned and grouting operation continued to refusal at the specified maximum pressure maintained for a period of minimum 10 minutes, the consolidation grouting of the foundations shall be done at pressure up to $3 \text{ to } 4 \text{ kg/cm}^2$ or by the engineer-in-charge. Utmost care and precautions shall be taken to ensure that the masonry or concrete is not damaged during the grouting- Any damage caused to the concrete or masonry or any other element, material or structure in the present work or adjacent to it, shall be made good by the contractor at his own expenses and to the satisfaction of the Engineer -in- charge.

4.6 GROUTING EQUIPMENT:

The equipment for mixing and grouting shall be capable of effectively mixing in corrected specified proportions, agitating the grout and pumping it into the holes in an uninterrupted flow at the designated pressure up to a maximum of 15 kg/cm². There should be satisfactory arrangements for accurately measuring the quantity of water, cement and other ingredient. Agitation shall have paddle of suitable design and shape to keep the mix in proper consistency till it is pumped into the hole - Standard equipment of approved quality shall be used. The mixing and conveying system shall be laid out to provide sufficient capacity for a heavy flow of grout. The mixer shall be in two compartments or parts so that grout could be mixed in one when that from the other is being pumped. The components or parts shall be independently connected to pump. In general, an uninterrupted flow of grout shall be maintained, and the grout conveyed from the pump to the hole through a pipe. The mixer shall be placed as near the hole as possible and long Pipelines avoided. The flow of grout into the holes shall be controlled by a pressure relief valve by passing and returning to mixer, all grout not accepted by the hole at the desired pressure. Proper pressure gauges shall be provided to measure the pressure of the grout pumped into the hole. They shall provide with diaphragm to prevent grout mix getting into the gauges & clogging them. The circulating System shall be so provided that the grout shall be kept circulating continuously at sufficient velocity to prevent settlement of cement or clogging of pipeline and fixings. The pumps and the pipelines shall be flushed with clear water at frequent intervals, to keep them clear. Deposit of grout in the pump, mixer, etc. not removed by flushing shall be removed by scrapping, chipping etc. A fine screen capable to being readily removed, cleaned and replaced would be desirable between the mixer and the pump. Proper arrangements shall also be provided with equipment to stock adequate quantity of cement etc. likely to be required for the grouting. After the grouting operations are completed for the shift on the day the remaining unused grout mix shall be thrown away. Also, a mix not used up completely within one hour after mixing of that which in the opinion of the Engineer-in-charge has set or clogged shall be thrown away.

4.7 METHOD OF APPLYING GROUT:

The grouting of hole shall be continued until the hole, or a continuation of holes takes grout mix at a rate less than.

<u>Rate of grout</u>	<u>Time in Minutes</u>	<u>Pressure</u>
0.03 Cum	20	As decided by the Engineer-in-charge and depending upon the location

The grouting shall, however, be stopped when the pressure gauge registered sudden rise or when other indications are seen on extension or upheaval of rock, under the pressure being applied. After the hole has been grouted it should be closed by means of a valve to maintain the grout under pressure in the seams or crevices into which it has been forced. After any hole is grouted, it should be examined of cement just settled unduly with water coming up, the amount of settlement depending on the proportion of mix used. Holes where such settlement has taken place are to be cleaned of all soft sediment and grouted again under pressure.

Grouting operations shall always be started in the side of pattern towards which the seams dip so that the trapped air may be more easily forced out. Grouting shall be continued until at specified pressure the hole refuses to take grout more than specified above. If for any reason grouting operations must be stopped before a hole has been grouted to refusal, clear water shall be kept running into the hole until grouting is resumed. Where grouting of foundation is to be done after concrete or masonry has been placed, no hole or connection shall be grouted until all concrete or masonry within a radius of 15 m. and to a thickness of not less than 3 m. has attained sufficient strength. For grouting these areas after concrete or masonry is placed and has set, pipe nipples shall be installed where foreseen and necessary connection made for later grouting.

4.8 TEST FOR GROUTING WORK:

To test the efficiency and penetration of grouting fresh holes shall be drilled as directed by the Engineer-in-charge after the grouting operations are completed. These holes shall be tested by water under pressure equal to the maximum grout pressure adopted at the particular location and the amount and the rate of leakage if any measured in each such hole. If the Engineer - in - charge so directs such holes shall be grouted at pressure specified by the Engineer-in-charge. If not these holes shall be left open. No extra payment will be made for testing the holes by water. If such holes are grouted under directions of the Engineer-in-charge such grouting will be paid for as ordinary grouting on the basis of quantity of cement actually forced in. Cost of drilling of such holes shall be paid under the appropriate item of drilling.

4.9 KEEPING RECORDS OF DRILLING AND GROUTING OPERATIONS:

Records shall be maintained by the contractor of drilling grouting and testing etc. neatly and systematically in the manner approved by the Engineer-in-charge the exact locations of all holes in relations to proper reference lines and accurate logs of all operations shall be detailed in the record maps and section shall be compiled showing all conditions of holes grouted. All information regarding the grouting operations amounts of grout taken effects observed in the surrounding holes and rock etc. shall be noted for each hole. Observation about behavior of holes under air and water pressure, appearance of wash water, quantity and proportion of grout used, time and pressure of grouting applications etc. shall be noted for each hole. A copy of such records shall be submitted to the Engineer-in-charge daily during drilling and grouting operations.

4.10 GROUTING MUST BE DONE IN THE PRESENCE OF THE ENGINEER-IN-CHARGE:

Whenever pressure grouting is to be done, the contractor will give due notice thereof to the Engineer-in-charge, to enable him or his authorized representative to be present during the grouting operations, which will always be done in his presence.

4.11 FINISHING:

The grout mix, that might flow out or otherwise or split on the foundation rock or concrete or masonry or other surface shall be removed expeditiously without allowing any time for the grout to set on any of the aforesaid surfaces After the grout has set, the grout holes shall be plugged with cement mortar in the proportion of one to two by volume and the surfaces finished smooth in line with the floor at that location.

4.12 CALIBRATION OF PRESSURE GAUGES AND WATER METERS ETC:

The contractor should calibrate the pressure gauges and water meters from time To time at his cost as directed by the Engineer-in-charge. The contractor shall produce necessary test certificate for such calibration. The pressure gauges and water meters, which have been duly tested and calibrated, shall only be used for grouting and testing holes.

E. BUILDING WORKS

1. Requirement of works at campus of raw water pump house and chak pump rooms
 - 1.1 General
 - 1.2 Requirement of works at pump house campus
 - 1.3 Rest house building
 - 1.4 Requirement for furniture to be provided in areas at pump house campus
 - 1.5 Pump House campus boundary wall
 - 1.6 Roadways, Pathways, and hard standings
 - 1.7 Requirement of works at pump rooms at outlet points
 - 1.8 General arrangement
 - 1.9 Orientation
 - 1.10 Administration and control building
 - 1.11 Residential and non-residential buildings
 - 1.12 Equipment storeroom
 - 1.13 Detailed technical requirements
 - 1.14 Raw water reservoir and sump
 - 1.15 Raw water pump house
 - i. General requirement of pump house building
 - ii. Doors & windows
 - iii. Walkways and access stairs
 - iv. Painting of metallic surfaces
 - 1.16 Final Finishing
 - 1.17 Internal Water Supply
 - 1.18 Site Drainage
 - 1.19 Cable and Pipe trenches
 - 1.20 Pipes and Ducts
 - 1.21 Valve Chambers
 - 1.22 Requirements for other area development works at pump house campus
 - i. Preparatory works
 - ii. Boundary walls and gates
 - iii. Horticulture and landscaping
 - iv. Material
 - v. Trenching
 - vi. Spreading
 - vii. Grassing
 - viii. Digging pits for planting trees
 - ix. Tree guards
 - x. Road, Path and Hard-Standings
 - xi. Electrification
 - 1.23 Parking Shades
 - 1.24 Security Cabins
 - 1.25 Miscellaneous requirements
 - i. Nameplates, Sign Boards, Nomenclature
 - ii. First aid kits
 - 1.26 Soil investigation
 - 1.27 Specifications for furniture
2. Rolling Shutter
3. Chequered Plate
4. Roads

1. **REQUIREMENTS FOR WORKS AT CAMPUS OF RAW WATER PUMP HOUSE AND PUMP HOUSE 1ST**
2. **REQUIREMENTS FOR WORKS AT CAMPUS OF RAW WATER PUMP HOUSE**

1.1 GENERAL

The raw water pump house building along with required sump and siltation well are to be constructed by the contractor. The Contractor shall carry out all the necessary works including construction of Substructure, Superstructure, foundation works for pump/motor/transformer and other equipment and allied works, finishing works, lighting works etc. The Contractor shall suitably plan all the construction activities and take utmost care.

The civil works envisaged at Intake shall be as follows, but not limited to:

- a. The Contractor shall ensure construction of the structural adequate raw water pump house in view of installation of larger pumps. However the actual requirement has to be ascertained by the contractor during detailed design.
- b. The Contractor shall carry out all civil works for installation, finishing and furnishing of the building using material as detailed in the specifications.
- c. Construction of Retaining walls for reclamation of land as necessary.
- d. Filling of land to be reclaimed with approved soil. The filling of soil shall be done up to the level as directed by Employer's Representative.
- e. Boundary Wall of the Campus including intake, substation etc.
- f. Providing a control room totally air-conditioned for PLC-SCADA, of area not less than 40 Sq. m.
- g. Providing double door entrance for the SCADA System control room with air curtain arrangements.
- h. Providing a separate Switchgear room for 33kV indoor switchboard near gantry.
- i. Providing office area of not less than 25 Sq. m in existing raw water pump house building.
- j. Providing Operator Room of area not less than 25 Sq. m in raw water pump house building.
- k. Construction of Residential, Official and rest house building in all respects located in the campus of raw water pump house and proposed Grid Sub Station campus for distribution networks, including complete furnishing with furniture as specified.
- l. Providing lighting fixtures along with cabling, distribution boards, switches, starters, and other accessories for indoor and outdoor areas of:
 - i. The substation and Switchgear room
 - ii. At the roof level and all around the building outer area
 - iii. At SCADA System control room, office areas, lobbies, rest house, staircases, and other areas.
 - iv. Within Pump House campus (Inside compound wall)
- m. Providing operating platform for valves etc
- n. Flooring, plaster
- o. Providing pipe supports and thrust blocks/anchors for delivery pipes, valves, and manifold pipes.
- p. Providing main doors at entrance of pump house and to provide gates for connecting switchgear rooms and motor floor area.
- q. Providing Doors and windows at appropriate locations.

- r. Providing lavatory for working staff.
- s. Providing water cooler for drinking purposes.
- t. Providing pressure filters of adequate capacity required for pump shaft bearing lubrications, drinking and any other purpose of this proposed system.
- u. Providing terrazzo grey cement tiles on entire pump house at roof top.
- v. Dry distemper on interior and cement-based paint on exterior walls of entire Pump House and Buildings constructed under this contract.
- w. Providing one First Aid Kit consisting of equipment's.
- x. Providing internal roads, overall site grading and landscaping including planting of trees in campus.

1.2 REQUIREMENTS FOR WORKS AT PUMP HOUSE CAMPUS

The requirements and specifications for the works at Pump House campus shall be as under,

S. No	Particulars	Specifications
1.	Retaining Walls	RCC
2.	Earth Filling for Reclamation of additional Land	With suitable earth with compacted to 95% modified proctor density
3.	External walls below plinth area	RR stone masonry in Cement Sand mortar 1:6
4.	External walls above plinth area	Brick masonry in Cement Sand mortar 1:5
5.	Area for SCADA System Control Room with Air Conditioning	As required
6.	Area for office and allied works	As per description in Detailed Scope of work volume I
7.	Internal load bearing Walls and partition wall around electrical/ battery rooms	230 mm thick Brick masonry in Cement Sandmortar 1:6
8.	Other partition walls	115 mm thick Brick masonry in Cement Sandmortar 1:6
9.	Interior Plaster	12 mm thick in Cement Sand mortar 1:6
10.	Toilet	Ceramic tiles up to lintel level and plaster 20 mmthick in Cement Sand mortar 1:4 above
11.	False Ceiling	Required in PLC control room, Luxton.
12.	Flooring	
a)	Pump/motor Room	Floor Hardener topping with Cement Concretebase
b)	Floor level other than pump/ motor room	Floor Hardener topping with Cement Concretebase
c)	Switchgear Room	Kota stone with rubber mat
d)	Battery room	Acid resistant tiles for flooring and dado.
e)	Battery Charger room/Operator office space/ duty room / office space/toilets and other areas	Kota stone

f)	SCADA System control room	Antistatic PVC flooring with CC flooring base
g)	Corridors and stairs	Kota stone with marble strip border
13	Painting	
a)	Outer building area	Cement based paint
b)	Inner areas of pump/motor room, office area and lobbies	Oil bound Distemper
c)	Battery room	Acid resistant paint
d)	PLC room	Plastic Emulsion Paint
14	Doors	
a)	SCADA System Control Room	Glass panelled Aluminium Double door shutters with aluminium frame and single panel hinged shutters with door closures. The first gate shall be provided with air curtain of appropriate design to ensure dust proofing.
b)	Main Entrance Doors	Glass panelled Aluminium door shutters with aluminium frame and double panel hinged shutters with door closures.
c)	Switchgear room/ Battery room	2 hour Fire rated door-HMPS(hollow metal pressed steel)
d)	Toilet and other areas	Pressed steel frame with 38mm thick flush doors shutter
15	Windows	
a)	On Outer Front Walls and other windows opening in main entrances	Glass panelled Aluminium shutters with aluminium frame and double panel shutters. (All windows in PLC room will be fixed without shutters of same specifications). Thickness of glass should be minimum 5 mm.
b)	Other Windows	steel section window with wire gauge and safety grill
16	Cooling Arrangement	
a)	Entrance lobby	Fans
b)	Office rooms	Fans and Coolers

c)	Duty Room	Fan and coolers
d)	SCADA System Control room	Air-conditioners
17	Drinking water arrangements	
a)	Pressure Filters	Providing pressure filter of adequate capacity required for cooling of bearing, drinking and other purpose with 100% standby arrangement.
b)	Treatment and cooling	Water cooler 40 litre per Hour and storage capacity 80 litres with Zero –B, to be installed
c)	Roof Treatment	Water proofing treatment followed by Terrazzo/ Pre-Cast Grey Cement Tiles topping
18	Other requirements	
19	Eye wash facility with sink	To be provided in battery room.

1.3 REST HOUSE BUILDING:

Work shall involve planning, designing, construction of Rest House building along with its required ancillary services like water supply, drainage, electrification etc complete. Work will also include required foundation treatment, land filling etc. Rest House Building shall be of RCC framed structure having following facilities.

ITEM	Nos. Required
Office Pump House	
Executive Table	1
Tables	2
Computer table	1
Printer table	1
Revolving Chairs with arms	6
Visitor Chairs	10
Steel Almirah 1980mm x 915mm x 485mm	5
Filling cabinet	2
Steel Almirah 1270mm x 765mm x 440mm with glass paneleddoors	5
Air Coolers with 600mm sweep exhaust fans	2
Room Heaters	2
Wooden Stool	4

Locker Cabinet with minimum 15 compartment - Godrej Make	1
Drawing Cabinet A0 size with racks	1
Control room	
Tables	1
Visitor Chairs	2
Switch gear room near 33 kV gantry	
Tables	1
Visitor Chairs	2
Ceiling fan	1
Air Coolers	1
Room heater	1
Duty room	
Steel Lockers 8ft X6ft minimum (12 cabinets)	1

- 6 number rooms and Total Plinth area of Rest House shall be 500 sqm
- It should have 2 Double bedrooms and 4 Single bedrooms
- All double bedrooms shall have attached dressing and Bathroom
- Single bedrooms shall have attached bathrooms
- Each room shall have one door, one window, one bed, one almirah, one fan point, two light points , one power point.
- Vitrified Porcelain Polished tiles of size (600mmX600mm) of make (Naveen/Bell/Johnson/Kajariya) 10mm thick on floor skirting and steps etc. laid with tile admixture (Roof Pidilite of equivalent) including joints to be filled with tile grout shall be provided for flooring except toilets where ceramic tiles of superior quality shall be provided.
- Meeting Hall, Dining Hall, Reception etc shall be provided
- The full Rest House is to be finished for Category A and shall be fully furnished including utensils and crockery.
- One kitchen block of min 15 sqm with necessary amenities.
- Entrance lobby and staircase of minimum 60 sqm area.
- A storeroom of minimum 20 sqm for keeping the equipment's with provision of adequate number of shelves, gate etc.

1.4 REQUIREMENTS FOR FURNITURE TO BE PROVIDED IN AREAS AT PUMPHOUSE

CAMPUS

The office, control room, other rooms, and rest-house and other office Buildings, shall be furnished to the minimum requirement given below. However, the Contractor shall be responsible for providing any additional items which otherwise required for proper functioning:

Rest House at Pump House Campus

General requirement	
Curtains on all doors and windows of cost not less than Rs 200 per meter	As required

Ceiling Fans 1200 mm, ISI mark	1
Central Lobby	
10 Seated wooden sofas set	1
Visitor Chairs	20
Wooden with glass top central tables	4
Wooden peg tables	8
Diffused lighting arrangements	As required
Decorative light with central chandelier	As required
42" HD colour Television	1
Desert cooler-heavy duty	1
Room heater (fan type).	1
Dining Area	
12 seated wooden dinning table with 12 chairs	1 set
Wooden cabinet for crockery	As required
Rooms with dressing (each)(Total 4Rooms)	
Double bed with mattress, pillow, quilt, bed sheet	1
Center table	1
Study table	1
Easy chairs	2
Study Chair	1
Cup-board	1
Dressing cabinet with stool	1
Split air-conditioner 1.5 ton	1
Reading lamp	1
Heater	1
32" HD colour Television	1
Rooms without dressing (each)(Total 6 Rooms)	
Single bed with mattress, pillow, quilt, bed sheet	1
Center table	1
Easy chairs	1
Cup-board	1
Mirror 4'x1.5'	1
Room Cooler	1

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Reading lamp	1
Bath Rooms	
25 liter Geyser of ISI make	1
CP fittings including bath mixture and shower	As required
Bath room accessories	As required
Kitchen	
Cooking Platform of black granite with a steel sink.	1
Wooden cabinets	1
Gas burner, ISI mark	1
Water Cooler with RO	1
Ancillary items for functioning of kitchen	As required
Exhaust fan	1
Refrigerator minimum 300 lit cap.	1
ITEM	Nos. Required
Office for EE (Each)	
Executive Table	1
Tables	5
Computer table	3
Revolving Chairs with arms	1
visitor chairs	20
Steel Almirah 1980mm x 915mm x 485mm	5
Filling cabinet	2
Steel Almirah 1270mm x 765mm x 440mm with glass paneled doors	5
Air Coolers with 600mm sweep exhaust fans	5
Room Heaters	2
Wooden Stool	4
Locker Cabinet with minimum 15 compartment - Godrej Make	1
Water Cooler with RO	1
Drawing Cabinet A0 size with racks	1
ITEM	Nos. Required
Office for AE (Each)	
Tables	3
Computer table	2
visitor chair	11

Steel Almirah 1980mm x 915mm x 485mm with lock	1
Filling cabinet	2
Steel Almirah 1270mm x 765mm x 440mm with lock	2
Air Coolers with 600mm sweep exhaust fans	3
Wooden Stool	1
Pump Room cum WUA office at each outlet	
Tables 5'x3'	1
Chair	5
Lockable Steel Almirah embedded in wall of 1980mm x 915mm	1
Cotton Floor matt (Dari) 12'x 9'	1
Base phone	1
Bathrooms	With standard fittings

1.5 PUMP HOUSE CAMPUS BOUNDARY WALL

The Contractor shall construct Boundary wall (average height 2.4 meters above ground excluding wire fencing of 0.6 meters) including provision and installation of one Main gate, along with Cow Catcher and Gate lights, complete in all respect. The boundary wall shall be made in RR stone masonry in CM 1:4 and shall be pointed in CM 1:4. The top of wall shall be provided with 75 mm thick CC coping with temperature reinforcement.

1.6 ROADWAYS, PATHWAYS AND HARD-STANDINGS

Approach road from main road upto the Raw Water Pump House and other units shall be provided to permit vehicular access. Along the road, pre-cast cement concrete kerb stones of approved shape and size shall be provided.

Hard standing areas shall be provided to permit the parking of vehicles involved in the delivery of consumables from blocking site roadways during unloading or loading. Damage to any existing roads on account of their use by the Contractor shall be made good to the satisfaction of the Employer's Representative.

1.7 GENERAL ARRANGEMENT

The following general guidelines shall be considered while preparing General Arrangement of the proposed Pump House and other buildings.

- The architectural layout of the Pump house, has to be functional, adapted to the regional climate conditions and has to give an aesthetic appearance bearing in mind the local environment and culture.
- The detailed plan, architectural elevations, furnishing details and technical specifications shall be got approved from the Employer's Representative.
- An area adjacent to all mechanical Plant shall be provided as maintenance lay-down area.
- Suitable passages, lifting eyes or other means shall be provided to permit the removal of equipment that may be required during the course of its normal operational life for maintenance or any other purpose.
- Areas where leakage is likely to occur whether under normal use or during maintenance shall be provided with covered drainage channels, which shall direct spilled water either to a

suitable plant drain or to a sump from where it can be pumped out to external drain in the plant area.

1.8 ORIENTATION

The layout of the proposed plant shall be suitably prepared so that it shall allow space for future expansion of plant and to fit it within the space allotted in order to conveniently interface with the infrastructure of roadways and inlet and outlet pipework.

1.9 ADMINISTRATION AND CONTROL BUILDING

The control building shall have the following rooms at the ground floor.

- a) Administration and Control Building of plinth area not less than 100 sqm shall be constructed comprising of one room with attached toilet for officer and one room for operators with toilet and arrangement of bed, mattress, pillow, bed sheet etc. Administration and Control Building shall be provided with all civic amenities. All areas in the Block under routine occupation shall be suitably Air-cooled. Minimum floor to ceiling height of these areas shall be 3.5 m.
- b) Main control room for the Pump House with control panel (not less than 40 sq.m). Minimum floor to ceiling height of these shall be 3.5 m.
- c) office/Staff room with toilets (Indian toilets, urinal) (total size not less than 15 sq.m). Minimum floor to ceiling height of these areas shall be 3.5 m.
- d) Storeroom of minimum 20 sq.m. area
- e) staircase

The roof terrace shall be accessible for inspection via staircase. Finishing and other requirements are as in Table 'B'

Residential and Non-Residential Buildings

The Residential and Nonresidential buildings shall be provided within Pump House campus area or at location provided by the employer within the Project office area. The no. of quarters as detailed in the scope of work shall be provided. Plinth area for each type of building has been provided in the detailed scope of work. The water supply, wastewater drainage and disposal, electric supply, and fittings etc shall be provided by the Contractor. Recreation facilities shall be provided in the campus for resident staff. The detailed requirement is as given in Table 'B'.

1.10 EQUIPMENT STOREROOM

It shall have minimum 50 sqm divided in two segments of space with adequate number of shelves designed for keeping the equipment's, spares and records.

1.11 DETAILED TECHNICAL REQUIREMENTS

Buildings and site development Works:

Table- 'A'
Requirements for building units other than covered in Table B

Sr No.	Particulars	Specification to be adopted
1	Type of Structure	RCC framed Structure
2	Damp Proofing Course	75 mm thick Reinforced Cement Concrete in M15
3	Exterior Walls	

(a)	Below G. L.	Stone masonry in CM 1:6 up to P. L.		
(b)	Above P. L.	Brick Masonry Wall in C. M. 1:5 min 230mm thick.		
4	Interior Walls			
(a)	Below G. L.	Stone masonry up to P. L.		
(b)	Above P. L.	Brick Masonry Wall in C. M. 1:5 min 230mm thick.		
5	Partition Walls	Half Brick in C. M. 1:4 reinforced properly		
6	Roofing	RCC / For flat roofs treatment shall be provided with brick bat coba and finishing coat of 25 mm thickness in CM 1:4 with Water Proofing Treatment		
7	Interior Plaster	Cement Mortar 1:4, 12 mm thick		
8	Exterior Finish	Cement Mortar 1.:4, 20 mm thick and water proofing cement paint.		
9	Interior Finish	<u>Floor</u>	<u>Wall Finish</u>	<u>Doors</u>
	<u>Unit</u>			<u>Frame</u> <u>Shutter</u>

Sr. No.	Particulars	Specification to be adopted			
	g) Office	TPT	AE	PSDF	FD
10.	Sanitary				
	W. C.	Indian type Orissa Pan Size 580mm			
	Urinals	Flat Back size 610x400x80 with 25 mm G. I.Waste pipe			
	Flushing Cistern	Low Level 10-liter Capacity, PVC			
	Wash Basin	Flat Back 550x400 mm			
	a) Staff Toilet	KS	Ceramic Tiles upto LL	PVC	PVC
	b) Lobby	Kota stone	AE	AL	ALG
	c) Staircase	KS	WW	-	
	d) Parking Shade	CC	WW	RS	
	e) Backwash pumps and compressor room with sump	CCH	DT	PSD FRS	DDSRs
	f) Security cabin	TPT	WW	PSDF	DDS

Table 'B'
Requirement of Official, Residential and other buildings

Type of Building	Official Buildings	Residential buildings
Structure	RC framed Structure	RC framed Structure
Masonry in foundation and plinth	RR stone masonry in CM 1:6	RR stone masonry in CM 1:6
Damp proof course	RCC M15 with water Proofing Compound	RCC M15 with water Proofing Compound
Masonry in Superstructure	Brick Masonry in CM 1:5 230mm thick minimum for external walls and 115mm for Internal partition walls	Brick Masonry in CM 1:5 230mm thick minimum for external walls and 115mm for Internal partition walls
Lintels sun-shades etc	R.C.C. lintels and sun shades	R.C.C. lintels and sun shades
Roofing Treatment	Brick bat coba with water proofing compound min. average 75mm thick.	Brick bat coba with water proofing compound min. average 75mm thick.
Internal Plaster	12mm CM 1:4 for walls, 12 mm the CM 1:4 for ceiling	12mm CM 1:4 for walls, 12 mm the CM 1:4 for ceiling
Exterior Plaster	20 mm CM 1:4 for walls, 20 mm the CM 1:4 for ceiling and waterproofing cement paint	20 mm CM 1:4 for walls, 20 mm the CM 1:4 for ceiling and waterproofing cement paint
Beneath floor	C.C. 1:3:6 base concrete 150mm minimum	C.C. 1:3:6 base concrete 150mm minimum

Type of Building	Official Buildings	Residential buildings
Finish	Living, Drawing, kitchen and Remaining space - Kota Stone and toilet-ceramic tiles	Living, Drawing, kitchen and Remaining space - Kota Stone and toilet-ceramic tiles
Skirting and dados	10 cm. Height to match flooring	10 cm. Height to match flooring
Windows (frame, panels, wire gauging, safety bars)	Steel Section window as per design with wire gauging and safety bars	Steel Section window as per design with wire gauging and safety bars
Doors (Frames and shutter)	Frame - pressed steel section Shutters - Flush door 40 mm as per specifications and approved drawing	Frame - pressed steel section Shutters - Flush door 40 mm as per specifications and approved drawing
White/ Colour/ Cement lime/ Decorative Finish	Oil bound Distemper	Dry Distemper in rooms.
Painting of doors, Windows and walls	Synthetic enamel paint	Synthetic enamel paint
Electrification (type of wiring, fittings and fixture)	PVC Conduit wiring as per drawing and specifications	PVC Conduit
Sanitary and Water Supply	CPVC pipes and fittings as per approved drawings and specifications	CPVC pipes and fittings as per approved drawings and specifications
(I) Indian WC	in common toilets	In Common toilets
(ii) European WC	In attach toilets with room	In attach toilets with room
(A) Wash Basins	In every toilets and in lounge	In every toilets
(iv) Sinks	Steel sink	Steel sink
(v) Other accessories	As per approved drawing	As per approved drawing

Other Specification	PVC frames and shutters in Bath rooms/Toilets	M.S. sheet single leaf door shutter as per specification
Special fitting and fixture		
Fans	In every Room	In every Room
Type of Building	Official Buildings	Residential buildings
Tube light	In every Room	In every Room
Exhaust fans	Kitchen / Bathroom	Kitchen / Bathroom
Coolers	As described above	As described above

1.12 RAW WATER RESERVOIR AND SUMP

A Raw water reservoir of adequate design capacity is to be constructed. The RWR shall receive water from outlet pipe of Intake structure. The raw water reservoir shall have total live storage of 25000 cum above the water level required for pumping with vortex free suction. The live storage depth shall not exceed 5 meters. The RWR shall have sump of required depth along entire length on pump house side of reservoir. The RWR shall be planned with a common wall between RWR sump and Raw Water Pump House. Each opening shall be provided with electrically operated sluice gate. The roof of the reservoir and sump shall be in flat slab construction. The internal tank surface above the full tank level and the roof shall be painted with suitable epoxy paint. A capacitance type sump level sensor in each sump shall be provided. All electrically operated gates shall have facility of operation through local push button station, manual operation, through L.T. panel of clear water reservoir and through PLC system. The reservoir shall have a drainpipe connected to a natural drain or a drainage sump and dewatering pump for easy drainage of RWR for cleaning and repair. At least two stairs shall be provided for access to RWR floor. Access stairs in each sump shall be provided.

1.13 RAW WATER PUMP HOUSE AND PUMP HOUSE -1

The Raw water pumping station building is to be constructed along with 33 kV outdoor switchyard. The Pumping Station shall have Pump House, Duty room, Maintenance Bay, Toilet block, PLC Control Room etc.

I. The general requirement of pump house building shall be as follows

S.No.	PARTICULARS	SPECIFICATIONS
1.	Type of Structure	RCC frame Structure
2.	Plinth Level	Minimum 0.45 meters above finished ground level
3.	Minimum Height of building above finished floor Levels	As per conceptual drawing.
4.	Retaining Walls	RCC
5.	External walls Below Ground Level	RR stone masonry in Cement Sand mortar 1:4
6.	External walls above Ground Level	Brick masonry 230 mm thick in Cement Sand mortar 1:4

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7.	Internal load bearing Walls and partition wall around electrical/ battery rooms	Full Brick 230 mm in Cement Sand mortar 1:4
8.	Partition walls	Half Brick masonry in Cement Sand mortar 1:4
9.	Area for PLC Control Room with AC	Minimum 40 Sq. meters having partitions with aluminum framed glazed panel partitions of height up to lintel level
10.	Area for duty room	minimum 25 Sq. meters
11.	External finish	Either of water proofing cement paint, sand face plaster, Dholpur / Karauli stone facing as per approved architectural plan
12.	Plaster	
	Interior Plaster	12 mm thick in Cement Sand mortar 1:4
	Plaster on external Walls	20 mm thick in Cement Sand mortar 1:4, two coats
	Ceiling Plaster	8 mm thick in Cement Sand mortar 1:4
	Toilet	Ceramic tiles up to lintel level and plaster 20 mm thick in Cement Sand mortar 1:4 above
13.	False Ceiling	Required in PLC control room
14.	Flooring	
a)	Pump/motor Room	Floor Hardener topping with CC base
b)	Switchgear Room	Kota stone with rubber mat
c)	Battery room and Battery charger Room	Acid resistant tiles for flooring and dado, Sink and eye wash
d)	Operator office space/ duty room/ office space/toilets and other areas	Kota stone
e)	PLC control room	Anti-static PVC flooring with CC flooring base
f)	Walk ways	GMS Chequered plates
g)	Corridors and stairs	Kota stone
15.	Painting	
a)	Outer building area	Cement based paint
b)	Inner areas of pump/motor room, office area and lobbies	Dry distemper
c)	PLC Control room	Acrylic Plastic Emulsion Paint
d)	Battery room	Acid resistant paint
16.	Doors	
a)	PLC Control room	Glass paneled Aluminum Double door shutters with aluminum frame and single panel hinged shutters with door closures. The first gate shall be provided with air curtain of appropriate design to ensure dust proofing.
b)	Main Entrance Doors	Glass paneled Aluminum door shutters with aluminum frame and double panel hinged shutters with door closures.
c)	Switchgear room/ Battery room	2 hour Fire rated door-HMPS(hollow metal pressed steel)
d)	Toilet and other areas	Pressed steel frame with 40mm thick flush doors shutter

17.	Windows	
a)	On Outer Front Walls and other windows opening in main entrances	Glass paneled Aluminum shutters with aluminum frame and double panel shutters. (All windows in PLC room will be fixed without shutters of same specifications)
b)	Other Windows	Steel section window with wire gauge and safety grill
18.	Cooling Arrangement	
a)	Entrance lobby	Fans
b)	Office rooms and duty room	Fans and Coolers
c)	Pump house	Air washer
d)	PLC Control room	Fan and air-conditioners to maintain 24°C temperature through out the year
19.	Drinking water arrangements	Taping to be taken from the general water system installed for the campus supply.
a)	Treatment and cooling	Water cooler 40 liter per Hour and storage capacity 80 liters with Zero –B, to be installed

II. DOORS AND WINDOWS

The total area of openings for windows, doors and ventilators shall be not less than about 25 % of the floor area.

Doors to the pump room shall be of the rolling shutter type with manual operation from inside. They shall have adequate width and height so that a truck can enter, (backside first). A standard door shall be provided for entry of the operators. Doors in dangerous areas (main distribution panel room) shall open to the outside.

All outer doors and those of dangerous areas shall have a self -closing device.

Locations of the doors and windows shall be approved by the Employer's Representative.

III. WALKWAYS AND ACCESS STAIRS

All units shall be accessible by concrete walkways of a width of 1.0 m. The walkways shall have railings of 1.0 m of galvanized steel tubes of diameters 32 (pillars and upper railing) and 25 mm (lower railing). Painting of metallic surfaces

If not otherwise stated metallic surfaces shall receive one initial primer coat in the manufacturer's workshop. After arrival of the equipment on site, the same shall be inspected and damaged and corrugated portions shall be cleaned and given the primer and under coat of similar paint. After erection all metal work shall be painted as follows:

IV. PAINTING OF METALLIC SURFACES

All mild steel railing, mild steel ladders, pipes for water supply, grit iron plates	Galvanization, Zinc chromate primer, and two coats of approved oil paints, finishing coat of approved oil-based paint of approved shades.
Submerged metallic parts and their projections above water level	Two coats of bituminous paint
Metal parts above water level or in dry places	Primer of red oxide, two under coats and one finishing coat of an approved oil-based paint and of approved shades
All indoor fixtures, instruments, and similar equipment on panels etc.	Chromium or copper nickel plating

1.14 FINAL FINISHING:

The Contractor will ensure that the entire buildings along with all its installations are in a finished and in new and fully operative condition when handed over. Contractor shall have repaired and removed all signs of damage that might have been done during the course of installation and fixing of equipment. He shall also see that the entire exterior has been finished properly and the entire site is cleared of all extra construction material, debris and excavated soil. This shall have to be done to the satisfaction of the Employer's Representative.

1.15 INTERNAL WATER SUPPLY

The water supply of the whole plant shall have two circuits:

- Process Water
- Drinking/ Service Water

a. Process water

Process water shall be supplied from the backwash water tank for:

- Back-washing of the filters
- Supply points for desert coolers and cooling system

b. Drinking / Service water

The Contractor shall provide the drinking water facilities within the campus. These shall be provided in staff room, offices, watchman's cabin, staff quarters and any other location required by Employer's Representative. The material used for providing drinking water facility shall be of

superior quality so that water losses are minimum in the system and shall be approved by Employer's Representative.

1.16 SITE DRAINAGE

The Contractor shall provide a site drainage system. The system shall comprise of the following:

- Storm Water Drainage
- Foul Drainage
- Process Drainage

a. Storm Water Drainage

Storm water drains running along the proposed roads (to be provided under this Contract) shall be sized for a rainfall intensity of 50 mm/hr, allowing for 100% runoff. Drains adjacent to roads shall be in brick masonry (1:6) of appropriate thickness, topped with 75mm thick M10 concrete and plastered internally in cement mortar (1:4), 20 mm thick.

The storm water system shall have Main drain leading to nallah.

b. Foul Drainage

The foul drainage system shall accept discharge from toilets, washrooms, and the offices. The foul drainage system shall discharge to a septic tank of appropriate capacity and the supernatant shall discharge into a soak pit away from water retaining units.

c. Process Drainage

Process Drainage shall be routed through a closed channel or a pipe and shall discharge into the last manhole of the proposed sludge drying beds. It shall have an alternative arrangement for discharging in nearby nalla.

1.17 CABLE AND PIPE TRENCHES

Cable and pipe trenches shall generally be constructed in reinforced concrete. However, 500 mm x 500 mm size or smaller trenches, not on fill may be constructed using 350 mm thick stone masonry in C.M (1:4) over 150mm thick PCC base slab. The trenches shall be plastered internally with cement mortar (1:4).

Trenches within the buildings or Pump House areas shall be covered with G.I. chequered plates, and those outside the buildings shall be covered with M20 precast R.C.C covers. The trenches shall be suitably sloped to drain off rainwater to a suitable location.

Layout of trenches outside the buildings shall allow space for construction of future trenches where necessary with due consideration for planning for future developments. This aspect shall be brought to the notice of the Employer's Representative while planning the works.

1.18 PIPES AND DUCTS

R.C.C ducts for drainage shall have minimum 1m thick of soil overburden while running across road. Access shafts of size not less than 600 mm x 1000 mm shall be provided.

All drains (except storm water drains running along the roads) shall be covered and designed structurally for appropriate loads.

1.19 VALVE CHAMBERS

All valve chambers shall be of an adequate size to facilitate ease in maintenance and operation. The base slab of valve chambers shall slope towards a sump pit from which water can be pumped out to make the chamber dry. All valve chambers shall be constructed in reinforced concrete. However, chambers having size 1500mm x 1500mm x 1200 mm deep or less may be constructed using 350mm thick stone masonry in C.M. (1:4). Chambers shall be plastered internally with C.M. (1:4) 20mm thick and shall be constructed over R.C. base slab. Minimum thickness of the baseslab shall be 150mm. Chambers shall be equipped with removable cast iron/ precast concrete covers, approach ladders/ rungs and valve support as appropriate.

1.20 REQUIREMENTS FOR OTHER AREA DEVELOPMENT WORKS AT PUMPHOUSE CAMPUS

The campus area of Pump House is to be developed which includes landscaping, construction of boundary wall all around the campus, providing interior roads, piping and infrastructure for drinking water, electrification of campus area, providing drainage system, providing gates with cow catchers, development of gardens, plantation of trees etc. The residential area shall have independent access, to avoid interference/ security problems with the Pump House.

I. PREPARATORY WORKS

The Contractor shall undertake the following works:

- i) Approval of architecture, design and drawing of civil structures
- ii) Approval of developmental plans and landscaping
- iii) Approval of design and drawing of Staff quarters and recreation facilities
- iv) Drainage plans and designs
- v) Electrification of campus area
- vi) Pipe and piping work for potable water in campus area
- vii) Other designs / plans required for campus area development

II. BOUNDARY WALL AND GATES

Construction of Boundary wall (average height 1.8 meters above ground and wire fencing of 0.6 meters) all along the periphery of the acquired land measuring about 175 x 175 meters, and providing and installation of One Main gate, one other gate, with Cow Catcher and Gate lights, complete in all respect. The boundary wall shall be made in RR stone masonry in CM 1:4 and shall be pointed in CM 1:4. The top of wall shall be provided with 75 mm thick CC coping. The residential area with recreation facilities shall be isolated with boundary wall and gate within the campus. *The section of the boundary wall, design of gates and cow catchers will be got approved from the Employer's Representative.*

III. HORTICULTURE AND LANDSCAPING

Horticulture and Landscaping shall be done according to the topography of the area and should be planned so as to make the campus a focal point. The open areas leaving expansion requirements must either be covered by tree plantation or must be suitably grassed. Shadow trees must be planted at a maximum distance of 15 m c/c along the periphery of the campus area and along the roads. The campus must be provided with gardens, with seasonal flowerbeds and decorative plants.

Horticulture operations shall be started on ground leveled and dressed to require formation levels and slopes. In case where unsuitable soil is met with, it shall be either removed or replaced or it shall be covered over to a thickness decided by Employer's Representative with good earth.

IV. MATERIAL:

The grass shall be fresh, free from weed and rank vegetation but having Rhizome with sufficient nodes and shall be approved by the Employer's Representative before planting. The manure shall be well decayed free from grits and any other unwanted materials. The good earth to be used for gardening shall be free from kankar, Moorum, building rubbish and any other foreign matter. It shall have pH value ranging between 6 to 8.5.

V. TRENCHING:

Trenching of soil in depth between 30 to 60 cm shall be done in order to loose the soil, and turn over and bury the top layer containing weeds etc. in the base and to bring up the lower layers of good earth to form proper medium for grassing, regrassing, hedging, shrubbery.

VI. SPREADING:

The good earth shall be spread evenly over the surface with twisting motion to avoid segregation to the thickness ordered by the Employer's Representative.

VII. GRASSING:

The area from where the grass roots are to be obtained shall be specified by the Employer's Representative at the time of execution of the work. The soil shall be suitable moistened and then the operation of planting grass shall be commenced. Generally planting in either direction at 15cm, 10 cm spacing is done in the case of large open spaces, at 7.5 cm spacing in residential lawns.

VIII. DIGGING PITS FOR PLANTING TREES:

Pits of square or circular shape in ordinary soil shall be excavated to the dimensions ordered by the Employer's Representative and shall be manured with powered neem/castor oil cake at the specified rate along with farmyard manure or sludge shall be uniformly mixed with the excavated soil.

IX. TREE GUARDS

The concrete tree guard of 5' height shall be provided as specified by Employer's Representative. The planted trees, garden etc. so developed shall be maintained in good condition during the execution and maintenance period of the Contract without any additional costs. The Contractor shall ensure the safety of plants and shall take all the activities such as re-plantation, manuring, use of pesticides, mulching, cutting etc. for growth of trees / plants and maintenance of plants.

X. ROADS, PATHS, AND HARD-STANDINGS

A comprehensive road network shall be provided to provide appropriate connectivity of the buildings and utilities, pump house and other important units of pump house campus to link with the main road and the existing road network to permit vehicular access to each unit of the campus for necessary maintenance, delivery of consumables and personnel access. The internal roads shall be made as specified in the Roads subsection of same section. Along the road, pre-cast cement concrete kerbs of approved shape and size shall be provided.

The road layout shall have due consideration to the storm water drainage system so as to prevent standing water in the campus area.

Paved pedestrian access ways shall be constructed to provide a network of logical routes interlinking plant areas.

Hard standing areas shall be provided to permit the parking of vehicles involved in the delivery of consumables from blocking site roadways during unloading or loading. The road system shall be designed such that vehicles involved in the delivery of consumables can follow a continuous route through the plant area and leave again without going in reverse or

carryout complicated maneuvers in order to exit the pump house campus.

Damage to any existing roads on account of their use by the Contractor shall be made good to the satisfaction of the Employer's Representative.

XI. ELECTRIFICATION

Suitable planned electrification works are to be done for providing illumination as per specification along the roads, all along the boundary of campus and all other important points within the gardens.

The main entrance door to campus, outside area of raw water pump house, entrance to rest house, residential and official buildings and gardens must be provided with streetlights to provide as specified in the design criteria in section 6.

In no case, the spacing between two successful street poles must be more than 30 meters along the internal roads and boundary walls.

The specifications of cabling, switches, junction box, receptables, lamps etc. used for electrical works, shall conform to the provisions laid down in Sub Section-9.

1.21 PARKING SHADES

Covered Parking Shades of 150 sqm. shall be constructed in different locations within the Pump House campus. The floor shall be simple Cement Concrete flooring 25 mm thick with base concrete of 100 mm provided on soling stone. A. C. Sheet roofing shall be provided and erected on suitably designed MS framework having purlins and rafters.

1.22 SECURITY CABINS

Necessary security cabins shall be provided at each gate. The cabin building shall be of permanent type with minimum area of each cabin as 10 sqm. The detailed requirement is as given in Clause 4.7.3.11.1.-Table A

1.23 MISCELLANEOUS REQUIREMENTS

I. NAMEPLATES, SIGNBOARDS, NOMENCLATURE

Each item of the Pump house shall have permanently attached to it in a conspicuous position a nameplate, on which shall be engraved or stamped the manufacturer's name, type and serial number, year of manufacture, details of the design capacity etc. Such labels shall be of non-hygroscopic material to be approved by the Employer's Representative.

The Contractor shall also provide bilingual signboards and instruction tables of durable material, throughout the pump house, for the purposes of operation, maintenance and security:

- Danger and caution signs (English and local language)
- Preventive maintenance schedules (local language)
- Operating instructions (local language)
- Unit names (English and local language)
- Nameplates at the doors to the units (English and local language)

Signboards and plates shall be appropriately sized in relation to the relevant item and its surroundings. Details of the proposed inscription, size, material and colors shall be submitted to the Employer's Representative for approval before any signboards or plates are manufactured. They shall be compatible with the instructions in the operation manual.

All cables shall be provided with clip-on identification numbers on both ends and at all terminations in between, for identification. The nomenclature shall correspond to the electrical as-built drawings.

The nomenclature and labeling of the plant shall be decided in close co-operation with the Employer's Representative.

II. FIRST AID KITS

The first aid kit shall consist of all materials, medicines necessary for treatment of cuts, wounds, burns bad effects of inhalation of chlorine, bad effects on skin due to contact of chemicals acids etc. Following materials in general in sufficient quantities shall be provided.

- Medical cotton, sterile cotton pads
- Cotton Bandages, elastic bandages
- Pair of scissors, packet of new shaving blades
- Sticking plaster for medical use.
- Band aid stripes

Following chemicals/medicines shall be provided in sufficient quantities:

- Tinctures iodine and mercury chrome
- Burnol ointment
- Bottles of spirit and of Dettol
- Toilet soaps

To be procured under medical advice

- Skin lotions and ointments for burns, acid effects
- Eye drops for soothing effects

First Aid Kits shall be provided in Raw Water Pump House, Fire extinguisher and first aid kits shall be provided for the entire period of project i.e., from execution to O&M period. They shall not be used before and shall be complete.

1.24 SOIL INVESTIGATION

Contractor should carry out his own detailed soil survey at the site with view to an analysis of the safe bearing capacity, angle of friction, cohesion, the lateral resistance of the soil, resistivity, and the general soil conditions as required to finalize his designs.

1.25 SPECIFICATION FOR FURNITURE

I. Executive Table

Godrej or Equivalent make table frame of 25x25 mm tubular section of 16-gauge ERW MS pipe, with standard size two drawer on right side operate on precision made slides, using 22-gauge MS sheet. Tabletop of 18mm thick particle board laminated with veneer top (shade to be approved by Employer's Representative) and back panel having teak wood beading all around. Drawers to be provided with suitable locking arrangement and with Godrej type handle. The glass top (5 mm thick) shall be provided.

Size – 2135 mm x 865mm - height 735mm

II. Table

Godrej or Equivalent make table frame of 25x25 mm tubular section of 16-gauge ERW MS pipe, with standard size two drawer on right side operate on precision made slides, using 22-gauge MS sheet. Tabletop of 18mm thick particle board laminated with veneer top (shade to be approved by Employer's Representative) and back panel having teal wood beading all around. Drawers to be provided with suitable locking arrangement and with Godrej type handle. (Godrej or Equivalent) The glass top (5 mm thick) shall be provided.

Size- 1675mmx865mm - height- 750mm

III. Computer Table

Godrej or Equivalent make table frame of 25x25mm tubular section of 16-gauge ERW MS pipes 'C' frame designed with sliding keyboard on nylon rollers. Tabletop and sliding board of 18mm pre-laminated particleboard with PVC lipping. Size -730 mm (W) x 880 mm (D) x 750mm (H).

IV. Printer Table

Godrej or Equivalent make table frame of 25x25mm tubular section of 16-gauge ERW MS pipes 'C' frame designed on nylon rollers. Tabletop and sliding board of 18mm pre laminated particleboard with PVC lipping.

Size-730mm(w)x770mm(d)x750mm(h)

V. Revolving Chairs with Arms

Godrej or Equivalent make chair with revolving seat on tubular pipe frame of 25mm diameter ERW MS pipe of 14 gauge having high back with push back system and PU arms on five-pronged base with ball coaster and pneumatic seat height adjustment. Molded PU foam on seat and back and covered with good quality tapestry, color and quality of tapestry should be used as approved by Employer's Representative.

Size-660mm (d) x660mm

(w)Height - 1025mm-

1145mm Seat height -

440mm-560mm

VI. Visitor Chair

Godrej or Equivalent make chair made of 25mmx25mm tubular section of 14 gauge, 25mm diameter ERW MS pipe of molded PU foam on seat and back with upholstered seat and back by good quality tapestry as approved by Employer's Representative.

Size-460mm (w) x820mm

(h)Seat height – 450 mm

VII. Steel Almira

Godrej or Equivalent make office store well made from high quality CRCA steel of 20 gauge having anti rust treatment equipped with Godrej precision lock and four adjustable shelves with powder coated finish of following sizes:

1980mmx915mmx485mm (Big)

1270mmx765mmx440mm

(Small)

VIII. Filing Cabinet

Godrej or Equivalent make 4 drawer lateral filing cabinet made of premium quality CRCA corrosion resistant steel of 20 gauge with 25mm teak wood tabletop and powder coated finish. Drawer should be moved on precision balls slides with anti-tipping and anti-rebound mechanism provided with full length drawer pulls.

IX. Desert Cooler

600mm sweep ISI mark exhaust fan and ISI mark water pump fitted in 20-gauge MS body.

X. Lockers

Godrej or Equivalent make industrial locker of 18 doors size 284mm(h) x 274mm (w) x 485mm (d) made of 20-gauge premium quality CRCA anti corrosive steel fitted with Godrej

XI. Drawing Cabinet

Godrej or equivalent make cabinet shall be made of premium quality corrosive resistant 20gauge steel. A seamless, integral casing should frame through careful welding of sheet metal components. Drawers should be smoothly moved on a accurately fabricated precision slides having nylon rollers. Drawers should be fitted with label holders, continuous pull-out handles, and multi lever Godrej lock with anti-tipping and anti-rebound mechanism.

Overall dimension - 625mm (h) x1170mm (w) x865mm

(d)Drawer dimension - 65mm (h) x1040mm (w)

x780mm (d) No. of drawers - 6

XII. Ordinary Cane Chair

Godrej or Equivalent make made of 25mm diameter tubular MS ERW pipe of 14-gauge seasoned teak wood seat and back with canning without arms, cantilevered chair duly polished and painted and using half round canning.

430mm(w)x570mm

(d) x 885mm(h)450mm seat height

XIII. Side Racks

Godrej or equivalent make made of 35x35mm ERW MS angle section with five shelves. Shelves material should be 20-gauge ERW MS sheet.

5 tier - 1800mmx900mmx375mm

XIV. Sofa Set

Made of teak wood frame with 80 mm thick 40 density foam seats upholstered with good quality tapestry, design to be approved by Employer's Representative.

XV. Central Table

Made of teak wood, 12 mm thick tinted glass top, design as approved by Employer's Representative.

XVI. Pelmet and Curtain Rods

12 mm thick palmets with 20 mm dia anodized Aluminum curtain rod with Aluminum brackets,and 100*25*3mm MS flat 150 mm wide of M P teak wood grade

3. **ROLLING SHUTTER**

- 2.1 Scope
- 2.2 Finishing
- 2.3 Painting iron and steel work
- 2.4 Item to include

2. ROLLING SHUTTER

Providing, and fixing rolling steel shutters fabricated from 18/20-gauge steel laths with side guides, bottom rail, brackets, door suspension shaft, rolling springs, locking arrangements and housing box at the top including painting complete.

2.1 SCOPE:

The rolling steel shutters required for Pump House Complex shall be of approved make and design & shall be suitable for fixing in the position ordered, i.e., outside, inside, on or below lintel or between jambs. The shutters shall be of manually operated pull or push up type up to 10 Sqm areas. If area of the shutters is between 10 Sqm three ball bearings shall be provided for easy operation. The particulars of the shutters shall generally be as under unless any other suitable changes are proposed by the approved manufacture and accepted by the Engineer

- a) The shutter shall be constructed with curved slats or laths from mild steel sheets of the specified gauge. The laths shall be machine molded and straightened with an effective bridge depth of 16 mm (about 5/8"). These slats shall slide into one another forming a continuous hinge throughout their length and shall be fitted with alternating end lock.
- b) Side guide and bottom rail shall be built up from mild steel rolled sections but in the case of small shutter they may be of pressed steel. The sizes of these members shall be as shown on drawings or as approved by the Engineer. The guides shall be generally 6 cm. (about 2 1/2")
- c) Rolling springs shall be manufactured from tested unbreakable high tensile tempered spring steel wire or strip of adequate strength to balance the shutter in all positions.
- d) The springs assembly shall be supported on strong mild steel or brackets shaped to fit the lintel. The shutter when coiled up shall be housed in a box of 18-gauge steel metal.
- e) Locking arrangement shall be provided at the bottom of the shutter at both ends. The shutter shall be opened from outside.
- f) The shutter shall be complete with door suspension shafts, locking arrangements, pulling hooks, handles and other accessories.
- g) Firing shall be done in a workman like manner so that the operation of the shutter is easy and smooth. All work disturbed or cut away shall be made good to match the existing.

2.2 FINISHING:

The whole work shall be painted with 1 coat of red lead and 2 coats of aluminum or other paint of approved shade.

2.3 PAINTING IRON AND STEEL WORK:

In addition to specifications for oil painting "General " the following shall also apply for painting Iron and Steel Work -

Operation and workmanship for painting iron and steel work shall be as per I.S 1477 (Part 1959, code of practice for finishing of Iron and Steel in Buildings, painting and allied finishes. Subject to the following -

- i. The method of preparation of the surface for painting shall be as specified by Engineer in charge- Where Iron and steel works need repainting (maintenance), instructions detailed In clause n of I. S. 1477 (Part - I) 1959 shall be followed.
- ii. Red lead paint shall be used for primer coat unless other paints are specified. The number of primer coats shall be given in detailed specifications for each item where not given it shall be one coat.
- iii. Intermediate protective treatments (pre-treatments) shall be omitted unless specified in the special provisions.
- iv. The finishing coat shall be of the paint as specified for each item by the Engineer. The number of finishing coats of the required shade of color shall also be specified for each item separately. They shall be two when the number is not specified.
- v. Actual date of painting girders, steel tanks and other steel structures shall be neatly marked by the contractor on the structure according to the instructions of the Engineer-in Charge.

3. CHEQUERED PLATE

3.1 Scope

3.2 Material

3.3 Erection

3.4 Item to include

CHEQUERED PLATE

Providing and fixing in position 8 mm. thick chequered plate with welding jointing, overlapping as per drawing including necessary fixtures and fastening with all leads and lifts etc. complete.

3.1 SCOPE

The work covers providing laying of chequered plates in the Pump house and other work complex.

The item provides for 8 mm, thick chequered plate flooring with M. S. Angle 50 * 50 * 6 mm for support of the flooring at landing level and opening near pumps.

3.2 MATERIALS

The M. S. chequered plate & M. S. Angle shall confirm to I. S. 225 – 1969 & 800 – 1902 & shall be of required size & shape. The length of M. S. angle shall be 2.97 m.

3.3 ERECTION

The M. S. angle firstly fixed in wall/or over block out on arrangement for support to chequered plate as directed by Engineer – in – charge or as per detailed drawing. After fixing the angle in concrete chequered plate of required size shall be cut and welded to M. S. Angle.

4. ROADS

4.1 General

Contractor shall construct new Service Road of 5.5 m wide carriage way to connect the Pump House campus with Existing Road near madanpur with all associated CD and other necessary works. Contractor shall construct network roads within pump house campus to link all the proposed buildings and amenities. The works for roads shall cover site clearance, construction/ preparation of earthen embankment, subgrade, sub-base (granular), base course, pre-mix carpet surfacing, Cross Drainage (CD) works, pipe culverts, shoulder construction, road markings, kilometer stones, Arboriculture and other associated civil works and maintenance of the constructed road for 8 (Eight) years. All the works shall be carried out as per the guidelines given under publication of Ministry of Road Transport and Highways specification (MoRTH IV revision), Indian Road Congress Special Publication No. 13 (IRC13) and other relevant IRC specifications. The new road shall have concrete wearing course. The internal roads at the Pump House campus shall also have concrete wearing course. All the roads shall be repaired and maintained during the entire project duration and repaired just before handing over. The Contractor shall also provide gates and security cabins at suitable locations on the access road adjacent to pipelines for stopping unauthorized entry of personnel.

4.2 Preparatory Works

The required survey for preparation and planning of road shall be done along with the survey for the other project works. The Contractor shall, submit to the Employer's Representative for his approval, a profile along the road Centre line and cross-sections at intervals as required by the Employer's Representative along with the L-section. The Contractor shall decide the locations and type of cross drainage and road/canal crossing structures. The hydraulic and structural design of all such works must be got approved from the Employer's Representative before execution of works. The approval of the L-sections and location of CD works will not limit the numbers of CD works to be provided in Contract and if found necessary, during execution or maintenance, the Contractor shall provide additional CD structures as directed by the Employer's Representative.

4.3 Considerations for Planning

- a. The formation level of road in cutting must be kept considering that the drainage of the nearby area does not cause impounding during rains.
- b. In embankments, suitable CD works must be provided to ensure that the embankment is not damaged during rains.
- c. The formation levels must be kept minimizing frequent variations in the road gradient.
- d. Wherever the road is provided on the existing road and the embankment is extended for the required formation width, the Contractor shall extend the existing CD works so that the same can be used for the road. The associated work of dismantling, cleaning and extension of the existing CD works forms part of the work up to road formation level.
- e. The work of extension of the CD work mentioned above includes the laying of the slab culvert in the additional width, construction of railing in the slab culvert portion, extension of the wingwalls, repair of the damaged wing walls, slab culverts, replacement of the broken non-pressure pipes in existing Hume pipe culverts, etc. to ensure proper functioning of the CD structure and the safety of the slab of culvert for class A loading.
- f. Suitable apron shall be provided upstream and downstream of the CD works crossing the road.
- g. Wherever it is felt that the embankment may be damaged during heavy rains, the embankment suitable stone pitching must be done with suitable length of cut-off wall.

4.4 Methodology and Sequence of Work

Prior to start of the construction activities at site, the Contractor shall submit to the Employer's Representative for approval, the detailed construction methodology including mechanical equipment proposed to be used, sequence of various activities and schedule from start to end of the work. Programme relating to pavement and shoulder construction shall be an integrated activity to be done simultaneously in a coordinated manner. The methodology and the sequence shall be so planned as to provide proper safety, drainage and free flow of traffic.

4.5 Technical requirements

I. Earth Work

The work should be executed as per MoRTH specification clause 300. The subgrade whether in cut or fill shall be well compacted to utilise its full strength and to economise thereby on the overall thickness of pavement required. A top 50 cm portion of the roadway shall be compacted to achieve minimum dry density of 97% as per IS: 2720 (Part 8). In waterlogged areas, the level of formation shall be above flood level at least by about 1.0 meter.

II. Granular Subbase

225 mm thick granular Sub-base will be laid as per clause no 401 of MoRTH specification.

III. Base course

225 mm thick base course of WMM as per the MoRTH specification clause no 406.

IV. Wearing Course

i. Concrete Wearing Course

200 mm thick Concrete pavement wearing course shall be provided for all roads in campus at Pump House. The Concrete shall be of grade M25 laid over prepared base course of 100 mm thick cement concrete in M10 as per MoRTH 600.

V. Shoulder Construction

Shoulder construction shall be as per MoRTH clause 407 shoulder (earthen/granular material) dimensions shall be 1.875 m wide on both side of road out of which 1.0 m shall be treated with granular sub-base and remaining shall be earth shoulder.

VI. CD Works

It shall be as per IRC SP-13 and MoRTH specification.

To provide effective drainage across the road at all natural rivers, Nallahs and in areas where impounding of water is suspected, the Contractor shall design and provide required cross drainage structures including necessary river training works. The provided structures must ensure safety of their foundation and protection of Nallah/river/road banks in embankment.

VII. Road markings, Kilometer Stones

After completion of road work, the center line of road shall be marked properly. Kilometer stones, with separate type of 5 km stones, are to be provided all along the road length. It shall be as per MoRTH clause 800.

VIII. Arboriculture

The roadside plantation shall be taken up just after the completion of carpeting and shoulders. Shadow trees such as Shisum, Neem, Pipal, Gulmohar, Semal, Amaltas, Morchidi etc. as approved by the Employer's Representative shall be planted at an average distance of 50 m c/c on one side of the road opposite to that of pipeline. The height of saplings should be at least 1.5m. Plants should be implanted as soon as possible and at the time of taking over all plants should be growing.

The work includes

- (i) Preparation of soil including cleaning and removing of unwanted shrubs and removal of stone and garbage.
- (ii) Digging of pits of at least 60 cm depth and including removal of stones, manuring, application of insecticides and watering plant after planting.
- (iii) Procurement of required plants and planting.
- (iv) Safety and security of plants and fencing etc.

The Contractor shall be responsible for the following activities to ensure proper growth of trees and their safety. The Contractor during the execution time as well as during the operation and maintenance period shall undertake all the following activities.

- (a) Watering of plants at required intervals.
- (b) Re-plantation without any additional cost in place of dead plants or damaged plants
- (c) Intercultural operation such as hoeing and weeding etc.
- (d) Pruning and trimming and cutting of old big trees for required growth.

E. TRASH RACKS AND GATES

GENERAL: -

1.1 SCOPE OF WORK

The Scope of the work covers the following items of work as per relevant IS Codes of Gates, Trash Racks & Hoists.

- (a) Manufacturing and supplying including painting (field and workshop both), transport, erection, testing and commissioning of vertical gates with suitable electrically operated hoisting arrangements.
- (b) The scope of work also covers manufacture, transport, supply, and erection of all the anchorages including first stage and second stage embedded parts required to be embedded in the first stage / second stage concrete for above gates.

1.2 The scope of work also includes providing 2nd stage cement concrete of approved grade in block outs as per approved manufacturing drawings. The scope of work also covers proper storing of all components, sub-assemblies, electromechanical parts etc. of the items to be furnished under this tender and keeping them in safe custody till they are taken over by the owner in the final installed form.

- 1.3 The Contractor shall furnish at his own expense all the materials, consumables, tools, plants, equipment's, machinery etc. and labour and supervision required for carrying out manufacture / fabrication , transportation, supply installation, painting (both field and shop), testing and commissioning of the above mentioned components and equipment's of the gates and hoists as per the conditions and specifications, in these tender documents and as per drawings as may be approved by the Engineer-in-Charge. The Contractor shall also carry out at his own expense all the preliminary and enabling works and all other incidental works such as establishing a field workshop and stores, furnishing and installing erection aids, cranes if necessary, scaffoldings, ladders, temporary bracings and supports etc. complete as required to facilitate execution of work and shall also carry out at his own expense all other operation covered under the meaning and intent of conditions and specifications in the tender documents. The cost tendered by the Contractor for the above items shall be deemed to be inclusive of all expenses required to be incurred by him for executing the work. Structural steel conforming to IS:2062 shall be used for all gates & trashrack, stoplogs designed as per relevant IS codes,

1.4 APPLICABLE B.I.S. CODES:

All materials & methods and procedures for the work of design, manufacture, transport, supply and installation shall conform to latest edition Indian Standard Specification and other publication listed below unless otherwise specified.

IS: 800 Code of Practice for General Construction in Steel.

IS: 808 (Part – 1) Dimensions for Hot Rolled Steel Beams M.B. Series.

IS: 808 (Part – II) Dimensions for Hot Rolled Steel Column Series.

IS :814 All parts Specification for Covered Electrodes for metal Arc Welding Of Structural Steel, Welding Sheets

IS : 815	Classification and coding of covered Electrodes for Metal Arc Welding of Structural steel.
IS : 816	Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel.
IS : 961	High Tensile Structural Steel
	IS : 1458 Bronze
IS : 1028	Bushing
IS : 7205	Safety code for erection of structural steel.
IS : 7215	Tolerances for fabrication of steel structure.
IS : 8500	Weldable structural steel (Medium & High strength qualities)
IS : 9595	Recommendations of metal Arc welding of carbon and carbon manganese steels.
IS : 9917	Specification for calcium base heat stable grease.
IS : 9954	Pictorial surface preparation standard for painting of seal surface.
IS : 11228	Recommendations for design of screw hoists for Hydraulic gates.
IS : 11855	General Requirements for Rubber seals for Hydraulic gates.

The above list is only indicative & in no way complete or exhaustive. Any other materials necessary as per approved drawings have to be procured and used by the Contractor within quoted rates.

1.5 TECHNICAL PROVISION FOR GATES

The materials shall conform to the specifications as mentioned in the approved drawings and as per direction of the Engineer-in-charge. The Contractor shall go through the approved drawings thoroughly and bring to notice of the Engineer-in-charge immediately of any discrepancy or deficiency before taking up fabrication. The Engineer-in-charge shall not be responsible if any problem arises due to discrepancy in the drawings noticed during or after fabrication. The Contractor shall be fully responsible for smooth operating of the gates under all conditions. The gates shall be capable of being operative at any opening under all conditions of unbalanced operations and shall be free from vibrations at all conditions of gate operation. The leakage through the gates shall not exceed the permissible limits. The EPC contractor can also use high quality HDPE Gates with modern technology and confirming to national or international standards.

1.6 METAL WORK, FABRICATION AND MACHINE WORK:

1.6.1 General workmanship.

All fabrication work under the contract shall be done in accordance with the specifications and works shall be performed and completed in a through workman like manner as per the practice in manufacture and fabrication of materials of the type covered by the specification. The work, shall in all cases, be of the highest quality and carefully performed to the specification of the Engineer-in-Charge. All materials and workmanship furnished by the Contractor be free from injurious defect. He shall replace free of cost to the Engineer-in- Charge, any defect in material or workmanship noticed during erection and shall bear all cost of the modification in the field of any defect for which he is responsible. Workmanship shall conform to the latest standards, laid down in Indian Standard specification. All members shall be free of twists, bends or other deformations and all surfaces that will be in contact shall be thoroughly cleaned before assembling. Parts shall be adjusted to line and fit and shall be firmly bolted or otherwise held securely together so

that surfaces are in close contact before drilling, reaming, or welding is commenced. If weight limitations and transport clearances do not permit anchorages and miscellaneous embedded parts, they shall be fabricated into sub-assemblies. The Contractor shall submit a drawing showing the sub-assemblies into which he proposes to fabricate the gates, anchorages, miscellaneous assemblies and embedded parts and hoists for transporting them to site.

Plates with laminations discovered during cutting, welding or at any other time shall be rejected. Minor surface imperfections can be repaired wherever possible with the prior approval of the Engineer-in-Charge. Materials not supplied or workmanship not performed in accordance with the approved drawings and / or with the specifications shall be rejected and replaced. All parts of the gates, hoists shall be fabricated in accordance with the specifications and approved drawing. The Contractor shall take special care in fabrication of the parts affecting strength, rigidity, and water tightness of the gates. The seal bases shall be finished after the plates have been welded to the skin plate and the finished surfaces of the seal bases shall be in the same plane within the tolerances as specified elsewhere.

1.6.2 FITS AND TOLERANCE

Fits used for difference components shall be according to the best modern shop practice. Due consideration shall be given to the special nature of function of the parts and to the corresponding accuracy required to secure proper operation. The fits shall be in accordance with the Indian Standard "Guide for the Selection of the Fits (First Revision) IS: 2709.

1.6.3 SCREW THREADS

The threads for bolts and nuts shall have metric threads of International Standards Organization and conforming to Indian Standards "ISO Metric Screw Threads Diameter Pitch Combination IS: 4218 Part.II.

1.6.4 MACHINE FINISH

The type of finish, unless otherwise specified shall be that most suitable for the part to which it applies and shall be smooth, average, or rough as defined under Indian Standard "Assessment of Surface Roughness (With Amendment No.1 to 3) IS:3073. A smooth finish (Three Delta, that is 0.20 to 0.8 micrometers) will be required for all surfaces in sliding / rolling contact, an average or commercial finish (Two Delta, that is 1.6 to 6.3 micrometers) for surfaces in contact where a tight joint is required and a rough finish (Single Delta, that is 12.5 to 25 micrometers) for all other machined surfaces which are not in contact, but which require finished dimensional accuracy.

1.6.5 FABRICATION OF STRUCTURAL STEEL:

- I. The structural steel work for the equipment's covered by the specifications shall conform to the requirements of "Reamed work and shall conform to the following requirements unless otherwise called for in these specifications.

II. STRAIGHTENING

Before being laid off or worked in any manner, structural materials shall be straight without twist, bends or kinks and if straightening is necessary, it shall be done by methods

that will not injure or mark the materials. Heating or hammering shall not be permitted. All steel surfaces to be welded shall be cleared of dirt, rust and mill scale prior to fabrication.

III. SHEARING, CHIPPING, AND GAS CUTTING:

Shearing, chipping, and gas cutting shall be done carefully by torch or by arc and all portions of the work which shall be exposed to view shall present a neat appearance. Gas cutting shall be mechanically controlled. Re-entrant cuts and copes in beams and channels shall be filled before cutting.

IV. PLANNING OR FINISHING EDGES:

Planning or finishing of the sheared or cut edges of plates or rolled shapes shall not be required except otherwise specified for welded edges or as shown on the Contractor's drawings, approved by the Engineer-in-Charge

V. WELDED EDGES:

The edges of plates or shapes to be joined by welding shall be properly formed to suit the selected type of welding. Sheared edges of plates and shapes to be joined by welding shall machine or chipped to sound metal before welding.

VI. BENT PLATES AND SHAPES

Where bending of plates or forming shapes is required, these shall be bent to the proper curvature by cold forming. Heating and hammering to correct curvature shall not be permitted.

VII. DRILLING AND REAMING:

Holes shall be accurately located drilled and reamed perpendicular to the face of the member and if necessary, a template shall be used. Holes in material 20mm, or less in thickness shall be sub-punched or sub-drilled before assembly and reamed to full size during assembly. Holes in materials more than 20mm in thickness shall be sub-drilled 3mm. smaller than the normal diameter of the rivet or bolt before assembly and reamed to full size during assembly.

Counter boring shall be done carefully to meet the requirements for clearance and fill the weld studs. Anchor bolt holes shall be punched or drilled out to full size. All holes shall be made by the following methods.

i. Punching.

Punching of holes to full size shall not be permitted. For sub-punching, the diameter of the punch shall be 4.5mm smaller than the nominal diameter of the bolt used, and the diameter of the punch shall not be more than 2.50mm larger than the diameter of punch. All holes shall be clean cut without any burn or ragged edges or burrs.

ii. Drilling and reaming

For sub-drilling, the diameter of the drill shall be 3mm. smaller than the nominal diameter of bolt used except where tapping is required for tight fit bolts. Ribbed bolts or dowel are to be used full size drilled or reamed holes shall not be less than 1.5mm nor more than 2.5mm larger than nominal diameter of the bolt used. Holes for ribbed bolts shall be drilled or reamed to 1.5mm. less than the diameter of the ribbed shank of the bolts to ensure a tight fit. Reaming of sub-punched or sub-drilled holes shall be done with machines after assembly. The templates shall be used when assembled reaming is impracticable. Tapped

holes shall be drilled to the proper diameter for the tap used and shall be tapped carefully so that the threads will be continuous, smoothly cut, and free from imperfections.

VIII. ACCURACY OF PUNCHING, DRILLING AND REAMING:

Before assembly: -

The accuracy of all holes shall be such that during assembly, a cylindrical pin 3mm. less in diameter than the normal size of the holes shall be entered perpendicular to the face of the member.

During assembly:-

The accuracy of reaming and drilling during assembly shall be such that not less than 85 percent of any group of continuous holes in the same plane shall show no offset greater than 0.5mm between adjacent thickness of materials, unless a greater degree of accuracy is called for on the drawings approved by the Engineer-in-Charge- in these specifications.

IX. WELDED STUDS:

Welded studs wherever used shall be welded in place with automatic end-welding guns. Templates of sufficient thickness to afford good alignment shall be used to accurately locate the studs during the welding cycle and to locate matching holes in other materials. Bushing shall be used for template holes, if necessary to ensure angular alignment of the studs and location, accuracy required for proper fit of parts to be assembled.

PATTERNS:

The price bid shall include the cost of all necessary patterns. Patterns shall remain the property of the Contractor. While making patterns, care shall be taken to avoid sharp corners or abrupt changes in cross section and ample fillets shall be used. The Contractor shall provide pattern thickness as will conform to his standard foundry practice and as may be necessary to ensure that all metal thickness of the finished castings shall be in accordance with the dimensions shown on the Contractor's drawings approved by the Engineer-in-Charge

1.6.7 WELDINGS:

I. PREPARATION FOR WELDING:

Members to be joined by welding shall be cut accurate to size, and where required shall be rolled or pressed to the proper curvature in accordance with the dimensions shown on the Engineer-in-Charge's drawings. The edges of the member to be joined by welding shall be sheared, flame cut or machined to suit the required type of welding and to allow through penetration. The cut surface shall expose sound metal, free from laminations, surface defects caused by shearing or flame cutting operations and other injurious defect. The surfaces of plates to be welded shall be free from rust, grease, and other foreign matter for a distance of at least 50mm, back from the edge of the weld. In assembling and during welding the components parts of built-up members shall be held in place with sufficient and proper clamps or other adequate means to keep all parts in proper position.

II. WELDING TECHNIQUE:

All welding shall be performed by electric arc process using coated electrodes or other means whereby the atmosphere is excluded from the molten metal and where applicable, automatic machines with correct precision control shall be used. After being deposited, the weld shall be cleaned of slag or flux and shall show uniform section, smoothness of weld metal, feature edges without overlap and free from porosity and clinkers. Visual inspection at the edges and ends of welding shall indicate good fusion with the base metal. When weld metal is deposited in successive layers, each layer except the last shall be peened moderately with a tool before the next layer is applied. Particular care shall be taken in aligning and separating the edges of members to be joined by butt welding, so that complete penetration and fusion at the bottom of the joint shall be ensured. All pin holes, cracks and other defects shall be repaired by chipping or grading the defects to sound metal and re-welding. Where fillet welds are used, the member shall fit closely and shall be held together during welding. The welding rods used for manual welding shall be of heavily coated type and shall be suitable for all position welding where required. While welding precaution shall be taken to minimize stresses due to expansion and contraction and distortion due to heat by using the proper sequence in welding i.e., by peening the welds while hot or by other satisfactory methods. Rectification of distortions by blows after welding shall not be permitted. Welds shall not be primer coated until they have been inspected and approved by the Engineer-in-Charge. The welding shall conform to Indian Standard "Code of practice for use of Metal Arc welding for general construction in mild steel IS: 816. All skin plate welds shall be continuous and watertight and shall develop the full strength of plate. The electrodes shall conform to the "Indian Standard Specifications for covered Electrodes for Metal Arc welding of structural steel for welding products other than sheets and for welding sheets (Part-I and II) IS: 814. The Contractor shall prepare shop and field welding procedure including stress relieving and preheat requirements and shall submit this procedure to the Engineer-in-Charge for approval. The procedure shall be in accordance with the best modern welding practice and shall be such as to minimize residual stresses and distortion of the finished members of the structure. Approval of any procedure, however, shall not relieve the Contractor of the sole responsibility for producing a finished product meeting all requirements of these specifications. Welds in contact with rubber seal shall be ground flush, all corners and corner welds in contact with rubber seal shall be rounded.

III. APPROVAL TEST OF WELDING PROCESS:

Specification of the welding procedure that are proposed to be used shall be established and recorded and a copy of such procedure, specifications together with certified copies of reports of results of tests made in accordance with the procedure specifications shall be furnished by the Contractor. The procedure specifications shall conform to the Indian Standard "Approval Tests for welding procedure Part-I Fusion Welding of Steel IS: 7307 (Part-II).

IV. QUALIFICATION OF WELDERS:

All welders assigned to the work shall have passed qualification test for welders. If at any time, work of the welder appears to be questionable, such welder shall be required to pass additional qualification test conforming to Indian Standard “Code of Practice for Training and Testing of metal Arc welders “IS:817 and Indian Standard “Approval test for welding procedure part-I Fusion welding of steel IS: 7307 (Part-I).

1.6.8 CASTINGS: DELETED**1.6.9 FORGINGS: DELETED****1.6.10 ERECTION OF BOLTS, NUTS, WASHERS, AND OTHER FASTENERS:**

Erection of bolts, washers and other fasteners shall be furnished in the amount of 15 percent the bolts, nuts, washers, and other fasteners whichever is greater, more than the nominal nature of each size and length required for complete installation of equipment.

Bolts in tension shall have net section at root of thread 15 percent more than the net section required in tension.

1.6.11 WASTAGE OF STEEL

There shall be some wastage of steel section and plates during fabrication & cutting losses. It is the responsibility of the Contractor for minimizing such losses & the cost of such lost steel shall be deemed to have been included in the Bid price. Contractor s also shall not be compensated for the wastage of steel under price variation clause.

1.7 CLEANING, SURFACE PREPARATION AND PAINTING:**1.7.1 GENERAL**

The Contractor shall furnish, prepare, and supply all materials for cleaning surface preparation and painting of metal work as hereinafter specified. The cost of furnishing, preparing, and supplying all materials which are required for cleaning, surface preparation, painting and coating operations including supply of all labor, tools and equipment's shall be included in the rate quoted.

1.7.2 CLEANING AND SURFACE PREPARATION:**1.7.2.1 Cleaning of different components**

Gate Leaves/Hoist and Hoist bridges:

All the surface (except nonferrous surface and machined mating ferrous surface) of the gate leaves for the gates, hoist & hoist bridges etc. shall be cleaned and prepared for painting in accordance with the “METHOD –A specified vide section 1.7.2.2.1 below.

(ii) Embedded parts:

The surface (except non-ferrous surface and machined matting ferrous surface) of all the embedded parts for all the gates shall be cleaned and prepared for painting as under.

All the exterior ferrous surfaces of the embedded parts which are to come in contact with concrete shall be cleaned by the “METHOD-B” specified vide section 1.7.2.2.2 below.

The ferrous unfinished surfaces of the embedded parts which will be exposed to water or atmosphere shall be cleaned and prepared for painting in accordance with the “METHOD A” specified vide section 1.7.2.2.1 below.

a) All the exterior surfaces of the hoist and heads including non-matting finished surfaces and unfinished surfaces of hoist stems, coupling and stem retaining device shall be cleaned

and prepared by the “METHOD-A” specified vide section 1.7.2.2.1 below.

- b) The ferrous surfaces of the pipes and other fittings for the surfaces of hoist support frames and girders, ladders, hand railings, grating etc. shall be cleaned and prepared by the “METHOD – B” specified vide section 1.7.2.2.2 below.
- c) The exposed external surfaces of the bought-out components like gear boxes, worm reducers etc. which are shop coated by their respective manufacturers shall be cleaned by suitable means in a manner which will avoid any damage to the components. The damaged portion (if any) of the shop coat on such items shall be repaired.
- d) Any other metal work not specifically mentioned in the foregoing paras (i) to (v) above, but which requires painting shall be cleaned and prepared for painting as directed by the Engineer- in-Charge.

1.7.2.2 METHOD-A AND METHOD-B

1.7.2.2.1 The METHOD-A shall be as under: -

The weld surfaces shall be de-slagged and weld splatters, burrs and other objectionable surface irregularities shall remove carefully. All rust, mill scale and other foreign substances shall be removed from the surfaces by scrapping, chipping, vigorous wire brushing, blasting or other effective means. Care shall be taken to avoid excessive brushings of steel. All oil, grease, dirt and all other contaminants shall then be removed by the use of clean mineral spirits, xylol or white gasoline and clean wiping materials.

1.7.2.2.2 METHOD-B:

In case rust forms of the surfaces become otherwise contaminated in the interval between cleaning and painting, re-cleaning shall be carried out by the same method as herein above specified for the respective items. Surfaces of stainless steel, Nickel, Bronze and machined surfaces adjacent to metal work being cleaned or painted shall be protected by masking tape or by other suitable means during the cleaning and painting operation.

1.7.3 PAINT MATERIALS AND PAINTING:

1.7.3.1 GATE LEAF:

All the surfaces (except non-ferrous surfaces and machined mating ferrous surface) of the gate leaves for all the gates shall be after cleaning as per section 1.7.2.2.1 above, applied with 1(one) coat of Epoxy Base Primer followed by 2(two) coats of COAL TAR EPOXY. The Epoxy Base Primer and coal tar epoxy paint shall generally conform to the particular given in the relevant IS Codes or as directed by the Engineer-in-Charge. The first coat of the Epoxy Base Primer shall be applied within 4 hours of cleaning. The dry filling thickness (DFT) of each coat of zinc rich primer shall be at least 50 microns. The dry filling thickness (DFT) of each coat of coal tar epoxy paint shall be at least 100 microns.

1.7.3.2 EMBEDDED PARTS:

The surfaces (except non-ferrous surface and machined mating ferrous surfaces) of all the embedded parts for all the gates after cleaning as per the relevant foregoing para shall be coated as under:

- I. All the exterior ferrous surfaces of the embedded parts which are to come in contact with concrete shall be given 2(Two) coats of cement wash mixed with 5% potassium dichromat. The first coat shall be applied immediately after cleaning and second immediately before pouring concrete.

- II. The ferrous, unfinished surfaces of the embedded parts (except stainless steel) which will be exposed to water or atmosphere shall be painted with the same paint materials (viz.

Epoxy Base Primer and Coal tar epoxy paint) and coated in same manner as specified for the gate leaves vide foregoing section 1.7.3.1.

1.7.3.3 HOISTS AND OTHER PARTS

- I. All the exterior surfaces of the hoist stem (screw hoist) machined mating finished surfaces shall be given one coat of Epoxy Base Primer at a coverage rate of approximately 6 square meters per liter. This shall be followed by two coats of alluminium paint of suitable grade at a coverage rate at 5 square meters per liter per coat, without thinning. The hoist stems, couplings and stem retaining device shall be given four or more coats of red lead priming paint to achieve a total dry film thickness of 0.15 mm.
- II. Miscellaneous items such as hoist support frames and girders, control cabinets, ladders hand railings, and gratings etc. shall be given 2 coats of Alkyd priming paint or machinery grade paint or Aluminum paint as directed by the Engineer-in-Charge The exterior surfaces of the bought-out items like electric motors, gear boxes etc. which are shop coated by the manufacturer shall be given one additional coat of the same paint as original shop coat or one coat of Alkyd priming paint or machinery paint or Aluminum paint as directed by the Engineer-in-charge.

1.7.3.4 APPLICATION PROCEDURE:

1. Painting shall not be done when the ambient temperature is less than 10 degrees C and when relative humidity is more than 80%.
2. Primer coats shall be applied without any time lag after the cleaning and surface preparation as per clause 9.7 above and care shall be taken to ensure that paint is not applied to damp surface.
3. Painting shall be discontinued during rain and dust storm and shall not commence until the surfaces are perfectly dry and clean.
4. Welds and adjacent parent metal shall not be painted or touched up prior to de-slagging inspection and approval.
5. All materials shall be in a thoroughly mixed conditions at time of application and shall not be thinned unless otherwise specified. When paint is applied by spraying, suitable means should be provided to prevent segregation during the painting operation.
6. Any warming of the paint materials shall be performed by means of hot water bath and except as specifically provided. Paints shall not be heated to a temperature higher than 38⁰C.
7. Each coat of paint shall completely and uniformly cover the surface and shall be free from runs and sags. Each coat shall be allowed to dry or harden sufficiently as per manufacturers recommendations before the next coat is applied.
8. The detail application procedure indicating method of preparing and applying etc. shall be evolved in consultation with the paint manufacturer which shall be followed by the Contractor.
9. Surface to be painted that will be inaccessible after installation shall be completely painted

1.7.4 REPAIR AND PROTECTION OF COATINGS:

Metal work that has been shop painted or field painted should be handled with care so as to preserve the coatings in best practicable condition. Before proceedings with a fresh coat the Contractor shall clean and repair all areas of the previous coat which are defective or damaged. Previous coat on the areas where the coating is loose, weakly bonded blistered, abounded or otherwise defective shall be removed to clean metal by scrapping, chipping, power wire brushing or other effective means. Areas thus prepared shall be cleaned of all dust, dirt and other contaminations using clean rags and clean solvent. These surfaces shall then be repainted in accordance with the painting schedule. Hair line cracks or areas where the thickness of coating is less than specified but which are otherwise damaged shall be cleaned of all dust and other contaminations if any, and shall be recoated with additional paint to build the coating to specified DFT. All repaired areas of paint will be required to pass acceptance tests performed by the Engineer. The cost of cleaning and painting of damaged and defective areas shall be borne by the Contractor.

1.7.5 INSPECTION OF PAINT MATERIALS AND ACCEPTANCE TEST FOR PAINT COATINGS:

The Contractor shall use the paint materials made by reputed manufacturers whose paint have been successfully used on the underwater high head gates of another comparable hydro project in India. The particulars of the paint product intended to be used and name of the manufacturers shall be furnished to the Engineer-in-Charge for approval prior to making any use of any paint materials in the works. All paint and coating materials shall be made available for sampling at least 30 days prior to use and no paint or coating materials shall be used until they have been tested and/or approved by the Engineer-in-Charge

1.8 SHOP TESTS AND INSPECTIONS:

1.8.1 GENERAL

All materials and components of the equipment's offered under the specifications shall be tested by the Contractor prior to fabrication. After fabrication the equipment shall be assembled in the shop and shop tests shall be performed by the Contractor to ensure accuracy in fabrication and workmanship. The Contractor shall carry out such tests as may be required by the Engineer-in-Charge in order to determine that the gates, hoist will fulfill the functions for which they have been designed. The Contractor shall be responsible for all modifications and adjustments required for the work as a result of such tests. The test shall be repeated, if necessary, until they are successfully carried out to the satisfaction of the Engineer-in-Charge

1.8.2 TESTS OF MATERIALS:

All materials supplied parts and assemblies thereof being used in the work to be done under these specifications shall be of tested quality and all works performed shall be subjected torigid inspection and no article or material or supply shall be dispatched until all tests analysis and sub-inspection have been completed and certified copies of reports of results and analysis have been accepted by the Engineer-in-charge.

1.8.3 SHOP ASSEMBLY AND TESTS

1.8.3.1 GENERAL:

The gates hoist along with hoist bridge shall be completely assembled in the shop for inspection and to ensure that all parts to be connected are fitted properly and that all the dimensions, clearances and tolerances called for in these specifications and / or shown in the drawings of Engineer-in-Charge are obtained. Any template or layout plates required to ensure correct matching of holes in connecting parts for erection shall be furnished by the Contractor to the Engineer-in-Charge. The gates and the hoists shall be assembled in a vertical / inclined position to ensure proper alignment and holes for field connections shall be carefully drilled or reamed while the gates are being shop assembled. The gates shall be shop assembled as considered necessary to check fabrication and all parts shall be carefully match marked to facilitate erection at site.

1.8.4 INTERCHANGEABILITY

Where possible all similar items and removable parts of similar equipment's of gates, hoists and their embedded parts shall be interchangeable with each other.

1.9 TRANSPORTATION AND STORAGE

1.9.1 GENERAL

All the components to be furnished against items of BOQ and all the spare parts as may be ordered by the Engineer-in-Charge shall be transported by the Contractor as per the requirements stated below. The Contractor shall be also responsible for proper storage of the above-mentioned components (till the acceptance of the final installed forms) at his field store or field workshop near project site. The land for establishing the field store / workshop is the responsibility of the Contractor for which no extra cost will be paid.

1.9.2 TRANSPORT

- I. All the components shall be transported (including loading and unloading) by the Contractor from his workshop or any other place of their manufacturer as the case may be to the said field store / workshop near project site. The transport of the fabricated components from workshop to the said field shall be done after all shop tests are completed and after obtaining clearance from the Engineer-in-Charge. Such clearance given by the Engineer-in-Charge shall not be construed as acceptance of any components and the same shall in no way absolve the Contractor of his responsibility for satisfactory performance of the equipment's or any other obligations under this contract. It shall be ensured that respective components are transported and brought to project site sufficiently in advance of the programme for their erection.
- II. The Contractor shall be responsible for any damage or loss in transport as well as for all claims to accident if any occurs in transporting the components. The necessary transit insurance for the equipment up to destination shall be the responsibility of the Contractor and insurance cost shall be borne by the Contractor.

III. Disassembly for dispatch

After completion of required shop assembly shop tests and inspection the equipment shall be disassembled into minimum no. of sub-assemblies convenient for transport and storage without damage to any parts of the equipment to the satisfaction of the Engineer-in-Charge

IV. Unit marking, match marking and transportation designation

Each part of the cross regulator, head regulator and escape gates and their respective parts, hoists etc. which is to be transported as a separate piece shall be marked to show the unit of which it is a part and match marked to show its relative position in the unit to facilitate assembly in the field. Unit marks and match marks shall be made with heavy steel stamps and paints. Each piece sub-assembly or package transported separately shall be labeled or tagged with transportation designation consisting of the specification number and the mark number of such piece or the no. of parts grouped in such sub-assemblies or contained in package.

V. Weighing, packing and preparation of transportation

All assemblies or parts shall be packed by the Contractor in a secured manner in boxes or crates and adequate skids and lifting slings provided where necessary. All protruding pieces or long slender parts shall be adequately protected from damage. All exposed finished surfaces of the equipment's shall be adequately protected from abrasion. All packing shall be allowed for easy removal and checking at sites. Special precautions shall be taken to prevent rusting of steel and iron parts during transit. The methods proposed to be adopted for protection against moisture shall be subject to the prior approval of the Engineer-in-Charge. The Contractor shall provide a wooden blocking to prevent deflection and vibration of all parts of the gates and hoists during transport handling and storage. All opening shall be covered, and all parts shall be tightly coated with a rust preventing compound as specified. Rubber seal shall be dismantled after shop assembly and shall be transported separately. They shall be rapped and boxed to protect them from any element which would adversely affect their size, shape, or physical properties before their field assembly to the gates. The gates, hoists shall be prepared for transportation so as to permit minimum amount of field assembly. All projecting plates etc. shall be kept in shape in timber or angles bolted to them. All straight bars and plates except small pieces shall be transported in convenient bundles, temporarily bolted, or bound together. All slender pieces shall be adequately supported and blocked. All bolts, nuts, washers, plates under 0.3m and generally such small article as may be selected shall be tacked in a strong case and made secure for transportation to site. All bolts and nuts of different sizes shall be packed in separate bags each having a label indicating the contents of the bag. All packings shall become property of the Engineer-in-Charge. All oils shall be drip drained from hoists and all connection for piping and valves shall be metal plugged or otherwise closed watertight and dust tight to the satisfaction of the Engineer-in-Charge.

VI. MANUFACTURERS' NAME PLATE

The Contractor shall be permitted to attach a metal plate indicating his name, address etc. on equipment at suitable locations approved by the Engineer-in-Charge. Cast lettering except pattern number will not be permitted on any of the casting. Suitable name plates shall be provided in the controlled cabinets and other locations where necessary. The name plates shall be made of laminated material suitable for engraving, shall be opaque and consist of black lettering over white background or white lettering over black background. All the name plates shall be in English language. Each case or packing shall be clearly marked with name of work and the items to which the contents pertain and shall contain a packing list which will also include similar details. Copies of the packing list shall also be

VII. Maintenance and Operation Instructions

One set of the following manuals in English shall be furnished by the Contractor along with the respective equipment at the time of transport.

1. Technical and design data
2. General description of main components
3. Operating instructions.
 - I. General
 - II. Specific (Dealing with any useful features of safety precautions)
4. Maintenance and repair instructions
5. Lubrications
6. Materials and part identification list
7. Adjustments
8. Two sets of drawings as built and
9. List of all special tools required to correctly follow the servicing procedure along with a set of such tools.

After the final approval, the Contractors shall complete the submitted documents in order to constitute 6 complete approved sets of maintenance and operation instructions. All these instructions shall be written in English.

- 1.9.3 All the fabricated components shall be in the custody of the Contractor for work under this tender till they are taken over by the Engineer-in-Charge in final installed form. These components shall be stored on suitable platforms and shall be supported in a manner which will not cause damage / distortions or bending due to their own or superimposed weight. All components shall be protected from all sides against rusting's or any other deterioration which may affect their performance. The machined parts and other precision components of hoists and sills etc. shall be stored in godown or a closed shade with proper locking arrangement as directed by the Engineer-in-Charge. The Contractor should make all arrangements at his own cost for establishing his field store / workshop. All other facilities and arrangements required for storage of the components in the above stated manner and for proper watch and word of the component while in storage shall be provided by the Contractor at his own expenses. In case of any bending, deformations or any other injury occurs during storages, transportations, and handlings before and during installations they shall be rectified to the satisfaction of and in a manner specified by the Engineer-in-Charge, without any extra cost. Decision of the Engineer-in-Charge shall be final and binding. Notwithstanding anything stated in these clauses, the Contractor shall be entirely responsible for loss, damage, or depreciation of stores during transport, handling, storage or installations. Separate payment shall not be made for transport and storage of the equipment's as per the requirements of these specifications and all costs for the same shall be deemed to have included in the rates tendered for in the items of BOQ.

1.10 INSTALLATION, TESTING AND COMMISSIONING

1.10.1 GENERAL:

1. The items covered under the scope of the work also covers installations, operational trials and commissioning of the various equipment's and components to be furnished under this contract. The Contractor shall carry out installations, testing, operational trials etc. as per the requirements of contract specifications and conditions of approved drawings and as directed by the Engineer-in- Charge He shall ensure that all equipment's and components furnished by him under this contract are properly installed, tested and commissioned and shall be wholly responsible for the satisfactory performance of the same.
2. Not less than 45 days prior to commencing any erection, the Contractor shall submit to the Engineer-in-Charge:
 - a) Detailed programme of erection prepared in accordance with relevant provision in these tender documents. He shall also indicate the methods and procedures intended for transport, handling and installing the equipment's and components to be furnished under this contract.
 - b) Erection drawings indicating the identification of the components and their relative positions, field welds and connections and any other relevant details.
3. The Contractor for the work under this tender shall fully co-operate and work in close co-ordination with the Contractor for construction of other related works of the project and other appurtenant work.
4. The Contractor shall at his own expense provide to install bracings and temporary supports, fixtures etc. necessary for safe transport, handling, erection and testing of the various components and equipment's to be furnished under this contract. The platforms, scaffoldings, false works, erection aids and other facilities required for accurate installation and inspection and testing of the equipment's and components supplied shall also be provided by the Contractor at his own expense.
5. The reference lines, Centre lines of openings and labels having relations to completed civil structures shall have to be established on site by the Contractor so as to facilitate installation at proper locations. Installation in the field shall be done by bolting and / or electric arc welding, or by any combination of these as shown on the approved drawings or described in these specifications and the Contractor shall be prepared to perform this class of work. The requirements "Welding", "Bolting" etc. stipulated under relevant foregoing clauses shall apply to all welding's, bolting's etc. performed during installation.
6. The Contractor shall keep posted at the project site his one senior qualified engineer and foreman having adequate experience in fabrication and installation of gates and hoists and mechanical equipment's. The Contractor s' crew for the work shall also be experienced in the type of work involved under this contract.

1.10.2 EMBEDDED PARTS AND GATES

1. All the embedded parts, gates and hoists shall be accurately assembled and installed in lines, levels and plumbs as shown on the approved installation drawings and as directed by the Engineer-in-Charge. All match marks shall be followed carefully, while installing these parts members shall not be over stressed. Hammering that will injure or distort the members will not be permitted. Bearing surfaces and surfaces to be in permanent contact shall be carefully cleaned before the members are assembled or installed. The work shall be performed duly adhering to the tolerance stipulated.
2. The Contractor shall furnish erection gauge with each type of gate and the same shall be used to check the alignment of gate frame for required tolerances. The anchor bolts shall be located accurately and shall be held rigidly in position while the concrete in the structure is being placed. Frames and guides shall be placed in position and be adjusted accurately to exact position and alignment by means of adjusting nuts and turn buckles on the anchor bolts or by means of erection beams. Exceptional care shall be taken to ensure that all frames and guides are installed such that the gate sealing surface of each frame is even and true and lies in a true plane and that bearing surfaces of the tracks and gate guide on each frame lies in the same plane, so that, when slide gates are installed the gate seal and seats will bear evenly without leakage, all these operations being to the satisfaction of the Engineer-in-Charge
3. After the second stage embedded parts are erected, aligned, and secured properly and rigidly by the Contractor, the Contractor shall provide and place 2nd stage concrete for their embedment after all necessary field trials or as directed by Engineer-in-Charge. It is to be insured by the Contractor that the gates are operational to the design requirements after 2Nd stage concreting. The Contractor shall provide and fix all necessary dressings, supports etc., and ensure that 2Nd stage embedded parts are not damaged or their alignment is not disturbed due to the placement of 2Nd stage concrete.
4. Unless otherwise directed by the Engineer-in-Charge the gate leaves shall not be inserted before curing of the 2nd stage concrete. Sealing strips and seals shall be cut accurately to the required length and shall be attached to the gates as shown on the approved drawings or as directed. The Contractor shall locate carefully holes to be drilled in the sealing strips. The seal clamps shall be used as templates for drilling holes in the rubber seals where required. At joints, the end of the seals shall be cut so as to butt evenly. All gates shall be raised and lowered several times and all adjustments shall be made to the satisfaction of the Engineer-in-Charge. Each set of gates shall be tested for satisfactory operation and leakage by lowering and raising the same in their respective grooves.

1.11 INSPECTION:

The inspection of all gates their accessories, shall be carried out in accordance with Indian Standard recommendations for inspection, testing and maintenance of fixed wheels and slide gates part-II, inspection, and testing at the time of erection part-III – IS:7718.

1.11.1 INSPECTION AT THE TIME OF INSTALLATION:

1. It shall be ensured that sill beam is correctly positioned in level and location.
2. The parts to be embedded, i.e., track plates, guides, seal, seats shall be checked when all these parts are in final position from bottom to top of the groove. Check shall be carried out both in location and levels, with respect to sill beams already established in position. Each part shall be checked first individually and thereafter relatively to other parts.
3. The track plates and seal seats shall be in true alignment. The alignment of track plates and seal seats shall be checked at 300mm. intervals from bottom to top side of the gate / stop log opening. Alternatively, diagonal checking or any other satisfactory method can be adopted for checking the alignment.
4. After checking the track plates and seal seats on both sides it shall be ensured that they are in their respective planes.
5. Guide and guide shoes shall be checked for true location and alignment first individually and then relatively.
6. Groove corner protection angles shall be checked for true location and alignment.
7. The following critical dimensions shall be checked at intervals 300mm from bottom to top of the groove for embedded parts.
 - I. Centre to Centre distance of track plates.
 - II. Centre to centre distance of side seal seats.
 - III. Face to face distance of guides.
 - IV. Face to track plates to face of side seal seat and
 - V. Face of track plate to centre line of guide.
8. Eccentricity provided to gate for its fine adjustment in the grooves, shall not be accounted for while erecting parts to be embedded.
9. The groove concreting shall be done only after satisfying all these details including field trial and keeping proper record thereof. Recheck of alignment of embedded parts shall be done after concreting.
10. It shall be ensured that there is offset of joints while extending the embedded parts.
11. All the gates shall be inspected on site before lowering them in the respective grooves. Overall dimensions shall be checked to ensure that the respective gates match correctly in the respective grooves.
12. The following critical dimensions shall be checked at an interval of at least 300mm., wherever applicable for gate.
 - I. Centre to centre distance between thrust pad treads.
 - II. Centre to centre distance between side seals / bases.
 - III. Face to face distance between guide shoes / rollers.
 - IV. Face of seal base to pad treads and
 - V. Centre line of guide shoes / roller to pad tread in zero position.
13. Seals and seal base shall be checked to ensure that they are coplanar. All pads shall be adjusted to ensure that pad treads are in proper alignment.
Seal bolts shall be tightened adequately and uniformly.
14. To check the effectiveness of seal, actual seal interference shall be compared with that provided in the design.
15. It shall be ensured that installation of the various parts of the hoisting arrangements along with gates has been done to specified locations and alignment, particularly in respect of correct positioning and attachment of stem of the gates as well as hoists.

16. Connections like shaft couplings, connection of stem rods to the gates and hoists, connection of stem links, connection of hoist components to the base shall be checked.
17. It shall be ensured that intermediate supports for the stem rods are provided at the required levels and permit free movement of stem rod for the entire gate travel.
18. It shall be ensured that electric installations have been properly earthed.
19. The hoists provided for the operation of the gates shall be independently tested when not connected to the gates to ensure satisfactory workings. The hoists shall be kept running for a sufficient period so as to ensure independent working. Bearings shall be checked to ensure that there is no undue friction.

1.11.2 INSPECTION AFTER INSTALLATION

At an appropriate stage (as decided by the Engineer-in-Charge) after installation of respective gates the Contractor shall give field tests as directed in these specifications. The Contractor shall at his own expenses make all arrangements and provide all necessary equipment's, materials, tools, tackles and labour necessary for carrying out the said field tests. The inspection after installation shall cover following points and any other point considered necessary by the Engineer-in-Charge

- I. Drain holes of the components of the gates shall be so checked that they do not get clubbed with silt causing accumulation of water in the horizontal girders.
- II. Inspection of gates shall be carried out to detect defects, if any, after erection and when the water along the gates is full. The gate shall be operated up and down several times to make sure that they function well, without vibrations.
- III. Inspection, after erection shall consist of visual inspection of exposed surfaces of embedded parts, sill beams, seal seats, gate leaves, hoisting equipments, hoist supporting structures and checking of important dimensions. In case of inaccessible parts necessary inspection shall be carried out with the help of arrangements to be provided by the Contractor at his expense.
- IV. Inspection shall be carried out for connection, for structures, gate, tightness of all fittings, soundness of the welds, leakage through gates, lubrication of all bearings, guide shoes, machineries and equipment, wear and tear, corrosion, sealing, pitting of all metal work and machineries (soundness of metal).

1.12 FIELD TESTS:

Field tests shall be for all the gates and shall include

- I. Operational tests in dry.
- II. Operation steps with stipulated full supply level, and
- III. Leakage tests.

The tests will be repeated, if necessary, until they are successfully carried out to the satisfaction of the Engineer-in-Charge.

i. Operation tests in dry

Operational tests in dry will be carried out after completion of erection. The tests will include at least 2 complete traverses from the maximum raised position to the full seated position. All adjustments, clearances etc. shall be checked and adjusted by the Contractor for proper operation.

ii. Operational tests with full supply level

These tests will simulate the actual operating conditions as early as possible. At least one complete traverse shall be made from the fully closed position to the normal raised position as follows: -

- a) When the gates are closed, raise the gates to their normally opened position and
- b) Lower the gates to the fully closed positions.

iii. Leakage Tests

Leakage tests will be carried out with the gates lowered unto the sill. Before the observation for leakage, the gates will be raised and lowered suitably in order to dislodge any debris it might have been lodged in the side and bottom seals. The leakage then shall be measured, and it shall not be more than the amount specified in the relevant code. The tests shall be repeated, if necessary, until they are successfully carried out to the satisfaction of the Engineer-in-Charge. Leakage tests and operation tests will be carried out at the convenience of the Engineer-in-Charge after completion of other portions of the work and when the river is at High Flow level. However, the Engineer-in-Charge will have the right to carry out such tests when the river is at a level lower than the High Flow level. The Engineer-in-Charge shall also have the right to carry out the leakage tests by jetting water at 1.5 times the normal working pressure on the sealing position from bottom to top. The Contractor, without claiming any extra cost or compensation, shall carry out all adjustments, modifications, which in the opinion of the Engineer-in-Charge based on the above-mentioned field tests are necessary to ensure satisfactory performance of the equipment furnished under this contract.

TRASH RACKS

2.1 Trash racks are to be provided to eliminate entry of debris to the sump chamber of the pump house of the scheme. It is proposed to provide trash racks at two places to effectively prevent any floating or submerged debris, both organic & inorganic entering the pump bell mouth. The primary function is to protect pumping equipment & appurtenances.

2.2 Design requirements.

2.3 Hydraulic Design requirements.

The net area of flow in any trash rack should be enough to allow the required flow with a velocity not more than 0.6 meters/sec. This is necessary to avoid any excess head loss by generating higher velocity through slots of the trash rack. Very close spacing to keep out small size floating debris or fish, may get clogged frequently necessitating clearing at closer intervals.

2.4 Structural Design

Structural design of the trash racks shall strictly follow the standards as specified in B.S. Code No. IS-11388:1995. (Re affirmed 2000) or latest. The size & shape shall be designed based on the openings of pipes/conduits for the intake & the opening of the entrance at pump bays.

- 2.5 The trash racks being of small dimensions needs to be designed as removable pieces, & bolted to embedded structural steel in face of the openings, to facilitate cleaning repairing, painting etc. during season/ off season.
- 2.6 Selection of structural steel should be done as per requirement and specification as mentioned in the specification for gates, as per IS Codes applicable. Similarly manufacturing, transporting, painting & fixing, should be done as per specification made in previous chapter for gates.

SECTION-IV

**TECHNICAL SPECIFICATION FOR PUMPS
&
MECHANICAL WORKS**

**TECHNICAL SPECIFICATION FOR PUMPS
&
ELECTRO-MECHANICAL WORKS**

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4. TECHNICAL SPECIFICATION FOR PUMPS AND ELECTROMECHANICAL WORKS

4.1 INTRODUCTION

4.1.1 Overview of the Pumping system envisaged in the Lift Irrigation Scheme. The contractor will be able to identify the brief details of the scheme.

4.1.2 As the suction lift of pumps would be much more than six meters, it is proposed to have Vertical Turbine Pumps in RCC framed Pump House proposed to be constructed about 1/2 km away from left bank of the river Chambal. Its location must be such that it shall be safe from the high flood conditions of the Chambal River.

4.1.3 From the intake arrangement in shape of intake well intake canal shall be laid with proper gradient. Trash Rack arrangement for floating debris and arrangement for silt cleaning has to be provided. Contractor shall make proper arrangements of sealing the intake structure during non-operation period of scheme to safeguard it against choking due to silt load carried by the river water. Electromechanical gate operation shall be provided.

4.1.4 The pump house shall have proper ventilation.

4.1.5 The control panels shall be located in or nearer to the pump house.

4.1.6 The VT pumps are lubricated by external clear forced water. The details are covered in VT Pump specifications. The discharge requirement shall meet out the VT pumps requirements. The forced water pumps will be located in a suitable area of pump house or in vicinity of pump house. The pumps shall draw water from the intake sump to the pressure filter and shall store the filtered water in tanks to further pump in the pipeline network for cooling as per requirement of the VT pumps, the work involved shall include providing and installation of all valves and accessories for regulating water in each pump and for providing necessary automation of the system. The pressure filter and the pumping arrangements shall be with 100% stand by system. The pressure filter shall be designed for the silt load anticipated during the operating period of the system.

4.1.7 EPC contractors will have to prepare the lay outs and submit for approval. EPC contractor will be given the map showing the area to be irrigated by a pumping system and the, rate of discharge, at which, the pumps will deliver water in peak season. The EPC contractor has to carry out survey, prepare the pump house site, decide piping route, collect data regarding max, min and high flood levels, compute friction losses etc before deciding head for each pump. **Power System connectivity to the Pump house** as defined in detailed scope of work **is also covered under the scope of contract.**

4.1.8 The location of AIR valves and surge protection devices will be decided after carrying out surge analysis by EPC contractor.

4.1.9 MOTORS

Motors of suitable rating with design voltage as per requirements given in the tender document shall be provided with each pump.

4.1.10 DRAINAGE PUMPS:

4.1.11 SLUDGE PUMPS

Sludge pumps shall be provided to dewater the sump. Sludge pumps to desludge the intake shall be provided so that the intake sump is dewatered within 6 hours of operation of pumps. The pumps shall be provided with 100% stand by arrangements. These pumps are part of sump cleaning system.

4.2 VERTICAL TURBINE (V.T) PUMPS

4.2.1 GENERAL

V.T Pumps of required capacity for pumping design discharge at duty point head are necessary to be provided at the pumping station of the scheme.

The desired characteristics of the pumps are as follows.

- The pumps to be rugged in structure both mechanically and electrically to withstand rough weather conditions & designed to run with minimum maintenance as the installation points are in remote inaccessible places.
- The materials of construction for different components to be selected to withstand wear and tear.
- The pumping units should be easy to handle, & install, and designed to withstand normal variation in power supply.

4.2.2 PUMPS IN PARALLEL

As per the preliminary design it is proposed two Rising Mains. For each Rising Main there shall be Three (including one standby) pumps working in parallel. Number of pumps indicated in bid document is indicative only based on owner's preliminary study. Contractor should choose economical option

- a) Stand by Pump: Pumps with 50 percent capacity of the designed capacity will be provided as stand by.
- b) As far as possible Pumps in a pump house shall be identical in all respect.
- c) Contractor should try to choose similar types of pumps in the pump house such that the pumps are interchangeable in case of emergency, and least quantity of spares required be stocked.
- d) V.T Pumps with High Voltages motors (6.6 kv) should be provided.
- e) RCC pump house structure is required for VT pumps so as to protect the motors from rain, wind, dust, etc. The VT pump house floor level should be above High flood level. The delivery piping for these should be designed judiciously to ensure most economic design without compromising the desired outcome of the scheme.
- f) Each pump house will have following major components
 - Pump house with suitable EOT crane, bay for maintenance, space for control panel, sump for fore bay, ventilation system.
 - VT pumps with HT motors, External forced clear water lubrication system
 - Dewatering pumps are required to remove sand and silt from the sump.

4.2.3 CODES AND STANDARDS:

Except as otherwise specified in this technical specification, the Indian Standards and Codes of Practice shall be adhered to for the design, manufacturing, inspection and factory testing, handling, installation and site testing of all material and equipment used for the work, or where a IS standard does not exist, to an approved national or international standard. The design, manufacture and performance of the pumps specified herein shall comply with the requirements of the applicable Codes and Standards, as follows, butnot limited to:

No.	Standard	Title
1	IS: 1710	Specification for pumps- Vertical turbine mixed and axial flow, for clear cold water
2	IS: 9137	Code for acceptance tests for Centrifugal, Mixed flow and Axial pumps Class-C
3	IS: 5120	Technical requirements for roto-dynamic special purpose pumps
4	ISO 5199	Standards of the Hydraulic Institute of USA.
5	IS 5120	Performance test of pumps
6	IS 11732	Mechanical Balancing

Only equipment supplied by reputed manufacturers and approved by the Engineer-in-Charge will be accepted.

4.2.4 Mechanical Plant & Equipment

It is not the intent to specify herein all the details pertaining to the design, drawing, selection of equipment/materials, procurement, manufacture, installation, testing & commissioning, however, the same shall be of high engineering standard and shall comply with all currently applicable standards, regulations & safety codes. The equipment's supplied shall be from approved vendors and in case approved vendor of a specific equipment is not given the same shall be got approved from competent authority prior to place order / make supplies. Only equipment supplied by reputed manufacturers and approved by the Engineer inCharge will be accepted.

4.2.5 DESIGN REQUIREMENT:

The equipment shall be capable of developing the required total head at rated capacity for continuous operation. The total head discharge curve shall be continuously rising towards the shut off with highest shut off point. Pumps shall be identical and shall be suitable for parallel operation with equal load division. Impellers shall preferably be of non-over- loading type. Pumps shall run smooth without undue noise and vibrations. The magnitude of peak-to-peak vibration at slip will be limited to 100 microns at the bearing housing. Pumps normally will be single/multistage based on design, vertical turbine type and suitable for the service condition stipulated.

- i. The contractor shall confirm that the pumps shall not be of a new design and a pump of at least the same size and same type should be in operation for more than 5000 hours satisfactorily in at least two locations. The details of locations shall be submitted in schedules.
- ii. EPC Contractor may decide to install booster pumps in the system to achieve the economical option of running and capital cost. The Booster pumps can be HORIZONTAL SPLIT CASE/END SUCTION Coupled sets/submersible pumps in casing pipe.

- iii. **Duty Point Pump Head:** Based on the preliminary study and the water demand, the duty points required for the pumps is specified in the tender document. However, contractor has to plan & design the system after detailed survey of the scheme and as per the actual requirement of the scheme. The contractor shall have to account for all losses (in entry, strainer, bell mouth, bowl assembly, column pipes, discharge tee etc/) while designing the pumps in addition to head loss in delivery pipe, valves, fittings, rising mains and velocity head beyond discharge flange of discharge head / pumps casing etc. are to be calculated taken into account while designing pump.
- iv. **Duty Point Efficiencies:** The DUTY POINT efficiency shall be guaranteed by the EPC contractor along with other parameters.
- v. **Head Range and Parallel Operations:** The pumps will satisfy the head requirement as per the system resistance curve, while operating in solo and in any combination up to maximum Nos. of duty pumps in parallel. The Pumps should be suitable for operation in head range of 10% above N.W.L. and 25% below N.W.L.
- vi. **Power Margin:** The specific gravity of water is to be taken as 1.03 while calculating power for the pumps. The pumps shall be capable of operating in the range as mentioned above without being overloaded at any point and keeping a margin of at least 5% of power in the motor of pump over entire operating range and 10% at rated Duty point whichever is higher. Requirement of power at shut off should not exceed power requirement at duty point. The pump should be capable of starting against fully closed valve without being overloaded at any point up to valve fully open. The starting torque of each motor should be such that, all pumps should be capable of starting without any problem automatically from remote control system.
- vii. **Pump Characteristics:** The pump characteristics shall be of stable nature and such that the efficiency is fairly steady for the water level variation. The maximum efficiency point will be nearer to the duty point and fairly constant for larger range on either side. The pumps should run smoothly from a lowest head to rated duty head, without cavitations and vibration. The variation in the efficiencies for any point of operation in the entire operating range should be minimum.
- viii. **NPSH Conditions (Net Positive Suction Head Conditions) :**
The required pump NPSH at duty point shall be adequately less than the available NPSH. The horizontal split casing pumps shall be used with positive suction head.
- ix. Pump must be suitable for operating in parallel over the entire operating range. The pump shall operate satisfactorily at any point between the maximum and minimum system resistance, or at the end of the pump performance curve with respect to the NPSH available at the lowest permissible suction water level.
- x. NPSH required by pumps offered by the Contractor should be lesser by at least 0.5 meters than N.P.S.H.A. at duty point and shall not exceed the N.P.S.H. available at any point of operation in the range with solo and parallel operations.
- xi. **Speed**
The first critical speed shall be away from the operating speed and in no case less than 130% of the rated speed.

- xii. **Solid Handling Capacity:** The pump shall be suitable for pumping of raw river water containing silt, sand and suspended solids up to 20 mm size. The river water may contain weeds and other long roots etc, which may pass through trash racks. These may obstruct the pump impeller, diffuser and bearing holder spiders etc. Hence contractor should take special care to avoid such occurrences, while designing intake pipe Contractor to get water analysis done and impellers and casings to avoid any damage due to abrasive material in raw water.
- xiii. **Class of Operation:** The pumps shall be suitable for nonstop continuous 24 hours operation without interruptions.
- xiv. **No. of Starts:** Pumps shall be suitable, for two hot starts, and three cold starts per hour of corresponding motor.

4.2.6 SUMP MODEL TESTING:

The contractor must design the sump of the scheme, to ensure vortex free and cavitations free operations of the pumps. If required contractor may carry out sump model test/or carry out sump design by mathematical modelling, at his own cost for vortex free operation. During the operation if it is required, the contractor has to modify the sump at his own cost without affecting the operation of the scheme.

4.2.7 DEFINITIONS OF EFFICIENCIES:

For all purpose of this contract, the various efficiencies will have the same meaning and effect as defined in the IS 1710- (latest version).

4.2.8 CHARACTERISTIC CURVES:

The contractor shall furnish characteristic curves of pump. The contractor shall furnish along with his tender the characteristic curves so prepared, superimposed on system head curves for single and multi-pump operation.

4.2.9 BOWL ASSEMBLY:

The casting of bowls shall be free of blow holes, sand holes and other detrimental defects. A pump bowl shall be flanged with machined matching faces. The suction bell mouth to bowl assembly, to column and to discharge head, i.e, all joints shall be flange joints. The bowl shall be capable of withstanding a hydrostatic pressure equal to twice the duty head or 1.5 times shut off head whichever is greater.

4.2.10 SUCTION BELL MOUTH & STRAINER:

A cast iron bell mouth shall be fitted to the suction nozzle to limit the velocity to 1.5m/sec maximum. The suction strainer shall be of Stainless Steel AISI 304. Net opening area in strainer shall not be less than 2.5 times of entrance area of bell mouth. The shape and

Curvature of the bell mouth shall be designed to streamline the flow of bowl suction. The thickness of bell mouth shall not be less than 10mm.

4.2.11 IMPELLER:

The impellers shall be dynamically balanced so as not to cause any vibrations & cavitations during operation. The impellers shall be semi open/closed type and shall be made in one piece and securely fixed to the stainless-steel shaft, to assure accurate adjustment of each impeller. The water passage will be finished smooth by hand. Balancing holes/ devices for reducing hydraulic thrust shall not be provided.

4.2.12 WEARING RINGS:

Wearing rings shall be renewable type. These shall be held in place by screwing against rotation, press fit or locked with pins, flanged and screwed. Wearing rings shall be provided on both casing and impeller.

Hardness of wearing rings shall be less by at least 50 BHN than the impeller.

4.2.13 SHAFT:

The shaft shall be of stainless steel and finished to the close tolerance at the impeller / Bearing fixing sizes. Single integral shaft, wherever possible or shaft in pieces with suitable screwed coupling shall be designed to withstand the torque loads throughout the whole range of operating conditions, for the selected impeller diameter as well as all the impeller diameters covered between minimum and maximum impeller diameters when coupled to the motor shaft through flexible coupling. The design of the shaft shall also take into consideration the critical speed of the shaft, which shall be at least 20% above / below the operating speed. The shaft shall be properly balanced so as not to cause any vibrations during operation. The pump shaft bearings i.e., bush bearings would be stainless steel, water lubricated. Extra- long bearing shall be provided for suction and discharge bowls. The hardness of bush bearing shall be less by at least 50 BHN than that of shaft.

4.2.14 COLUMN PIPE ASSEMBLY:

Column pipes shall be of M.S. Fabricated heavy weight, flanged type each in 2 m length or less so that after complete erection of the pump/s the bottom of strainer shall be at 1.5 m above the sump bottom level and length of strainer shall be adjusted accordingly. The total length of column assembly, bowl assembly, bell mouth and strainer shall be decided by the contractor based on the data collected after detail survey. The column assembly length (including column pipes, bowl, assembly, bell mouth and strainer) shall be adjusted considering, the pump floor, levels. A matching piece shall be provided if required. The stiffeners shall be provided to all pipe flanges. The discharge head/ tee and column pipe dia shall be same. The discharge head tee incorporates full diameter elbow.

4.2.15 LINE SHAFT:

The shafts shall be of solid circular section, prepared from stainless steel machined and ground thoroughly and coupled with muff couplings. The shaft sections shall be provided with noncorrosive and abrasion resisting wearing surfaces particularly at the location of each guide bearing. Length of line shaft shall not be more than 2 m. each.

4.2.16 LINE SHAFT BEARING:

These shall be designed to be water lubricated by external clear forced water and shall be placed in bearing holders located in position at the joint of columns. Line shaft bearing shall be of cut less hard rubber designed for efficient water lubrication. The line shaft protection tubes shall be provided for holding line shaft bearings. The line shaft protection tubes shall be of heavy-duty seamless tubes to withstand all mechanical and hydraulic forces exerted on it, with an allowance for corrosion and erosion. Composite design of line shaft materials and diameter and bearing Centre shall ensure that the entire rotating assembly is brought from standstill to full speed without any vibrations and shaft deflection and to ensure that first critical speed is not within 80% to 120% of full speed.

4.2.17 DISCHARGE HEAD & MOTOR STOOL:

The discharge head shall be fabricated from M.S. and shall incorporate mounting flange for motor stool for solid shaft motor, stuffing box with renewable gland packing and tapping for pressure gauge mounting etc. The discharge head shall be of robust construction and shall be designed to support entire load of pump assembly, water column and motor etc. and shall withstand all static and dynamic, torsion loads, hydraulic thrust imposed during operation from shut off to stipulated operating conditions and thrust due to change in direction of flow, without any vibrations. The delivery nozzle shall be above ground

- i. Discharge head with sole pads will not be accepted. The discharge head shall be installed on sole plate with ISMB frame and entire load of motor and pump shall be on the lower floor. Drain arrangement for gland leakage water shall be provided at bottom of discharge head with G.I. pipe. The base of the discharge head shall be sufficient to properly support the pump. The power shall be transmitted from motor to vertical shafting through a flexible coupling. Both halves of the coupling shall be machined all over, securely keyed to their respective shafts. The pins shall be of stainless steels. The arrangement of two halves shall be suitable to check alignment and parallelism.
- ii. A self-aligning thrust bearing shall be housed in the head gear adequately designed to accommodate entire weight of rotating parts and hydraulic through and shall be suitable for reserved rotation up to at least 150% normal forward speed. Bearing shall be designed for 20,000 hours life. The bearing shall be of oil lubricated type and shall be provided with oil level gauges and suitably positioned temperature probes. Two sets of adjustable contacts shall be provided one for an alarm and other for tripping the pump motor. This shall be connected to scanner panel so that digital temperature can be read out with alarm and tripping.
- iii. Motor stool shall be provided for mounting the electric motor. The motor stool shall accommodate the pump thrust bearing and pump motor coupling. The motor stool shall be robust construction and of fabricated mild steel and adequately sized with opening to work on the flexible coupling. Height of pump supporting girder/channel, discharge head and motor stool shall be adjusted to have motor base at or marginally above panel floor level.
- iv. The pump shall be provided with non-reversible ratchet to prevent them from rotation in reverse direction. Pressure gauge to each pump and manifold pipe shall be provided. Pressure gauge shall be 150 mm dial size and least count shall be 0.05, each pressure gauge shall be fitted with restrictor nozzle of brass and G.I. Pipe and

U tube. Pressure gauge on manifold shall also be provided. All pressure gauges shall be installed in pump house on wall with necessary G.I. pipe connections from manifold to pump house. The pressure gauges shall be installed at suitable height so that the reading can be taken accurately.

4.2.18 SOLE PLATE:

The M.S. sole plate arrangement shall be provided under the discharge head for precise horizontal and vertical alignment. It shall be independent of base plate integral with the discharge head. The contact surfaces of the sole plate arrangement as under shall be machined for precise levelling and shall ensure vibration free operation of the pump. Corner plates and sole frame Sole frame and sole plate Sole plate and discharge head. All joints between machined contact surfaces shall be with nut bolts/ tapped studs/ bolts. The opening in the soleplate/frame shall be of adequate size to pass the bowl assembly etc. very easily. M.S. base frame shall be anchored in the floor ensuring complete rigidity. Entire structural fabrication and foundation arrangement shall be designed and submitted for approval. M.S. plates shall be grouted on pump supporting R.C.C. beams provided in civil structure. The fixing of M.S. plates on the R.C.C. beams and subsequent anchoring of M.S. sole frame in proper level shall be the responsibility of contractor with all related works.

4.2.19 AUTOMATIC AIR RELEASE ARRANGEMENT:

An automatic air release valve of min 50 mm size shall be provided, to remove the air from column pipe during starting of the pump

NOTE: All accessories required for proper and safe operation, dismantling and erection and pump shall be supplied with heavy duty clamps for column and line shafts, one pair for each pump.

4.2.20 FORCED WATER LUBRICATION AND COOLING SYSTEM

The forced water lubrication system for transmission bearings and supply of cooling water to pump thrust bearing shall be provided. There shall be standby booster pump. A suitable capacity tank shall be provided to supply lubrication water to pumps, in case failure of Forced water lubrication system. The system flow and pressure requirements should be as pump manufacturer's recommendations

4.2.21 MATERIALS OF CONSTRUCTION FOR V.T. PUMPS/Booster Pumps

Sr. No.	Description	Material
1.	Bell mouth, pump bowls, suction casing and discharge nozzle	Ni-C.I. conforming to IS 210 grade 20
2.	Impellers for V.T. pumps & Booster pumps	Stainless Steel CD4 M Cu – Bhn.220 –270 with anti-abrasive
3.	Impeller shafts for V.T. pumps &	Stainless Steel AISI 410

	Booster pumps	
4.	Column Pipes	Mild steel IS 2062 EFW/ ERW pipes.
5.	Line Shaft Protection tubes	Seamless M.S.
6.	Flexible coupling	Forged steel conforming to IS 3495
7.	Wearing rings for V.T. pumps and Booster pumps	Stainless steel as appropriate
8.	Column Flanges	Mild steel IS 2062
9.	Nut bolts and washers up to bottom of discharge head	Stainless steel AISI ST 304/316
10.	Line shaft	Stainless steel AISI – 410
11.	Line shaft Bearing & coupling	Stainless steel AISI – 410
12.	Pump shaft bearing	Cut lass Rubber
13.	Discharge head	C.I. conforming to IS 210 or mild steel fabricated IS 2062
14.	BOWL bearings	Ni-CI confirming IS 210 or Mild Steel fabricated IS 2062
15.	Strainer	Gun Metal
16.	Casing of Booster Pumps	Ni-CI or galvanized steel
17.	Pressure Filters	C.I. conforming to I.S. 210 grade 20 i. Body and Flanges - M.S. fabricated ii Filter media - Graded sand

4.2.22 DRAWINGS / DATA TO BE PROVIDED

During detailed engineering the Bidder shall submit the following:

- General arrangement, cross-sectional and dimensional drawings/data pertaining to selected model.
- Complete performance curve with
 - (a) H - Q curves for complete range of impellers between minimum and maximum size of impellers and efficiency curves super imposed on them, highlighting selected impeller diameter.
 - (b) Shaft Power - Q curves for complete range of impellers.
 - (c) Efficiency -Q curve for Maximum impeller diameter and selected impeller diameter.
 - (d) NPSHR- Q curve for maximum, minimum and selected impeller diameters.
 - Torque-speed curve of pump superimposed on motor corresponding to 80%, 90%, 100% voltage.

- Test reports, performance curves and other particulars, as required by the applicable clauses of this specification.

Instruction Manuals:

- Instruction manual for Erection
- Instruction for pre-commissioning checkup, operation, abnormal conditions, maintenance, and repair
- Write up on Controls and interlocks provided
- Recommended inspection points and periods of inspection
- Schedule of preventive maintenance
- Ordering information for all replaceable parts
- Recommendations for types of lubricants, lubricating points, frequency of lubrication and lubricant changing schedule.

4.2.23 TESTING:

All the pumps shall be subject to factory test in presence of Engineer-in- Charge or his representative and or third party appointed for the purpose.

The contractor shall arrange all required test equipment duly calibrated; Field performance test shall be witnessed by authorities.

The performance and hydraulic tests of the pumps shall be made with their respective duty motors. The following inspections/tests shall be carried out:

1.	Performance Test	As per IS 5120 & IS 9137 at speed as approved by Engineer-in-Charge. Head v/s Discharge characteristic Power absorbed v/s Discharge Efficiency v/s Discharge Bearing Temperature
2.	Visual Inspection	Pumps shall be offered for visual inspection before shipment. The pump components shall not be painted before inspection.

i. Hydrostatic Test:

Following items shall be tested at hydrostatic pressure equal to twice duty head or 1.5 times shut off head of bowl assembly whichever is higher as per IS: 5120.

- Bowl assembly
- Discharge head / tee
- 20% quantity of column pipes.

ii. Performance Test:

The test shall generally be carried out as per IS 9137. Class pumps acceptable test for pumps class-C.

The test shall cover minimum 6 points, i.e.,

- Duty point
 - points above duty point
 - points below duty point
- Shut off head
- Power consumption at all above points
- Zero reading confirmation for V. notch.

The test shall be carried out only by the job motor which will be supplied under this contract. The test at reduced speed and reduced load will not be acceptable.

Strip Inspection:

All the pumps after completion of its performance test and as selected by the Engineer or Inspector at random will be offered for strip inspection and dimensional checking. The manufacturer/ contractor shall submit all required dimensional drawings of strip inspection. Minimum points as under shall be checked. Condition of all components particularly bushes, bearings and wearing rings to examine undue rubbing, wear etc. Hardness of cut less rubber bearing

Dynamic balancing of

- Impellers
- Flexible coupling

Clearance and tolerances between

- Wearing rings
- Impeller shaft and bearings
- Impeller shaft and key
- Shaft and flexible coupling
- Key and keyway on shaft at (d)

4.2.24 NUMBER OF PUMPS TO BE TESTED

- ALL pumps must be tested by manufacturers with lab motor for performance test and certificates to be furnished to owner
- Hydro test for all pumps to be carried out for all pumps/components by pump manufacturer and certificates shall be furnished for approval
- The material test certificates shall be furnished by manufacturer for all critical components
- One pump of each type shall be tested with job motor and shall be witnessed by client's representative. It includes performance test, hydro test, strip test,
- verification of material test certificates and balancing certificates
- The actual number of witness tests will be decided by client after proposal are received and before order is finalized
- The contractor shall intimate the time of inspection/tests at works sufficiently advance so that the tests may be witnessed by the employer.
- The witnessing of tests shall, however, not relieve the contractor of his responsibilities to fully meet the requirements of the specifications and guarantees.
- Test reports shall be supplied to the employer. No shipment/dispatch of any portion of the equipment shall be made till the test certificates for the tests conducted at the factory are approved by the employer in writing.

4.2.25 FIELD PERFORMANCE TEST:

The test shall be carried out as per IS: 9137 code of acceptance test of pump Class-C, in general and as started below in particular.

The purpose of the field test is not to ensure whether pump performance as regards parameter i.e., H.Q. & power etc. within acceptance limit as per IS: 9137. The purpose is to ensure that the pump performance is generally acceptable or otherwise. Final acceptance shall be as per following criteria.

- i. As regards H-Q characteristic for acceptance it shall be checked whether motor is not getting overloaded within the specified head range.
- ii. Flow measurement shall be taken by the flow meter to be provided by contractor.
- iii. The head shall be measure with calibrated pressure gauge of accuracy 1% or better. At least 3 pressure gauges shall be got calibrated from two different institutions with prior approval of the Engineer- in-charge. The calibration shall be point to point and not mere for percentage error. The gauge shall be fitted at suitable place from the discharge nozzle. It may be noted that pressure gauge shall be installed at least 2 times diameter away from discharge nozzle and delivery valve be placed at least four times diameter away from discharge nozzle. Such conditions shall be simulated at site condition and no allowance for this deficiency shall be considered. The decision of Engineer-in- Charge shall be final.
- iv. The input power to motor shall be measured by 2 wattmeter method. The watt meters shall be of Laboratory grade having accuracy of min. 0.5% and these should be digital type.
- v. The speed shall be measured by non-contact tachometer with digital display calibrated. The field test shall be taken with entire head range in such a manner that it would cover at least 6 points (i.e., duty point, 2 above duty point, 2 below duty point and shut off). The guarantee for head and discharge shall deemed to be fulfilled as per clause.
- vi. The field performance test at site is essential as above (i) to (v) and the manufacturer shall also be asked to attend the same.

4.2.26 SPECIAL TOOLS, SLINGS, CONSUMABLES ETC.

- All necessary special tools and devices such as lifting devices erection and maintenance c. shall be included in the offer. The contractor shall submit a list of the above special tools, slings etc. in the tender. Any special reamers and bracing equipment for all works to be done in field/site shall be provided by the contractor.
- The quantity and technical particulars/brand of the oil to be used for lubrication of the motor bearings shall also be specified in the bid.

4.2.27 SPARES

Spare parts for the pumps and other equipment's are to be supplied by the contractor. All spare parts furnished shall be interchangeable with and of the same materials and workmanship as the corresponding parts of the equipment.

4.2.28 PAINT & FINISH

All external and internal parts shall be finished and painted with epoxy paint to produce a neat and durable surface which would prevent rusting and corrosion. The contractor shall mention the shade and code number of paint to be used the equipment shall be thoroughly degreased, and sharp edges and scales removed and treated with one coat of primer and two coats of enamel paint

Material Test Certificate of the various pump components shall be furnished by contractor

4.3 ACCESSORIES AND SERVICES REQUIRED TO BE SUPPLIED BY THE CONTRACTOR WITH PUMP.

The contractor is supposed to provide at least the following accessories

- Base Plate
- Foundation Bolts
- Coupling
- Coupling guard

4.3.1 DRAWINGS AND INFORMATION TO BE PROVIDED

During detailed engineering the Contractor shall submit the following:

- General arrangement, cross-sectional and dimensional drawings/data pertaining to selected model.
- Complete detailed drawing of the base plate
- Complete performance curve with
 - (a) H - Q curves for complete range of impellers between minimum and maximum size of impellers and efficiency curves super imposed on them, highlighting selected impeller diameter.
 - (b) Shaft Power - Q curves for complete range of impellers.
 - (c) Efficiency -Q curve for complete range of impellers.
 - (d) NPSHr- Q Curve for the complete range of impellers.
- Test reports, performance curves and other particulars, as required by the applicable clauses of this specification.

4.3.2 INSTRUCTION MANUALS:

- Instruction manual for Erection
- Instruction for pre-commissioning checkup, operation, abnormal conditions, maintenance and repair
- Write up on Controls and interlocks provided
- Recommended inspection points and periods of inspection
- Schedule of preventive maintenance
- Ordering information for all replaceable parts
- Recommendations for types of lubricants, lubricating points, frequency of lubrication and lubricant changing schedule.

4.4 DETAILED TECHNICAL SPECIFICATION FOR MONO BLOCK CENTRIFUGAL PUMP SET

These specifications cover supply erection, commissioning and trial & testing of mono block pump set with required accessories of suitable size and capacity, as per site conditions and drawings.

4.4.1 MONO BLOCK PUMP SET

The motor driven Horizontal centrifugal pumping sets of mono block type for operation on 3 phase, 50 HZ AC supply between 300 to 440 voltage range. The set should have BIS marks as per IS: 9079-2002 with latest amendments and other international specification with latest developments.

The electric motor shall be totally enclosed fan cooled (TEFC), AC induction motor of squirrel cage type with synchronous speed of 3000 RPM with 'F' class insulation of NEMA& shall be designed manufactured and tested as per IS 7538-1996 with latest amendment having high peak efficiency, non-overloading characteristics, capable of operating at higher suction lift and other latest developments as per NEMA.

4.4.2 DESIGN REQUIREMENTS

The bidder can select the number of pumps required to meet the design demand. The number of pumps to be installed as specified in the scope of work.

Design requirements common for all Pump Rooms:

- The power characteristic shall be non-overloading and preferably flat for flows higher than the best efficiency flow (BEP).
- The required pump NPSH at duty point shall be at least 0.5 meters less than the available NPSH.
- The pump shall be suitable for satisfactory operation within the range of +10% and -25% of the specified duty point head and the entire range of operation (without noise or cavitations) shall be on the stable portion of the curve. The specified duty point should be as close to the maximum efficiency point as possible.
- Pump test, tolerance and guarantee of pump performance shall be as per IS 11346-2002 (amended up to date) and other relevant international specification and that no negative tolerance in quoted efficiency shall be allowed. The prescribed performance at duty point shall be tested at the voltage 415 volts. The test at duty point shall be carried out with a minimum suction lift as defined in clause 9.2 of IS: 9079- (amended up to date).
- Guaranteed efficiency at duty point (under operation at prescribed voltage i.e., 415V shall be without any negative tolerance. In all cases this overall efficiency should not be less than the calculated overall efficiency based on product of pump efficiency as given in fig3 to 6 of IS: 9079-2003 (amended up to date) and motor efficiency for quoted motor KW as given in table in these figures.
- Pump shall be suitable for use up to minimum suction lift as specified in clause (amended up to date). The net positive suction head NPSH requirement of pump shall be in consonance with this provision. The cavitations test shall be conducted as per clause 5.7 of appendix D
- The prescribed performance of the pump set including NPSH at duty point will be checked and guaranteed at the rated speed at rated voltage of 380 Volts and rated frequency of 50Hz. The motor rated KW shall be suitable for operation of pumping range from +10% to -25% of duty head. The actual performance shall however also be recorded at the lowest voltage i.e., at 300 Volts by the inspecting agency in the inspection certificate and it shall be ensured that motor does not get overloaded.
- The output motor rating shall be as per clause 14 of IS: 9079-2003 (amended up to date)
- Wherever reference of IS number is given it may be treated as amended up to date at the time of inspection of supply/replacement by inspection agency. Any amendment shall be effective only when it is implemented by BIS.
- The inspecting agency shall test & inspect the pump set as per approved data sheet & QAP.
- The marking shall be as per relevant IS code and purchasers mark WRD Rajasthan & year of supply shall be mentioned on each pump.
- The manufacturers shall submit performance curve for all proposed models for discharge, power, and efficiency. The efficiency curve is top flat to ensure that the pump set operates efficiently in the entire head range.
- The pump efficiency should not vary much in the head range as specified in the BIS.

4.43 FEATURES OF CONSTRUCTION:**a. PUMP****I. PUMP CASING**

The pump casing shall be of closed grain Cast Iron FG200 as per IS 210-1993 (amended or revised up to date). Liquid passages in the casing shall be finished smooth. Pump casing should have central delivery & no air release is required during operation and should be in one piece. The rotating unit and impeller should be dynamically balanced as per grade 6.3 of IS: 11732. Internal portion of casing shall be applied with anti-corrosive energy saving coating.

II. IMPELLER

The impeller shall be closed and casted in Stainless Steel grade 304, dynamically balance, enclosed type, made in one piece and securely keyed on the shaft. Means shall be provided to prevent loosening during operation including rotation in the reverse direction. The impeller shall be statically and dynamically balanced to prevent vibration, as per IS 2373.

III. SHAFT

The common shaft for pump and motor shall be of high tensile stainless steel AISI 410, accurately machined & ground supported by heavy duty antifriction bearings and wear resistant shaft sleeves. The size of the shaft shall be calculated on the basis of maximum combined shear stress. This shear stress shall not exceed 30 percentage of the elastic limit in tension or 18% of ultimate tensile strength whichever is lower. The critical speed of the shaft shall be at least 30% above or below the normal operating speed.

IV. SHAFT SLEEVE

Shaft sleeve shall be stainless steel AISI 410. Replaceable shaft sleeves shall be provided to protect the shaft where it passes through stuffing boxes. The end of the shaft sleeve assembly shall extend through the packing gland; shaft sleeves shall be securely locked or keyed to the shaft to prevent loosening. Shaft and shaft sleeve assembly shall ensure concentric rotation

V. BEARING

Bearings shall be either ball or roller type and provision shall be made to the radial and axial thrusts, under all operating conditions. Anti-friction bearing shall be of standard type and shall be selected to give 20,000 hours continuous operation at rated operating conditions. The rise in bearing grease temperature with continuous running of the pump shall be within the allowable limits which shall not exceed 20°C for grease bearings above ambient temperature. Cooling arrangements shall be provided if required. Bush bearings will not be acceptable

VI. STUFFING BOXES

Stuffing boxes at driving end and non-driving end shall be of such design that they can be re-packed, without removing any part, other than the gland and lantern ring. An axially split gland should be used to facilitate changing the gland packing. Sufficient space shall be available for maintenance purposes.

VII. SEALING

Self-sealing water connections should be provided.

VIII. FLANGES

Flanges shall be machined flat, with flange faces vertical and at right angles to the pump mounting surface. Cast iron flange drilling and thickness shall conform to IS - 1538, (part IV and VI) for ID up to 1500mm and to IS-6392 for ID greater than 1500mm.

IX. ACCESSORIES

All specified accessories and any other standard accessories required for correct and safe operation of the pump shall be furnished with the pumps. All incidental piping (including valves) required for sealing, lubrication and cooling of stuffing box packing and/or pump bearing shall be furnished by the Bidder.

Eye bolts (as many as required for safety), shall be provided for ease of lifting and installation.

b. PERFORMANCE

The pump set shall be tested as per IS 9079 and tolerate applicable shall be on IS 11346. (Amended or revised up to date) Accessories and services required to be supplied by the bidder with pump

The bidder is supposed to provide at least the following accessories

- Foundation Bolts

DRAWINGS AND INFORMATION TO BE PROVIDED

During detailed engineering the Bidder shall submit the following:

- General arrangement, cross-sectional and dimensional drawings/ data pertaining to selected model with the complete bill of material.
- Complete performance curve with test reports, performance curves and other particulars, as required by the applicable clauses of this specification.

Instruction Manuals:

- Instruction manual for Erection
- Instruction for pre-commissioning checkup, operation, abnormal conditions, maintenance, and repair including overhaul manual.
- Write up on Controls and interlocks provided
- Recommended inspection points and periods of inspection
- Schedule of preventive maintenance
- Explode view of all part and assembly with reference number and part description
- Ordering information for all replaceable parts
- Recommendation for types of lubricants, lubricating points, frequency of lubrication and lubricant changing schedule.

4.5 DRAINAGE PUMPS

TWO pumps are provided in each sump

The pump set shall be single stage submersible type, mono block, volute type driven by squirrel cage induction motor. The motor shall be an integral part of the pump set. It shall be a totally sealed unit suitable for completely as well as partially submerged condition. The pump shall operate continuously (S1 duty) even if the water level in the sump is low (motor portion not in submerged condition). The pump shall be suitable for reverse rotation and shall not have any adverse effect on the operation of mechanical seal or any other component. The pump shall be capable of handling heavy silt/sludge load.

Pump Casing

The pump casing shall be Gray Cast Iron as per ASTM – A 48 no. 35 B / EN 1561-GJL-250 or FG 260 as per IS 210 The pump casing shall be pressure tested at pressure twice the duty point pressure or 1.5 times the shut-off pressure, whichever is maximum. However, the minimum pressure shall be 10 kg/cm².

Impeller

It shall be made of high chrome stainless steel grade CD4MCu as per ASTM A 351 or equivalent having hardness 220-270 BHN or more

Fasteners All fasteners exposed fasteners exposed to pumping media shall be of stainless-steel grade AISI

Sealing

Each pump shall be provided with a tandem bi-directional mechanical shaft seal system consisting of two totally independent mechanical seal assemblies. The seal shall operate in a buffer fluid that lubricates and cools the seal.

Motor Cooling System

Motors shall be designed to be cooled by the surrounding pumping media.

Wear Ring

A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller

The impeller wearing rings shall be of stainless steel, heat-shrink fitted on to the suction inlet of impeller.

Bearing

The pumps shall be provided with one support roller bearing and one two row angular contact ball bearing as main bearing.

Shaft

It shall be made of ASTM / AISI 431.

Suction Strainer

Each pump shall be supplied with a suitable stainless-steel strainer at the suction of the pump set to keep the coarse solids away from the pump set.

Installation Accessories

For permanent type installation, the pump shall be automatically and firmly connected to the floor/base. For transportable type of installation, a suitable stand / base frame type of arrangement shall be provided in such a way that in no case the pump will tilt. Each pump set shall be provided with the suitable length of stainless-steel lifting chain.

Motor

The motor shall be dry type squirrel cage induction motor suitable for the offered pump set. The rating of the motor shall be the required power over the entire pump operating range. Also, the motor shall be suitable for minimum 8 starts per hour.

Construction

It shall be submersible type with degree of protection IP 68. The motor shall be designed for operation up to 40°C ambient.

Operating Voltage and Frequency

The motors % shall be suitable for operation on 415 V, 3 phase, 50 Hz Junction Box.

Protections

All stators shall incorporate three normally closed (NC) thermal switches in series to monitor the temperature of each phase winding. Should high temperature occur, the thermal switches shall open, stop the motor, and activate alarm. Control and Monitoring

Performance Parameters

The pump manufacturer must declare the performance parameters separately as Guaranteed Performance Parameters. These shall include Discharge, Head, Pump Efficiency and Overall Efficiency

MECHANICAL WORKS**C O N T E N T**

S. No.	Name	Page No.
1	CRANE & HOISTS	
2	VENTILATION & AIR CONDITIONING SYSTEM	

4.6 TECHNICAL SPECIFICATION FOR MECHANICAL

WORKSINTRODUCTION

4.6.1 CRANES AND HOISTS

Each pump house will be provided EOT cranes as per specification. The capacity and other designs will be carried out by EPC contractor.

4.6.2 VENTILATION AND AIR CONDITIONING SYSTEM

General guidelines are specified in this section. The air conditioning may be required for control rooms. The ventilation is required for pump house and electrical room, if AC is not provided

4.6.3 CRANES AND HOISTS

1.1 SCOPE

Specification covers the design, manufacture, shop assembly, shop testing, dispatch, erection, testing at site and commissioning of 1 no. Electrically operated overhead Travelling crane (EOT) for the pumping stations.

1.2 EOT CRANE FOR PUMP HOUSE

The crane shall be provided with a main hoist of capacity capable of safely handling the motor rotor with shaft or any other heaviest assembly of the pump house. The capacity shall not be less than 50% above the weight of the heaviest item envisaged to be lifted during erection and maintenance. The crane shall be with an auxiliary hoist of suitable capacity and shall be complete with motors for all motions of the crane and the hoists, control gears, power and control cables, runway rails, runway conductors with mounting brackets, collectors, insulators etc. The pump house crane shall be pendent operated. The power shall be supplied from a single electrical power supply point at a suitable location on the operation floor of pump house.

1.3 STANDARDS

All equipments under this specification shall comply fully except as otherwise specified in this specification with the requirements of latest edition of relevant Indian Standard specifications and in their absence with British Standard Specification or with any other internationally accepted standards

The relevant Indian Standards are as follows \

- IS: 807 - Code of Practice for design, manufacture, erection, and testing (Structural portion) of crane and hoists.
- IS: 3177 - Code of Practice for electric overhead travelling cranes and gantry cranes other than steel works cranes.
- IS: 800 - Code of Practice for General Construction in steel.
- IS: 2266 - Steel wire rope for general engineering purposes.
- IS: 5749 - Forged Ram shorn hooks.
- IS: 3815 - Points h00ks with shank for general engineering purpose.
- IS: 2062 - Weld able structural steel.
- IS: 325 - Three phase induction motors.

1.4 TECHNICAL REQUIREMENTS

The crane shall be electrically driven single trolley, double girder/overhead travelling type. Power will be supplied from the conductors (bus bars) mounted at. convenient height along the length of the pump house.

The crane span, lift of main and auxiliary hooks shall be provided to suit the requirements. Other requirements are indicated below:

- i) Crane rail - CR- 60 along with embedment
- ii) Safety Factors of - As per Clause 7.4 IS 3177 Mechanical components
- iii) Factor of safety of sling - 6
- iv) Brakes for hoisting - Elector-magnetic and Thruster
- v) Brake for other motion - Elector-magnetic
- vi) Class of mechanism - M₃
- vii) Nearest position of main hook - ≤ 800 mm to centre line of gantry rail upstream side
- viii) Nearest position of main hook - ≤ 1600 mm to centre line of gantry rail downstream side

The manufacturer may improve upon the hook limits specified to suit requirements. Minimum clearance to (400 mm) shall be made available between the extreme points of crane and side wall and 500 mm between the top of the crane and the overhead observation.

1.5 INCHING OPERATION

Inching operation for all motions shall be provided for achieving slow operation of the crane for the purpose of erection, lowering, centering, alignment etc. This shall be 10% of normal speed.

1.5.1 The crane shall be complete with trolley and truck, wheel & axles. Drive mechanisms, Hoisting Drums, Brakes, Creep Speed Arrangement, Lifting tackles, Buffers' Electric Motors, Controls, Switch Board and cabling, hams, warning lights, limit switches etc. Any item not mentioned herein but required to make the system complete for the satisfactory performance of the crane shall also be included.

1.5.2 Mechanical and Electrical equipment of each crane shall be of simple robust design, easy for correction adjustment, readily accessible for maintenance and elegant in appearance. All steel used in the crane shall be tested to requirements.

1.5.3 The lifting tackle shall consist of a safety type lower pulley block, hook, necessary sheave, and flexible steel wire ropes. The lower sheaves and ropes shall be of adequate design and size to handle the specified loads. The hooks shall be of forged steel. The main hook shall be of Ram shorn type conforming to IS: 5449 (latest edition) and the auxiliary hook shall be of shank type conforming to IS: 3815 (latest edition). The factor of safety for the rope shall not be less than six (6). The sheaves shall be of heavy duty with deep flanges made of cast steel and shall be properly grooved to fit the rope and adequately guarded.

1.5.4 Each crane shall be equipped with motors of ample capacity for the duties and speeds specified conforming to IS: 325-1970. The motor shall also meet the requirements as specified in IS: 3177 (latest edition) rated capacity of each motor shall be such that its full load torque shall not be exceeded in giving the specified performance of the crane. The rating of the main hoist motor (slip ring induction) shall be one hour, and ratings of all other motors shall be half an hour. All motors shall be suitable for operations at 415V, 50 cycles, 3 phase, 3 wire system.

Each crane shall have a permanent inscription in English on each side, readily visible from the ground level, stating the safe working loads in tones for both the hooks, year of manufacture, crane serial number and manufacturer's name.

Power conductor system (Down Shop Lead); Contractor shall provide a proven insulated (PVC Covered) mobile conduction and current collector system complete with all installation, accessories and special tool and tackles.

1.6 TESTS

Shop Tests

1.6.1 Shop tests shall include all tests to be carried out at supplier's work, works of his sub-supplier and at

works where raw materials supplied for manufacture of equipment is produced. The supplier shall carry out a comprehensive inspection and testing programme during manufacture at the works. All the test certificates and reports shall be submitted to Owner for approval. Owner's representative shall be given full access to all tests. The manufacturer shall enter in Owner of the listing well in advance so that it so desired Owner's representative can witness the test.

1.6.2 All electrical and mechanical equipment shall be tested in accordance with the appropriate Indian Standards or British Standards and such other tests as may be required by statutory regulations shall be carried out at either the crane manufacturer's or equipment manufacturer's Works. Test certificates giving the necessary test figures shall be furnished to the Purchaser. All test certificates must be endorsed with sufficient information to identify the material or equipment which the certificate refers to and must carry on top right-hand corner the identification of the owner and the Contract. Material used for the manufacture of crane hoists shall be of tested quality and suitably identified.

1.6.3 The EOT crane shall be completely assembled at shop including wirings and fittings shall be tested at "No Load" on hoisting and cross travel motions.

1.6.4 Electrical hoist shall be assembled at shop and tested for capacity, proof load, lift, functional check as per requirement of respective code & approved specs.

1.6.5 All electrical equipment's offered shall be of type-tested quality. Necessary type test reports shall be furnished before fabrication is started. In case the type test has not been carried out earlier on equipment's, the same shall be carried out without any commercial implication to Owner/Consultant.

1.6.6 Control cabinet shall be subjected to the following test.

1. Mechanical operation test
2. High voltage test (2KV for 1 minute)
3. Electrical control interlock and sequential test
4. Verification of wiring as per approved schematic

1.6.7 Following tests shall be carried out on all solid-state equipment

5. Surges withstand capability test (Refer ANSI publication C39.9a - 1994 or latest)
6. Humidity and elevated temperature test.
7. Insulation test as applicable
- 8.

1.6.8 Routine test and Acceptance test shall be carried out on all associated equipment as per relevant standards. Certified copies of all type and routine test certificates shall be submitted for the purchaser's approval before the dispatch of the control cabinet.

1.6.9 Girders (web, top and bottom, carriage, Crab, Gear box and rope drum:

1. The plate materials shall be tested for chemical & mechanical properties.
2. The plates above 25mm thick shall be ultrasonically tested.
3. Heat treatment as applicable

1.6.10 Forgings (Wheels, gears, pinions, shafts, axles, coupling hooks and hooks trunnion).

- i. Chemical and mechanical testing. For mechanical testing one sample, per sample, per heat treatment cycle shall be taken. Integral test pieces shall be identified for testing.
- ii. Ultrasonic testing (For gears and pinion blanks before teeth cutting).
- iii. D.P. testing
- iv. Heat treatment
- v. Hardness test

1.6.11 Welding

- i. All the welding processes and welders shall be qualified as per ASME Sec. IX and only qualified welders shall be employed for all the welding works. All the welding procedure specification as per ASME Sec-IX shall be furnished to Owner to review.
- ii. For welded steel drums, all circumferential welds shall be 100% radiographed and all butt weld joints on

structural members subject to " tensile stress shall also be 100% radio graphed, 25% of other butt weld joints shall be radio graphed at random.

1.6.12 Hook

1. Chemical, mechanical (Tensile, proof load etc.)
2. U.T
3. D.P.T. before and after proof load testing

1.6.13 Steel castings (pulley sheaves, brake drums etc.)

1. Chemical and Hardness and mechanical specification.
2. Ultrasonic examination.

1.6.14 Wire ropes

Wire ropes shall be tested as per relevant standard.

2. TESTS AT SITE

1. Insulation Tests

After erection but before the crane is connected to supply, the insulation of electrical equipment shall be tested by a suitable instrument and any defects revealed shall be rectified, as specified in relevant Indian or British Standards.

2. The basic parameters like crane clearances shall be verified. The height of the lift also shall be measured.

3. Tests of operation

After the supply has been connected, and before the complete crane installation is put into commercial service, tests shall be carried out as specified in IS: 3177 (latest edition).

4. Deflection tests

The deflection test shall be carried with the safe working load at rest and with the trolley in a central position as specified in IS: 3177 (latest edition).

- i. No deviation in the specification should be anticipated by the Supplier without, the prior consent of Owner/Consultant.

1.7.1 Contractor should submit test certificates as required by statutory authorities.

Guaranteed Technical specifications! Data

The Contractor may furnish all the data related to guaranteed technical specifications and relevant data

1.8 LIST OF MANDATORY SPARES FOR CRANES AT PUMPING STATION EOT Crane

for Pump House

- | | | |
|------|---------------------|----------------------|
| i) | Set of all bearings | 2 sets |
| iii) | Oil seals | 2 sets for each type |
| iv) | Brake springs | 2 sets for each type |
| v) | All limit switches | 2 sets for each type |
| vi) | Timers and relays | |

1. VENTILATION & AIR CONDITIONING SYSTEM

1.1 VENTILATION SYSTEM

Ventilation System is to be incorporated for ventilation of Pump House, Auxiliary Building and for all other Mechanical areas (where Air Conditioning is not provided) excluding Control Room and Office Axial Flow Fans

These fans shall have cast aluminum impeller with blades of aero foil design. The fan casing shall be of heavy gauge sheet steel construction. Necessary rain protection cowl, inlet and outlet cones; bird protection screen, dampers etc. shall be provided.

For supply fans, coarse filters and fine filters shall be provided. The fans coming in gaseous areas shall be suitably painted. All other accessories like supporting structure etc. as required shall be provided.

1.2 Roof Ventilators

Roof Ventilators shall be located in the pump house. The impeller shall be of axial flow type, cast in one piece and casing shall be heavy gauge construction. The head shall be provided to protect from rain and other contingencies. All accessories, steel supports as required will be provided.

1.3 Motors

All the motors provided shall have output 10% higher than the equipment power required (including that of drive in any) and shall be suitable for operation 50°C ambient.

1.4 AIR CONDITIONING SYSTEM

The PLC-SCADA control room in the pumping station shall be air-conditioned

1.5 Air Conditioning System Design

All load calculations shall have to be got approved by OWNER.

1. Split Air Conditioners of Inverter Type with Five Star energy efficiency rating

Section – V

Specification for PIPE LINE WORKS

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1	A. MS PIPES	
2	1.0 GENERAL	
3	2.0 CODE AND STANDARDS	
4	Technical Qualification for procurement of pipes during construction	

**PART – A
PIPELINE WORKS
GENERAL**

TYPE OF PIPES TO BE PROVIDED FOR DIFFERENT COMPONENTS OF LIFTSYSTEM.

Sl No	Components of the lift System	Type of pipes to be provided
1	Intake pipes	MS pipes with as per IS specifications coating.
2	Rising Main or Main pipes	MS pipes with as per IS specifications coating. & HDPE pipes as per detailed design and specification.

A. MS PIPELINE

Specifications

This part of the specification covers manufacturing, supply, delivery, lowering, laying, jointing, internal lining, outer coating, testing and commissioning of mild steel pipes. Manufacturing of MS pipes shall be done in conformity with IS: 3589. The MS pipes shall be fabricated out of steel plates or strips of fresh mild steel coils (HR coils/HR plates) conforming to IS-2062, and having minimum specified tensile strength of 410 MPa. MS pipes shall be of grade 410, spirally welded pipes / longitudinal welded pipes, having butt-welded joints with beveled ends, as per IS 3589. The electrode shall be conforming to IS 814. The random length of MS pipes shall be 6 meters or more. The minimum thickness of MS pipe shall be as per design thickness or minimum preferred thickness as prescribed in IS 3589-2001. A negative tolerance of – 2% in the thickness of MS pipe shall be permissible. MS Pipes and specials shall be provided with internal cement mortar (1:1.5) lining (for diameter equal or above 300mm) otherwise epoxy painted and the outer surface shall be provided with CC encasing in M-25 grade of minimum 15cm thickness. However, the pump house piping works shall be provided with inner and outer epoxy coating

1. Technical Qualifications for procurement of pipes during construction:

2. Pipe manufacturer:

HDPE PIPES

1. TECHNICAL SPECIFICATION & DESIGN GUIDELINES

Specifications for manufacture, supplying, Laying, jointing, Testing and commissioning of High Density Polyethylene (HDPE) **PE100** IS: 14151 (Part-I) 1994, IS: 4984 1995 and its latest version or amendment. **It is proposed to use HDPE Pipes 2500mm&1600mm Dia. Under this contract. General Technical Specifications are being provided as per IS: 14151 (part-I) but, for sizes up to availability in IS: 14151 (Part-I) the same should be followed and beyond that IS: 4984(latest version) should be followed. Pipe size confirming to IS 4984 - 2016 and/or BS EN 12201: 2011 or latest IS/international standards.**

A. GENERAL TECHNICAL SPECIFICATIONS

1.1 SCOPE

The contractor shall be covering manufacturing, supplying, lying, jointing, testing, and commissioning of HDPE pipes having pressure rating not less than PN4 and material grade PE80 bearing IS14151Part-I and its latest revision or amendments including designing and lay out plan on turnkey basis.

1.2 STANDARDS

The HDPE pipes is to be manufactured, supplied, and delivered under the scope of this contract so as to meet the requirement of pressure rating not less than PN4 from material grade PE80 in accordance and conforming to IS 14151 Part-I and its latest revision.

1.3 RAW MATERIAL

Raw material used to manufacture HDPE Pipes shall be virgin compounded or natural PE80 resin conforming to IS 2530, IS7328-1992. The resin proposed to be used for manufacturing of pipes should also comply with the following norms as per ISO 9080-2003:

- a. The resin should have been certified by the independent laboratory of international repute for having passed 10000 hrs long-term hydrostatic strength test extrapolated to 50 years to show that the resin has minimum MRS of over 8 MPa. Internal certificate of any resin manufacture will not be acceptable.
- b. Certificate for having passed the rapid crack propagation test S4 as per ISO13478& slow crack growth propagation as per ISO 13479.
- c. BIS licence, ISO, Factory licence etc. or any document containing the expiry date shall be valid at the time of approval of QAP/ pre-dispatch inspection of the material at manufacturer's premise and should be ensured. 3) Random samples shall be collected from manufacturer's premise during pre-dispatch inspection of the material and be tested in the manufacturer's laboratory. Similarly, random samples shall also be collected from supplies made to the site after pre-dispatch clearance and be sent to any NABL accredited laboratory for testing as per provisions in the BIS code (IS:4984:2016) and BS EN 12201: 2011 as applicable. Test reports of post-delivery samples, if found failed as per BIS/ other specifications, be sent mandatorily to Competent Authority office and further necessary action against such vendor/ contractor be ensured as per provisions in the QC manual of the department.
- d. Following compliances should also be ensured for supply of HDPE pipes as per conditions approved by the competent authority in the vendor approval of HDPE pipes as below: Procurement of virgin HDPE resin (100% virgin), Pre-compound and master batch should be procured from the manufacturer or its authorized distributor/ stockist/ DCA only (from Trader only in case, if virgin material is imported). However, if the virgin material is procured from trader, vendor (of HDPE Pipe) shall have to submit the test certificate issued by manufacturer (of Raw material) addressing a) the name of distributor/trader and the vendor of HDPE Pipe, with reference of invoice.
- e. Purchase invoice should have clear description of raw material with its grade, batch/ lot no.
- f. Details of raw material procured with invoice no/ date, batch/ lot no of raw material, payment details and consumption of raw material with pipe produced should be ensured.

1.4 QUALITY ASSURANCE CERTIFICATE:

Quality Assurance Certificate for the raw material proposed to be used for the project from one of certifying agencies such as Bodycote or Slevan or Advantica or any other internationally reputed organization shall be submitted along with the bid.

1.5 TEMPERATURE VARIATION:

All the pipes to be manufactured, supplied, and erected shall be subject to whether conditions likesun, dust, rain, wind etc as per the environmental conditions of the state of Rajasthan. They shall also be subject to carry and convey raw water under variable temperature conditions ranging from 4 to 40 deg. Centigrade.

1.6 MARKING

Each pipe shall be indelibly marked in English at interval of 1m by heat embossing. The marking shall show the following

- a. Manufactures name or trademark
- b. Grade of raw material
- c. Class of pipe & pressure rating
- d. Outside diameter
- e. Lot/ batch No of manufacturer
- f. ISI certification mark
- g. Purchaser mark as per the instructions of Engineer in charge
- h. Any other important matter that the manufacturer of purchaser deems fit to be inscribed.

1.7 MATERIAL AND WORKMANSHIP

- a. General requirements of material and workmanship shall mean any material or article either raw material or additives or finished are required to be used in the

- manufacturing process of pipes.
- b. The material used for manufacturing of pipes should not constitute any toxic hazards, should not support micro biological growth, and should not give raise to unpleasant test or order, cloudiness, or discoloration of water. Pipe manufacturer shall obtain certificate to this effect from the manufacturer of raw material. Also, a certification from raw material manufacturer that the raw material meets the PE 80 requirement as per IS 14151 Part-I and its latest revision/ amendments.
 - c. All other quality parameters like density, MFR, Carbon black contents and antioxidant used for manufacturing of pipes shall be strictly as per IS 14151 Part-I and its latest revision/ amendments.
 - d. The original Invoice of raw material required to manufacture ordered length of HDPE pipes and batch wise test certificate of raw material will be verified and certified by the WRD Rajasthan or third-party inspecting agency fixed by WRD.
 - e. The carbon black master batch used shall be certified by master batch seller as fit for the purpose of standard for which the HDPE pipes are under order.
 - f. The HDPE pipes shall be manufactured from certified raw material of PE 80 grade and bidder has to submit the certificate from raw material manufacturer.

1.8 VIRGIN MATERIAL

100% virgin material shall only be allowed. No rework material shall be used for the manufacturing of pipes, even though IS 14151:part-I allows for the same.

B. TECHNICAL SPECIFICATION**1. SUPPLY OF MATERIAL AND MANUFACTURE OF PIPES**

The General requirement relating to supply of material and manufacture of HDPE pipes shall be confirming to IS 14151 Part-I and its latest revision/ amendments.

- i. The dimension, material composition, tests etc shall be as per IS 14151 Part-I and its latest revision/ amendments.
- j. HDPE pipes shall be marked with ISI certification mark.
- k. The pipe dimensions and tolerances shall be as per latest revisions and amendments of IS14151: Part-I.
- l. The colour of pipes shall be black as per IS 14151 Part-I and its latest revision/ amendments.

2. TESTS

The following tests as per IS 14151 Part-I and its latest revision/ amendments will be carried out by third party inspecting agency nominated by WRD (RAJSTHAN).

- (a) Sampling
- (b) Dimensions
- (c) Visual appearance
- (d) Hydraulic Characteristics
- (e) eversion test
- (f) Overall migration test
- (g) Density
- (h) Melt flow rate (MFR)
- (i) Carbon Black content and dispersion test
- (j) Acceptance test
- (k) Internal Creep Rupture Test
- (l)(l)

The manufacturer should provide the test certificates for the internal creep rupture tests conducted, as given here under along with the supply of pipes. These tests are to be performed in the in-house laboratory of the pipe manufacturer under the mutually approved QAP.

EMPLOYER may depute one person to be positioned at the pipe manufacturing facility of the successful Contractor. This deputed person will check the raw material, its test certificates, production process and approve each lot of the pipes manufactured before they leave the factory after ensuring that they are meeting the required specifications.

When subjected to internal creep rupture test in accordance with procedure given in Annex A of IS 14151 (Part-1), the pipes under test shall show no signs of localized swelling, leakage or weeping and shall not burst during the prescribed test period. The temperatures, duration of test and induced stress for the test shall conform to those specified in Table below.

Hydraulic Characteristic Requirements of Pipes			
Test	Test Temp ⁰ C	Test Duration (h)	Induced Stress in MPa
Quality Test	80	165	3.5
Acceptance	80	48	3.8

All other tests shall be carried out as per IS 14151 (Part-I) and test certificates are to be provided as per the norms laid down in IS14151 (Part-I).

3. TYPE TEST

The type test shall be carried out as per IS 14151 Part-I and its latest revision/ amendments. However, WRD or third-party inspecting agency fixed by WRD can verify the certificate for the type test. WRD RAJASTHAN or third-party inspecting agency may call for the fresh samples for the type test if required.

4. HDPE FITTINGS/SPECIALS

All HDPE Bends and Tees shall be fabricated from PIPE that conforms to IS 14151(part I) or 4984:1995 specifications. Fabrication and test methods are to be indicated before supply.

Flange Adaptors (collars/stub ends) Reducers and other Injection moulded as per IS 8008 part1 to 9. HDPE fittings used shall be manufactured from approved resin as above with sufficient carbon black content to suit the UV stability of the product.

5. SLIP ON FLANGES

Slip-on flanges shall be metallic flanges covered by anti corrosive paint or with plastic powder coating. Slip-on-flanges shall be conforming to standard mating relevant flange of valves, pipes etc. Nominal pressure rating of flanges will be PN16.

6. WELDING

Jointing between HDPE pipes and specials shall be as per IS 7634 part II. Butt-welding machines as per ISO standard and installation and testing as per DVS 2207(German standard for PE welding), Method of jointing between the HDPE pipes to HDPE pipes and HDPE pipes to HDPE specials shall be with butt fusion welding using automatic or semi-automatic, hydraulically/mechanical operated, butt fusion machines. In any case manual welding shall not be allowed. An integral part of any pipe system is to ensure that performance of the total system including the accessories such as bends, tees, collars and the various types of control valves. If any non- HDPE appurtenances are being used with the Polyethylene Pipes, the Bidder should ensure the performance of such items are in accordance with the design conditions of PE pipe selected. Proper engineering design of a system will take into consideration the type and effectiveness of the techniques used to join all the piping components.

a) MATERIAL GROUPS FOR BUTT-WELDING

The PE pipe and fittings materials are divided into three distinct categories as per DIN 16776 based on their melt flow rates (MFR – 190/5). The welding procedure and the machines discussed here are suitable for welding of Pipes and fittings falling in MFR range of 0.2 – 1.7 g/10min. If the welding is to be carried between pipes and fittings of other group of MFR, weld tests are to be conducted as described in ISO 13953 before the same is utilized for field use.

b) HEAT FUSION

The principle of heat fusion is to heat two surfaces to a designated temperature, then fuse them together by application of a sufficient force. This force causes the melted materials to flow and mix, thereby resulting in fusion. When fused according to the pipe and/or fitting manufacturers' procedures, **the joint area becomes as strong as the pipe itself in both tensile and pressure properties.**

BUTT FUSION**GENERAL GUIDELINES FOR BUTT-WELDING:**

The welding area has to be protected from unfavorable welding conditions such as moisture, wind, dirt, excessive surface temperature and low temperatures $< 5^{\circ}\text{C}$ and intensive UV radiation. If the pipe is exposed to such UV radiation, the pipe ends are to be thoroughly scrapped (by planning tool) before the welding procedure is adopted.

Heating Pressure: 0.15N/mm^2

Welding Temp: $200 - 220^{\circ}\text{C}$

The steps involved in making a butt fusion joint are:

1. Securely fasten the components to be joined
2. Square cut the surface of the pipe end
3. Face the pipe ends
4. Align the pipe profile
5. Melt the pipe interfaces
6. Join the two profiles together
7. Hold under pressure and release

WELD FACTOR= 1

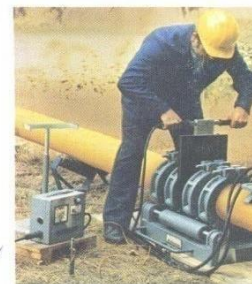
Butt fusion cycle and parameters are given in Annex A in ISO 11414 – the bidder is requested to follow this guideline for a good weld. It must be noted that **the friction factor ('c' value; 'k' value) should takes cognizance of the inside bead. Bead should not affect the design parameters for flow rates in PE pipes.**

BUTT FUSION EQUIPMENT:

Bidder has the proper machine for a good field weld.

The butt fusion equipment shall incorporate a facility for supporting the heating plate and planning tool (necessary to square cut the pipe end) when in use. The machine shall be robust enough to stand normal field use. The butt fusion machine shall allow the heating plate to be removed and the pipe ends closed after heating, without damaging the heating surfaces, within a time frame.

Fig. 45: Heated tool butt welding



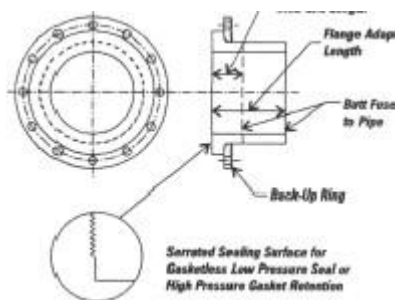
The clamp alignment system shall be such that there shall be perfect axial alignment of the pipe surface during heating and during pressurizing the pipe ends after heating, is assured. The guide elements of the machine shall be such that the gap between the pipe ends shall not exceed 0.25mm for $d < 250\text{mm}$ and 0.5mm $d > 250\text{mm}$. Butt welding machines can be manual, hydraulic, or pneumatic. However, a locking system to hold the fusion force is to be ensured in all the systems. All the systems shall be protected against over pressure. It shall be capable of maintaining the required interface force on the pipe or fittings ends as long as necessary

7. TRAINED MANPOWER FOR BUTT WELDING:

Only trained and technically qualified for the welding method are to be employed for the welding operation. **It is necessary that the manufacturer certified person need only be authorized for butt welding.** These persons shall carry at all the time in the field during site work, a valid and authentic certificate that the person performing welding has been so trained.

c) FLANGE JOINTS

The pipes are joined to each other by flanges or PE pipes required to be connected to a flanged valve or to a flanged tail piece of a metal pipe/CI pipe. In such a situation the polyethylene needs to be joined by a flange joint. The flange joint consists of a collar, flange adaptor or a pipe end and a loose flange (back up ring). This collar is welded by the butt-welding method. The Bidder has to check the MFR range of the collar and the pipe to ensure weld ability criterion. Flanges can be steel, or PE sandwiched with steel or pure PE only, depending on the site conditions.



d) MANUALS

- Technical Manual on HDPE pipes including precautions to be taken during operation of the pipeline
- As laid drawings of the entire Project.

2. SPECIFICATION OF SPECIAL ITEMS (NON – HDPE)

2.1 FLANGES

All flanges employed in the project must be compatible whatever material used.

The following table provide the general dimension of the flanges. These dimensions may vary with material but the number of bolts, their diameter and the drilling diameter on the flange must remain the same.

Nominal Dia (Inches)	OD (mm)	External diameter (mm)	PCD (mm)	Number of bolts	Diameter of bolts	Length of bolts	Thickness of flange	Diameter of hole
2	63	152	121	4	M12	70mm	8	18
4	110	229	191	4	M16	70mm	10	18
6	160	279	242	8	M16	100mm	14	18
8	200	343	299	8	M22	120mm	14	18
10	250	406	362	8	M22	150mm	18	24

2.2 VALVES

The valves shall be manufactured and supplied for the work generally as per manufacturer's specifications adhering to relevant IS/International specifications and basic parameters indicated hereinafter. All valves shall be fixed at the required locations with necessary bolts, nuts, washers, gaskets, etc., complete and provided with supports as per approved drawing. All valves shall be supplied to site along with manufacturer's test certificate.

2.3 AIR VALVES

The Air Valves shall be double acting Air Valves, with 60 or 65mm flange PN16 or female threaded connection, with integrated cock for shut/off. Air valves shall be connected to the pipeline by means of Tee (could be Cast iron or HDPE as convenient and with prior approval of EMPLOYER engineer) with flanged connections and or through GI riser pipe mounted on Saddle (MS or PP).

2.4 PRESSURE CONTROL VALVES (WHERE REQUIRED)

Pressure control valves must be Automatic Hydraulic Control Valves of diaphragm type and will work as pressure reducing valve for reducing of a higher upstream pressure to a constant lower downstream pressure, independent changes of the capacity or variations of the upstream pressure. This valve will include:

- a. 2 flanges of pressure rating PN16.
- b. main valve hydraulically operated.
- c. controlled by a pilot valve.
- d. central control box, to control the opening/closing and reaction speed.
- e. a pressure gauge for commissioning.
- f. The valve should have a position indicator, open speed regulator on pilot pipes, and able to receive 2 manometers.

2.5 SLUICE VALVES

The sluice valve will be installed in chamber or buried. The sluice valve will be of flanged type, pressure rating PN10 and resilient seated and non-rising type, with clock wise closing, approved for drinking water application and will correspond to IS specification IS 14846: Cast Iron Double flanged non rising spindle.

These valves will include:

- a. straight pipe-shaped flow-way to allow full and direct passage for water.
- b. wedge fully covered with rubber (EPDM) with lateral guidance.
- c. inside stem screw.
- d. stem sealing maintenance-free (O-rings in bronze bush).
- e. the joints box shall be accessible by screw.
- f. stem square cap of Ductile Iron;
Material of valve will be:
- g. body, bonnet, and wedge of cast iron.
- h. wedge in Cast Iron fully covered with rubber (EPDM).
- i. stem of stainless steel (min. 13% Cr.).
- j. the cover shall be able to remove for cleaning and maintenance of joints. Cover bolts and nuts have to be stainless steel or fully protected from corrosion (plastic seal).

2.6 GASKETS

All gaskets used between flanges of pipes, specials, valves etc., shall be of natural/neoprene rubber conforming to IS: 638 or relevant Indian/International Standards of thickness 4 mm suitable for clear water conveyance and as specified by manufacturer.

2.7 BOLTS AND NUTS

Fastener materials (nuts, bolts, and washers) shall be of or carbon steel as per one of the following standards:

- a. IS 1367: Class 4.6 -4
- b. BS 5916

All fastener materials must be duly electro-galvanized.

The deviations of the above Special Item specification, if any shall be authorized by EMPLOYER depending on the site conditions, availability of material within the required delivery schedule and the exigencies of the site demands. However, the contractor shall guarantee the performance of the same as per the tender conditions.

2.8 UNDERGROUND INSTALLATION OF PE PIPE:

Generally, the width of the trench should be minimum dimension compatible with safe working and the satisfactory laying, jointing, and bedding of pipe. The depth of the trench must allow for compliance with the cover depth requirements (i.e., minimum 750 mm for service pipes and 1000 mm for mains from the crown of the pipe) together with any allowance for the base of the excavation. As excavation proceeds, all unstable trench walls need to be supported and this requirement is mandatory for trenches of 1.20 m or deeper.

2.9 PREPARATION FOR PIPE LAYING.

Pipes are joined to form a single long length above ground prior to snaking into the trench. To prevent scratches of the road surface, pipe rollers should be used.

Before commencing of pipe laying into the trench a check should be made for deep cuts, scratches or other damages in the pipe and the fusion joint system is sufficiently cooled.

2.10 PIPE LAYING

Gradual changes in direction of polyethylene can be accommodated by pipe deflection but every effort should be made to keep the pipe as central as possible within the trench to enable correct side fill compaction. Similar care should be taken when any distortion of the coiled pipe has occurred.

2.11 CONNECTIONS THROUGH CONCRETE WALLS:

Pipe may have to go through concrete walls of manholes or pump rooms. In such a case, the pipe should have a puddle flange welded around the pipe to ensure leak proof joint between the pipe and the concrete wall.

3. GENERAL DESIGN

THE CONTRACTOR SHALL BE DEEMED TO HAVE SCRUTINIZED, PRIOR TO THE BASE DATA, THE EMPLOYER'S REQUIREMENT (INCLUDING DESIGNING CRITERIA AND CALCULATIONS, IF ANY). THE EMPLOYER HAS DONE PRELIMINARY DESIGN FOR ESTIMATION PURPOSE ONLY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF THE WORKS AS PER THE ACTUAL SITE CONDITIONS AND FOR THE ACCURACY AND CALCULATIONS, EXCEPT AS STATED BELOW.

The Employer shall not be responsible for any error, inaccuracy, or omission of any kind in the Employers requirements as originally included in the contract and shall not be deemed to have given any representation of accuracy or completeness of any data or information, except as stated below. Any data or information received by the contractor, from the employer or otherwise, shall not relieve the contractor, from his responsibility for the design and execution of the works. However, the Employer shall be responsible for the correctness of the following portions of the employer's requirements and of the following data and information provided by (or on behalf of) the employer. Portions, data, and information which cannot be verified by the contractor, except as otherwise stated in the contract.

Maximum allowable pressure at a given point in the system should not be more than 80% of Pipe pressure rating

- Deviations in the specifications mentioned here will not be allowed or considered for supplies under pressure irrigation of Kaliteer Lift scheme Project (Rajasthan)
- 100% virgin material shall only be allowed. No rework material shall be used for the manufacturing of pipes, even though IS 14151 (part 1):1994 allows for the same.
- All other specification as per IS 14151 (part 1): 1994 and its latest revision/ amendments.
- The bidder has to take utmost care while designing the system. The energy conservation shall be given due weightage particularly in selection of pipe diameter for particular section. The tail end should get desired discharge at design pressure. It is suggested that bidder while selecting pipe size, should take reference of economical pipe size selection based on CPHEEO manual. However, the bidder to follow broad guideline of allowable velocity for various pipe size as given below:

Pipe Size

**Maximum
Allowable
velocity in
m/sec**

- **Pressure rating of the main and sub-main pipes shall not be below as specified in IS/International Codes.**

SECTION VI
PUMPING STATION (ELECTRICAL EQUIPMENT)

SECTION VI: PUMPING STATION (ELECTRICAL EQUIPMENT)

6.1 GENERAL

The scope of work includes design, equipment selection, manufacture, inspection at Contractor's or his Sub- Contractor's works, supply, installation (including storing, unloading and transferring the material / equipment to Contractor's storage area, maintaining equipment / material in safe custody and assembling the elements of the equipment and installing at the place of work), testing and commissioning of the plant equipment/ electrical system on 'turnkey' basis After successful commissioning and trial run of the system, it should be handed over to the Employer. The Contractor shall also be responsible for operation and maintenance (O&M) of the plant for 8 years after it is formally taken over by the Employer. The Contractor shall submit their design calculations/ drawings based on 'Design criteria for electrical equipment/ system' for Employer's review and approval. These specification covers 33kV cables, 33kV substations, main and auxiliary transformers, HV/MV/LV switchboards, MV/LV motors, MV soft starters, MV and LV capacitors, HV, MV and LV power cables and control cables, DC supply system, and other allied equipment, etc. along with the specifications for workmanship, laying cables, lighting system, earthing systems, lightning protection etc. for Kaliteer Lift Drinking water Project. It shall be the responsibility of the Contractor to design the electrical system based on the selection of the mechanical equipment. The Bidder shall make his own estimate of sizes, ratings, and quantities for 33kV lines, substation equipment, all plant items and miscellaneous systems such as earthing, lightning protection, lighting, auxiliary power distribution, etc. Sufficient space in the switchyard and switchboard/ control room shall be provided for expansion/ up-gradation of switchyard / electrical equipment/ switchboard for future. It should be clearly understood that the Contract will be on 'turnkey' basis and no variation will be allowed for items of works not foreseen or omitted by the Bidder at the bidding stage, except where specifically indicated in the bid documents.

All equipment offered shall comply with the requirements specified in the latest editions of applicable Indian/ International Standards and shall also comply with the good engineering practices.

The drawings enclosed with the specification are for general guidance of the Bidder only. Contractor shall design the electrical system on the basis of 'Design Criteria' and to be submitted for Employer's approval. Contractor shall incorporate any changes/ suggestions in the drawings to suit site conditions and design criteria and standard engineering practice and resubmit for approval to Employer's Representative.

The Contractor shall possess the valid electrical Contractor's license of appropriate class from the concerned statutory bodies governing the area of workplace. The Contractor shall fully comply with the relevant statutory rules and regulations.

All type (as applicable), routine and acceptance tests shall be conducted in the presence of Employer/ Employer's Representative / Third Party Inspector on all the equipment as per latest applicable IS/IEC at no extra cost. Typical type test reports for other equipment shall be submitted by the Contractor for approval by Employer/ Employer's Representative.

All commissioning tests shall be carried out in the presence of Employer/ Employer's Representative and approval for the same shall be obtained before commissioning and installation. All test reports shall be properly maintained by the Contractor duly approved by the statutory bodies and shall be handed over to the Employer after completion of the job. All instrument and accessories required for testing and commissioning of the equipment specified herein shall be provided by the Contractor at no extra cost to the Employer.

Liaison with JVVNL/RV PNL and other Government organization/ statutory bodies for obtaining Power supply/ other clearance shall be Contractor's scope. After completion of installation work, the

Contractor shall arrange for inspection and obtain approval from the concerned statutory bodies. Any fees that are to be paid to such statutory bodies for testing, inspection or calibration shall be paid by the Contractor. Any modification / revision in the equipment / installation of equipment as required by the statutory bodies shall be carried out by the Contractor. All such costs / fees for revisions / modifications shall be deemed to be included in the prices of supply, installation, testing and commissioning of equipment as quoted by the Contractor.

6.1.1 Power Supply Information

The proposed power supplies are as follows:

(i)	33 kV AC System	Voltage variation +10 to -15% Freq. Variation +3 to -5%	Three Phase, 50 Hz, effectively earthed AC System SC. Rating of 750 MVA
(ii)	6.6 kV AC System	Voltage variation +10 to -15% Freq. Variation +3 to -5%	Three Phase, 50 Hz, resistance earthed system, SC. rating of 150 MVA
(iii)	415V AC System	Voltage variation +10 to -15% Freq. Variation +3 to -5%	Three Phase and neutral, 50 Hz, effectively earthed system, SC. rating of 20 MVA
(iv)	240V AC System	Voltage variation +10% to 15% Freq. Variation + 3% to - 5%	Single phase and neutral, 50 Hz, effectively earthed system
(v)	110V DC Supply	Voltage variation +/- 15%	Unearthed two wire system

All equipment shall have rated withstand capacity based on above criteria.

6.1.2 Design Criteria for Electrical Equipment/ System

The Design Criteria described below covers the electrical equipment/system for the proposed scheme.

General Power Distribution Scheme

Estimation of Load

The following assumptions have been made to arrive at the estimated load of the different sites.

- a) Load Factor
 - i) Main motor : 0.95
 - ii) Auxiliary motor : 0.9
 - iii) Auxiliary load, valve motors, etc. : 0.9
 - iv) Lighting load : 1.0
- b) Diversity Factor
 - i) Main and auxiliary motor : 1.0
 - ii) Auxiliary load, valve motors, etc. : 1.5
 - iii) Lighting load : 1.2
- c) Power factor of MV/LV Motors : As per Manufacturer's Catalogue
- d) Efficiency of MV/LV Motors : As per Manufacturer's Catalogue (Energy efficient eff1 in case of LV motors)
(Energy efficient, high-performance motors) shall be provided for optimum utilization of energy.)
- e) Protections
The following protections are proposed for various switchboards, transformers, motors and other plant feeders.

- 1) 33 kV Switchboard
 - i) IDMT over current and earth fault protection for incomers and bus coupler
 - ii) PT fuses failure protection
 - iii) IDMT and instantaneous over current and earth fault protection for outgoing transformer feeders
 - iv) Transformer differential protection
 - v) Transformer auxiliary protection (e.g., WTI, OTI, Buchholz, etc.)
 - vi) Transformer auxiliaries for alarm (e.g., MOG, PVR, etc.)
- 2) MV Switchboard
 - i) IDMT over current and earth fault protection for incomers and bus coupler
 - ii) PT fuses failure protection
 - iii) IDMT and instantaneous over current and earth fault protection for outgoing transformer feeders
 - iv) Restricted earth fault and stand-by earth fault protection for main transformer feeders
 - v) Stand-by earth fault protection for Auxiliary transformer feeders
- 3) LV switchboard
 - i) Over current, short circuit and earth fault protection on ACBs/ MCCBs
- 4) Motors

MV Motors

 - i) Thermal, locked rotor, short circuit, negative sequence, under voltage, over voltage, phase unbalancing and earth fault protection for each motor feeder
 - ii) Differential protection (for motors of ~ 900 kW rating)

LV Motors

 - i) Overload protection by thermal (bimetal) relays in all the three phases to trip with single phase preventer (SPP) and short circuit protection in all the three phases through motor protection circuit breakers/ MCCBs Alternatively, microprocessor-based motor protection relay shall also be used.
 - ii) Thermal, locked rotor, short circuit, negative sequence, under voltage, over voltage and earth fault for each motor feeder of rating 90kW and above.
- f) Metering

The following metering shall be provided.

 - 1) 33 kV Switchboard

Multifunction meter (for incomer) containing -

 - i) Ammeter
 - ii) Voltmeter
 - iii) kW meter
 - iv) Frequency meter
 - v) Power factor meter
 - vi) Kilowatt hour meter
 - vii) kVAr meter
 - viii) kVA

meter for outgoing feeder

 - i) Ammeter with selector switch
 - 2) MV Switchboard
 - i) Ammeters with selector switch (on all feeders)

- ii) Voltmeter with selector switch (on Incomers)
 - iii) Frequency meter (on Incomers) (part of multifunction meter)
- 3) LV Incomers
 - i) Ammeters with selector switch
 - ii) Voltmeter with selector switch
 - iii) kW meter
 - iv) Power factor meter
 - vi) Kilowatt-hour meter
 - vii) Frequency meter
- 4) LV Outgoing Feeders
 - i) Ammeter with ammeter selector switch

Multifunction meter shall be equipped with interfacing capability for RS-485 port.
- g) Indicating Lamps

The following indication shall be provided:

 - 1) 33kV Incomer, Bus Coupler and Outgoing feeders
 - i) Circuit breaker ON, OFF and TRIP, spring charged, control supply healthy and trip circuit healthy (Mains ON (R,Y,B) indication for incomer only)
 - 2) MV Incomer, Bus Coupler and Transformer feeders
 - i) Circuit breaker ON, OFF and TRIP, spring charged, control supply healthy and trip circuit healthy (Mains ON (R,Y,B) indication for incomer only).
 - 3) MV Motor Feeders
 - i) Motor ON, OFF and Trip indication (Red, green and Amber), control supply healthy and trip circuit healthy.
 - 4) LV Incomers
 - i) Mains ON (red, yellow and blue)
 - 5) LV Motor Feeders
 - i) Motor ON, OFF and Trip indication (Red, green and Amber)
 - ii) Motor ON, OFF and Trip indication (Red, green and Amber), control supply healthy and trip circuit healthy for breaker feeder.

The capacity of the transformers is decided based on 100 % standby (redundancy) i.e. in the event of outage of any one of the transformer, other transformer can supply the complete load of the system.

Neutral earthing resistor on the 6.6 kV side neutral of the main transformer shall be rated to limit the earth fault current on 6.6 kV side to 1000 amps and shall be sized for 10 second withstand.

All electrical equipment will be rated for 50⁰ C design ambient temperature.

All power cables shall be sized based on continuous current capacity, permissible voltage drop and short circuit current rating. The voltage drop shall be limited to 2.5 % at rated equipment current rating.

The other rating factors for variation in ground temperature, variation in ambient air temperature, grouping of cables, depth of laying, etc. shall also be considered for cable sizing.

The illumination levels proposed for various areas are as follows:

Area	Illumination level (Lux)
Pump House	250
Office	400
Switchboard Room	250
All other indoor areas	150
Switchyard area	50

Outdoor plant area and Road

10 – 20

Component of luminaries shall be 'energy efficient low loss' type. LED type of luminaries shall be used for office/ all indoor areas. Street/ area lighting shall be controlled by time switch/ photocell for automatic switching of luminaries. Emergency light shall be provided for safe evacuation of the people in case of fire or panic (blackout, total power failure, etc.) Emergency lighting shall be automatically switched ON when mains power supply fails.

The values of fault level for designing the electrical system shall be based on transformer capacity, its impedance and system fault level. Fault clearing time for sizing of earth conductor will be taken as one second.

The material of earthing conductor shall be hot dip Galvanized Steel. All connections between the earth conductors buried in earth/concrete and between earth conductor and earth leads shall be of welded type. While sizing the buried earth conductor, a corrosion allowance of at least 20% shall be taken. System earthing shall be designed such that the overall earthing grid resistance is maximum one ohm.

Main earthing conductors outside and inside the building shall be planned in such a manner that various equipment is connected to earthing system by two connections in a reliable manner.

6.1.3 System Description

33kV power supply with adequate voltage and power quality shall be available at the pump house and the electrical systems for the same are described below:

All the switchboards (i.e., 33kV switchboard, 6.6 kV switchboard and LV/ Auxiliary switchboards) shall be located in the electrical room at proposed pump house for the irrigation scheme. Incoming 33kV supplies shall be step down by two nos. of 33/6.6 kV transformers, which in turn shall feed the main 6.6 KV indoor switchboard at pump house. This switchboard shall feed entire load of pump house campus.

Two nos, 6.6/0.433 kV auxiliary transformers shall be provided to supply power to the LV auxiliary loads, which includes loads such as electrical valve actuators, battery charger, control and instrumentation panels, EOT crane, LV auxiliary motors and lighting (including staff quarters & other buildings).

6.1.4 Units of Measurement

Metric units of measurement (System International) shall be used in all Contract documentation. Angular measurement shall be in degrees with 90 degrees comprising one right angle.

6.1.5 Reference Standards

All equipment / systems supplied under this Contract shall conform to the latest editions of the International Electro-technical Commission (IEC) Standards or equivalent Indian Standards or other International Standards, provided they promise to confirm equal or superior performance. If standards other than IEC are referred, then the Bidder shall enclose English version of the standard with the bid.

6.1.6 Spare Parts, Tools and Appliances

The bidder shall supply essential spares as specified in these specifications. All the required spares and tools shall be made available at site to avoid any breakdown of the system.

All spares shall be interchangeable with the original parts. They shall be treated and packed for long term storage under the climatic conditions of site.

All cases, containers, or other packages are liable to be opened for inspection and checking on site.

6.1.7 Inspection and Testing at Manufacturer's Works and Dispatch

The Contractor will follow the Section IX of Technical Specification and will follow the approved QA/QC Plan for the Inspection and Testing of Equipment at Manufacturer's Works and Dispatch.

6.1.8 Site Services

6.1.8.1 Transport to Site and Insurance

Contractor shall bear all expenses in connection with the transport to Site of all plant, material and

items needed for the purpose of the Contract including warehouse rent, handling and other charges, which may occur. The Contractor shall observe any regulations, which limit loads on roads and bridges over which material may be conveyed. Contractor shall be responsible for all insurances such as insurance during transit, storage, erection and third-party insurances, etc.

6.1.8.2 Plant Handling and Storage

The handling and storage at the Site will be the responsibility of the Contractor. The Contractor shall arrange for suitable lay-down areas. The Contractor shall advise on the protection of all material against corrosion, theft, and mechanical damage during storage and erection at the Site.

Only galvanized structural steelwork may be stored in open. Plant sensitive to climatic conditions must be stored in closed buildings protected from dust and humidity.

6.1.8.3 Construction Power Supply

Contractor shall make his own arrangements for construction power supply from local power authorities. All power and lighting circuits shall be constructed with due regard for personnel safety and shall comply with recognized codes of practice and local regulations. All circuits shall be fitted with earth leakage systems.

6.1.8.4 Training of Local Staff

The Contract price shall include training of Employer's staff in all major / critical equipment and systems. Training to Employer's Representatives shall be given for each equipment/system at site.

Training shall cover technical and safety aspects as well as operation and maintenance aspects. Contractor shall arrange for demonstrations as appropriate.

6.2 OUTDOOR SUBSTATION EQUIPMENT

General

The scope of supply for the outdoor substation consists of galvanized steel (GS) gantry/supporting structure (including civil foundation) fabricated out of structural sections for supporting and fixing various equipment such as disconnectors, lightning arresters, current transformer, voltage transformer, insulators and hardware, ASCR conductor, etc.

The design, material, construction, manufacture, inspection and testing of all outdoor substation equipment shall comply with the relevant standards.

The details of the steel structure and support sections / members shall be subject to approval of structural design calculations to be furnished by the Contractor. Galvanizing shall be as per the details mentioned in this specification.

6.2.1 Disconnectors

Outdoor disconnectors and its accessories shall comply with the following Standards, including those referred to therein.

IEC 60129, 62271 / IS 9921

The technical parameters of disconnectors shall be as given below:

Description	Unit	Particulars
General		
Application		Outdoor
Type of disconnector		Double break with center pole rotating/ Centerbreak
Type of mounting		Horizontal/ Vertical – for 33kV system
Execution of poles		Group operated three phases
Rated Values		
Rated voltage	kV	36

Rated normal current	A	(*)
Rated frequency	Hz	50
Rated short time withstand current and time	kA (rms) / sec	16 kA for 1 sec
Rated peak withstand current	kA (peak)	40
Rated insulation levels		
Rated lightning impulse withstand voltage		
- Across the isolating distance	kV (peak)	195
- Phase to phase, between phases and across open switching devices	kV (peak)	170
One minute power frequency withstand voltage		
- Across the isolating distance	kV (rms)	80
- Phase to phase, between phases and across open switching devices	kV (rms)	70
Operating Mechanism		
Operating devices		Manual
Phase spacing	mm	1500 (preferable)
Support Insulators		
Number and type of insulators		Pedestal post
Nominal creepage distance	mm/kV	31

(*) – Parameters to be ascertained by the Contractor after submitting design calculations subject to approval.

Constructional features

Base channels and other structural steel members of the disconnecter such as operating pipes, phase coupling rods, etc., operating mechanism boxes, bolts, pins, etc. shall be hot dip galvanized. All castings except current carrying parts shall be made of malleable cast iron or cast steel. Grey iron shall not be used in the manufacture of any part. Manual operating handles shall be of galvanized steel. Live metal parts shall be of non-rusting and non-corroding metal. Current carrying parts shall be of copper. Bolts, screws and pins shall be provided with lock washers, keys or equivalent locking facilities and, if on current carrying parts, shall be made of non-rusting and non-corroding metal such as copper silicon alloy. The disconnecter or earthing switch shall be provided with current carrying contacts on the hinge and jaw ends and all contact surfaces shall be of silver faced copper.

Earthing pads

Each pole of the disconnecter shall be provided with two earthing pads of non-corroding material at opposite ends, brazed to the channel base. Flexible tinned copper earth connectors shall be provided for connecting operating handles of disconnecters and earthing switches to the earthing system.

Earthing switch

Earthing switch, where specified, shall form an integral part of each pole of the disconnecter. Two independent earthing pads each with flexible tinned copper braids and suitable connectors for the specified size of earth conductor lead shall be provided at the hinge end of the switch.

Accessories

Counterbalance springs shall be provided for counter balancing the disconnecter to prevent impact at the end of travel both on opening and closing of the disconnecter/ earthing switch. The springs shall be made of non- rusting alloy.

A mechanical position indicating device shall be provided for each disconnecter/ earthing switch, irrespective of whether isolating distance is visible or not.

Interlocks

Disconnectors and earthing switches shall be provided with padlocking facility to lock them in fully open or fully closed positions. Rust proof padlock with keys shall be supplied with the disconnector. Disconnector and earthing switch shall be mechanically interlocked such that it shall not be possible to close the earthing switch when the disconnector is closed and vice versa. Disconnector shall be provided with electrical interlocking feature. This shall be in the form of an interlock coil of latch-in type to lock the disconnector driving shaft and thus prevent disconnector / solenoid operation in the latch-in condition. It shall be possible to release the latch by energizing the interlock coil when certain preset conditions of external interlocking scheme are fulfilled. Further, a separate bypass switch or a similar facility shall be provided on the local control cabinet to facilitate emergency manual operation of disconnector. Electrical interlocking arrangement shall be fail-safe type.

Insulators

Insulators used in the assembly of disconnectors shall be of porcelain and of brown color. insulator cap and base shall be of high-grade cast steel or malleable steel casting, and they shall be machine faced and galvanized.

Operating mechanism and controls

The ganging mechanism shall be provided with facility for adjustment to allow for final alignment of the disconnector blades for simultaneous operation. Adjustable stops shall be provided to prevent over-travel in both directions. The mechanism shall provide quick, simple and effective operation. One man shall be able to operate the disconnector without undue effort. Disconnector and its operating mechanism shall be such that it cannot be dislodged from its open or closed positions by gravity, wind pressure, vibrations, shocks or accidental touching or breaking of the connecting rods or the operating mechanism. The manual operating handles shall be mounted on the base of supporting structure. Guide bearings shall be provided, if necessary, at a height of 1000 mm above grade level and at an interval of approximately 3 m. All members necessary for attaching the operating mechanism and operating handles to the supporting structure and foundations shall be supplied as an integral part of the disconnector. Rust-proof pins and bearings of the bronze bushing, ball and roller type, shall be furnished. All bearings shall be weather protected by means of covers and grease retainers.

A weather-proof galvanized sheet steel cabinet with gasketed hinged door and padlocking facility shall be provided to house the driving mechanism, solenoids, auxiliary switches, etc. as applicable. All cabling from operating mechanism and auxiliary contacts to operating mechanism box shall be in the scope of supply of the Contractor and shall be carried out using 1000 V grade, 2.5 sq. mm. stranded copper conductor, PVC insulated, armoured cables run in heavy gauge galvanized steel conduits, unless otherwise specified. The auxiliary contacts shall be of silver faced copper. The contacts shall be designed to carry 10 A continuously.

The operating mechanism design shall be such that during the operation of the disconnector when the moving blades reach the sparking distance, springs take over to give a quick, snap action closing so that the disconnector closing is independent of manual efforts. Similarly, the springs must assist during the opening operation to give quick breaking feature.

Adequate no. of spare terminals shall be provided in the operating cabinet for the purpose of external interlocks.

Supporting Structure

Supporting structure for disconnector shall be included in the Contractor's scope of supply.

Tests

All routine tests shall be conducted on completely assembled disconnectors, earthing switches, their operating devices and auxiliary equipment in accordance with the applicable standards in the presence of Employer's Representative. The following tests shall also be carried out:

- Test to prove satisfactory operation and mechanical endurance
- Test to prove satisfactory operation at temperature limits
- Test to prove the short circuit making performance of earth switch

- Test to verify the proper function of position indicating devices

Certificates of type tests carried out on similar equipment for the last three years shall be furnished with the Bid.

6.2.2 Lightning Arresters (LA)

Lightning arresters shall comply with IEC 60099-4, 60099-5, BS-2914 and IS 3070 including those standards referred to therein.

The technical parameters of lightning arresters shall be as given below:

Description	Unit	Particulars
General		
Application		Outdoor
Type of Arrester		Metal Oxide (Without gaps)
Rated frequency	Hz	50
Type of system neutral earthing		Non-effectively earthed system for 33kV system and effectively earthed for 132kV system
Rated Values		
Rated voltage	kV	30
Nominal discharge current	kA (peak)	10
Max. residual voltage at nominal discharge current	kV (peak)	72 (*)
Pressure relief class		20 (B)
Continuous operating voltage	kV (rms)	Approx. 24 (*)
Long duration current impulse		
- Line discharge class		3
- High current impulse	kA	100 (4/10 μ sec)
Arrester housing		
- Material of housing		Porcelain
- Creepage	mm/kV	31
- Primary terminal		Suitable for 'Panther' ACSR (*) conductor for 33kV system
Withstand test of voltages		
- One minute power frequency withstand voltage	kV (rms)	As per IEC-60099-4 and 60099-5
- Impulse withstand voltage	kV (peak)	As per IEC-60099-4 and 60099-5

(*) – Parameters to be ascertained by the Contractor after submitting design calculations subject to approval.

Constructional features

Lightning arresters shall be of the hermetically sealed type and of self-supporting construction. They shall be suitable for mounting on the steel structures. They shall be provided with pressure relief devices and shall be capable of withstanding the internal pressures developed during various discharges or should safely vent the internal pressures associated with arrester failure without violent shattering.

Insulator housing shall be of porcelain having adequate mechanical strength and rigidity. Arrester housing shall withstand short circuit, wind, seismic and other forces during operation. Porcelain shall be finely glazed and shall be free from imperfections. Arrester shall incorporate anti-contamination feature to prevent arrester failure consequent to uneven voltage gradient across the stack, in the event of contamination of the porcelain. LAs shall be complete with insulating base with a provision for bolting to flat surface of supporting structure. LA shall be complete with line and earth terminals. The terminal clamps / connectors on the earth terminal of the arresters and the discharge counter incoming and outgoing terminals shall also be provided.

Discharge counter

Self-contained discharge counter, suitably enclosed for outdoor use shall be provided for each single pole unit. The discharge counter shall be visible through an inspection window. The counter terminal shall be so located that incoming and outgoing connections are easily made with minimum possible bends. Suitably sized bypass shunts of copper to facilitate bypassing the discharge counter shall be furnished. The terminal connectors shall permit the connection of these shunts.

A leakage current meter as an integral part of the discharge counter shall be supplied. The counter and the meter shall be so arranged that it is possible to read the leakage current values from ground level. The value of leakage current beyond which the operation is abnormal shall be clearly marked in red color on the meter.

Supporting Structure

Supporting structure for LA shall be included in the Contractor's scope of supply.

Tests

Certificates of type tests carried out on arresters of similar type in the last three years shall be furnished with the Bid. Acceptance tests as per the applicable standards shall be carried out on the arrester in the presence of Employer's Representative. Viz. (but not limited to)

- Dry power factor voltage spark over test
- Standard lightning voltage impulse spark over test
- Residual voltage test at the nominal discharge current
- Porosity test on porcelain components
- Galvanizing test
- Visual inspection on porcelain housing
- Voltage withstands test of arrester insulation
- Current impulse withstand test
- Operating duty test

6.2.3 Insulator and Hardware

Insulator and its hardware shall comply with the following International Standards, including those referred to therein.

IEC 60137, 60168, 60273, 60305, 60383, 60433, 60815 / IS 731, 2486, 2544, 5350

The technical parameters of insulators shall be as given below:

Description	Unit	Particulars
String Insulators		
Type of insulators		Porcelain, ball and socket type
Highest system voltage	kV	36
No. of units per stack	Nos.	3 nos. of 12kV
Mechanical characteristics		
- Electromechanical or mechanical failing load	kN	70

- Nominal creepage distance	mm/kV	31
Post Insulators		
Type of insulators		Porcelain, Pedestal post
No. of units per stack	Nos.	2 nos. of 24 kV or Solid stack
One minute power frequency withstand voltage of stack	kV (rms)	70
Rated lightning impulse withstand voltage of stack	kV (peak)	170
Nominal creepage distance of each insulator	mm/kV	31

Constructional features

a) Insulators

- i. Insulators shall be of porcelain. The porcelain shall be free from defects, thoroughly vitrified, smoothly glazed and impervious to moisture. Insulators shall have good luster and uniform brown color. The glaze shall be unaffected by sudden changes in temperature and atmospheric pollution of ozone, acids, alkali, dust, etc.
- ii. Insulators shall be designed to avoid successive concentration of electrical stresses in any section or across leakage surfaces.
- iii. Each insulator shall have marking as per the applicable standards.
- iv. All metal parts shall be made of commercial grade malleable iron or open hearth or electric furnace steel and hot dip galvanized. Castings shall be free from blow holes, cracks and such other details.
- v. Tension strings shall comprise the conventional ball and socket type disc insulators. The locking clips shall be made of phosphor bronze.
- vi. Post insulators shall be either of solid core or stack post type.
- vii. Design features, which increase radio influence level, shall be avoided.

b) Hardware

- i. All hardware shall be drop forged from high carbon steel.
- ii. All ferrous parts shall be hot dip galvanized.
- iii. Locking and split pins shall be phosphor bronze or stainless steel.
- iv. Fittings intended to connect two dissimilar metals, shall be designed to avoid harmful bimetallic corrosion under service conditions.
- v. The items of hardware and fittings shall make complete assemblies and shall include all bolts, nuts, washers, locknuts, locking clips and other miscellaneous pieces, which are necessary for their satisfactory performance.
- vi. Minimum breaking strength of insulator hardware shall not be less than that of the insulator.
- vii. All clevis fittings and shackles shall be furnished with a high strength, high carbon steel galvanized bolt with nut and cotter key.

Tests

- a) Insulator, hardware, and assemblies shall be subjected to tests as covered by and specified in the relevant standards.
- b) Certificates of type tests carried out on similar equipment in the last three years shall be furnished.

6.2.4 ACSR Conductor

Conductors shall comply with the following International Standards, including those referred to therein. IEC 60888, 60889, 61089 / IS 398, 2629, 2633 ACSR “*Panther*” conductor for 33kV system equivalent shall be used.

Constructional features

Aluminum strands of ACSR conductor shall be hard drawn from 99.5% pure electrolyte aluminum rods with 60% IACS conductivity. Chemical composition of the material shall comply with the requirements of relevant Standards. The surface of conductor shall be clean and dry and free from any excess grease that may be used in its fabrication. The surface strands shall be smooth and free from burrs and other projections which may be cause for increasing corona losses when the conductor is used on extra high voltage lines.

The steel wire strands of ACSR conductor and steel conductor shall be hot dip galvanized. Zinc coating shall be evenly and uniformly coated and shall correspond to Class 1 of IEC 60888. The Bidder shall indicate in the bid, the proposed grade of strength of steel as per IEC 60888. No joints shall be present in aluminum and steel wires.

The steel core and the inner layer of aluminum wires, (where more than one aluminum layer exists), shall be protected with a special grease in order to provide additional protection against corrosion. The grease shall fill the whole space between wires within circumscribed cylinder at inner aluminum layer or at steel core, if the conductor has only one aluminum layer. Application of grease shall correspond to Class 1 of IEC 61089.

The grease shall be chemically neutral with respect to aluminum, zinc and steel. It shall withstand weather conditions and permanent temperature of 85°C without alteration of its properties.

Conductor shall be wound on non-returnable wooden drums made of seasoned and sufficiently strong wood and shall comply with specifications.

No joints shall occur in aluminum wires closer together than 15 meters. No joints shall be permitted in steel wires.

Tests

ACSR conductors, galvanized and steel wire shall be subjected to routine tests as per the applicable standards. Certificates of type tests carried out on similar conductor in the last three years shall be furnished.

6.2.5 Clamps and Connectors

Clamps and Connectors shall comply with the following International Standards, including those referred to therein.

IEC 60305, 60383 / IS 2121, 5561

Clamps and connectors shall be suitable for equipment and bus connections. Clamps and connectors shall have inside threads in addition to nuts and bolts.

The clamps and connectors shall be made of materials listed below:

For connecting ACSR Conductors	:	Aluminum alloy casting
For connecting equipment terminals made of copper or brass to ACSR	:	Bimetallic connectors made from aluminum alloy casting with min. 4 mm thick cast copper alloy liner
Bolts, nuts, plain washers and spring washers for the above	:	Hot dip galvanized mild steel

All aluminum and aluminum alloy shall conform designation A6 of IS: 617 and steel bolts and nuts shall conform IS:1363 and IS:1367. Contact paste shall not decay, evaporate, harden, or crack under the service conditions described in the Specification. The clamps shall be easy to handle and shall have low effective power loss. Clamps shall be light in weight and easy to handle. Suspension clamp shall have ease of oscillation around horizontal axis and small moment of inertia enabling it to follow freely the movement of the conductor. All casting shall be free from blow holes, surface blisters, cracks, and cavities. The temperature rises of power connectors above a reference ambient temperature of 40°C when carrying rated current shall not exceed 45°C.

Tests

All clamps and connectors shall be subjected to acceptance tests (e.g. tensile test, resistance test, dimension check, galvanizing test) as per the applicable standards. In addition, temperature rise test of each type of clamps and connectors are to be carried out. Certificates of type tests carried out on similar conductor in the last three years shall be furnished.

6.3 POWER TRANSFORMERS**6.3.1 Standards**

Transformers and its accessories shall comply with the following International Standards, including those referred to therein.

IEC 60076, 60214, 60296 / IS 2026, IS 335 / BS 148, 171

The technical parameters of transformers shall be as below:

Description	Unit	Particulars	
General			
Quantity required		Main Transformer	Auxiliary Transformer
		2 nos. each of 33/6.6kV	2 nos. each of 6.6/0.433kV
Installation (Indoor / Outdoor)		Outdoor	
Ratings			
Rated power		Main Transformer	Auxiliary Transformer
(*) Contractor shall submit their design calculation for rating of each equipment for Employer Representative's approval.	kVA	*	*
No load voltage Primary	kV	33	6.6
Secondary	kV	6.6	0.433
Number of phases		3	
Rated frequency	Hz	50	
Impedance voltage	%	As per IEC/BIS	
Vector group		Dyn11	
Winding material		Electric Grade Copper	
Type of cooling		ONAN	
System Voltage			
Nominal system voltage Primary	kV	33	6.6
Secondary	kV	6.6	0.415
Highest system voltage - Primary	kV	36	7.2
- Secondary	kV	7.2	1.2
Transformer Secondary Neutral Earthing		Earthed through resistance to limit the earth fault current to 1000 A	Effectively earthed
Insulation Withstand			
Rated lightning impulse withstand voltage	kV (peak)	170	60
Rated short duration induced or separate source AC withstand voltage - Primary	kV (rms)	70	20

- Secondary	kV (rms)	20	7.2
Temperature Rise			
Reference design ambient	$^{\circ}\text{C}$	50	
Temperature rise over design ambient temperature of 50°C			
- Average winding temperature rise (by resistance measurement)	$^{\circ}\text{C}$	55	
- Top oil temperature rise (by thermometer)	$^{\circ}\text{C}$	50	
Tap Changing Gear			
Type of tap changer		On Load Tap Changer	Off Circuit tap Changer
Tapping range	%	$\pm 10\%$	$\pm 10\%$

Description	Unit	Particulars	
Tapping steps	%	1.25	2.5
Bushings			
Rated voltage – Primary	kV	36	7.2
– Secondary	kV	7.2	1.2
One minute power frequency withstand voltage (dry and wet) – Primary	kV (rms)	70	20
- Secondary (Line and Neutral)	kV (rms)	20	3.5
Rated lightning impulse withstand voltage	kV (peak)	170	60
Nominal creepage distance	mm/kV	31	
Terminal Connections			
Primary line end		Cable box	Cable box
Secondary line end		Cable box	Cable box
Secondary neutral end		Bushing outside cable box	One bushing each inside and outside cable box
Type of wheels		Bi-direction, Flanged – Railmounted (Gauge-1676mm)	Plain – Bi-directional
Cable sizes:			
- Primary		*	*
- Secondary		*	*
Accessories		OTI, WTI, MOG, Buchholz relay, Pressure relief valve, conservator, pressure relief device on OLTC	OTI, WTI, MOG, Buchholz relay, conservator

(*) Values to be ascertained by the Contractor after Submitting design calculations subject to approval.

6.3.2 Design Features

Transformers will be located outdoor and shall also be rated for satisfactory operation at 50°C design ambient temperature.

6.3.3 Accessories and Fittings

Each main power transformer shall have the following fittings and accessories including but not limited to:

- a) A conservator of sufficient volume with
 - i. separate compartment for OLTC (Alternatively a separate conservator for OLTC)
 - ii. oil level gauge with potential free contacts for initiating alarm for low oil level
 - iii. weather-proof dehydrating breathers for both compartments with activated alumina or silicagel as the dehydrating breather
 - iv. shut off valves
 - v. filling plug and drain valves

The conservator shall be designed to maintain an oil seal upto a temperature of 100⁰ C.

- b) Gas and oil actuated Buchholz relay with
 - i. necessary shut off valves
 - ii. test cock with pipe connections for sampling
 - iii. potential free contacts for initiation of alarm in case of slow gas formation and trip in case offast oil and gas surges
- c) Separate Buchholz relay as in b) above for OLTC chamber of conservator
- d) Dial type thermometer with
 - i. maximum temperature indicator and its resetting device
 - ii. potential free contacts for initiating alarm on high temperature and trip on very high temperature
- e) Winding temperature indicator with
 - i. necessary sensing, compensating and calibrating devices
 - ii. potential free contacts for initiating alarm on high temperature and trip on very high temperature
 - iii. WTI transmitter for remote indication on remote tap changing panel
- f) Detachable type of radiators including but not limited to:
 - i. Shut-off valves and blanking plates on transformer tank at each point of connection of inletand outlet header
 - ii. Top and bottom shut-off valves and blanking plate on each radiator
 - iii. Lifting lugs
 - iv. Top oil filling plug, 19 mm size
 - v. Air release plug at top
 - vi. Oil drain plug at bottom, 19 mm size
 - vii. Earthing terminals
- g) Pressure relief device for transformer tank and OLTC
- h) Weather - proof marshalling box mounted on transformer tank
- i) Name plate, rating plate and Diagram plate
- j) Valves and plugs as below:
 - i. Drain valve
 - ii. Filter valve
 - iii. Oil sampling valves at top and bottom
 - iv. Valves between radiators and tank (in case of detachable radiators)
 - v. Air release plug
 - vi. Twin outlets (with plug) for applying vacuum with attachments.

- k) Earthing pads of copper or non-corrodible material for transformer tank (2 places) and radiator banks
- l) Inspection manholes as required
- m) Lifting arrangement for
 - i. fully assembled transformer
 - ii. core and coil
 - iii. tank
- n) Hauling eyes on each face of the transformer
- o) Bi-directional flanged wheels
- p) Anti-earthquake clamping devices
- q) Jacking pads

Each auxiliary transformer shall have the following fittings and accessories including, but not limited to:

- a) Conservator with oil level gauge
- b) Dehydrating silica gel breather
- c) Oil temperature indicator
- d) Thermometer pocket
- e) Explosion vent diaphragm / pressure relief valve
- f) Sampling and drainage valves
- g) A plug or blank flange at the top for connecting valve for filtration
- h) Two earthing terminals
- i) Rating plate (Name plate and diagram plate)
- j) Lifting lugs
- k) Removable plain rollers
- l) Adequate number of air vents for relieving trapped air during oil filling and during maintenance.
- m) Accessories for clamping the wheel to the foundation channel in order to withstand earthquake forces.

6.3.4 Windings

The windings shall be of electrical grade copper.

Materials used in insulation and assembly shall be insoluble, non-catalytic and chemically inactive in the hot transformer oil and shall not soften or otherwise be affected under operating conditions. Windings and insulation shall be so arranged that free circulation of oil is possible between coils, between windings, and between winding and core.

Leads from winding to the terminal board and bushings shall be rigidly supported to prevent injury from vibration. Guide tubes shall be used where practicable.

Windings shall be subjected to shrinking and seasoning processes so that no further shrinkage occurs during service. Adjustable devices shall be provided to take up possible shrinkage in service. High voltage end - windings shall be suitably braced to withstand short circuit stresses.

6.3.5 Core

The magnetic circuit shall be constructed from high grade, cold rolled, non-ageing, grain-oriented silicon steel laminations. Each sheet shall have an insulating coating resistant to the action of hot oil. Each lamination shall be coated with insulation which is unaffected by the temperature attained by the transformer during service.

The insulation structure for the core to bolts and core to clamp plates shall be such as to withstand appropriate dielectric test. All steel sections used for supporting the core shall be thoroughly shot or sand blasted after cutting, drilling, and welding. Core laminations shall be annealed, and burrs removed after cutting. Cut edges shall be insulated. The framework and clamping arrangements of core and coil shall be securely earthed inside the tank by a copper strap connected to the tank. The

core clamping structure shall be designed to minimize eddy current loss. The core shall be provided with lugs suitable for lifting the complete core and coil assembly. The framework and clamping arrangements shall be securely earthed.

The core and coil assembly shall be dried out and impregnated under vacuum.

6.3.6 Tank

The transformer tank shall be made from high-grade sheet steel, suitably reinforced by stiffeners made of structural steel sections. All seams, flanges, lifting lugs, braces, and other parts attached to the tank shall be welded. The interior of the tank shall be cleaned by shot blasting and painted with two coats of heat resistant, oil insoluble paint. Adequately sized manholes shall be provided for ease of inspection and maintenance. Steel bolts and nuts exposed to atmosphere, shall be galvanized. Tank together with radiators, conservator, bushings, and other fittings shall be designed to withstand without permanent distortion the following conditions:

- a) Full vacuum of 760 mm of Hg for filling with oil under vacuum
- b) Internal gas pressure of 0.35 kg/cm² with oil at operating level

Tank shall be provided with a pressure release device, which shall operate at a pressure below the test pressure for the tank and radiators. The device shall be provided with a device visible from ground to indicate operation. An equalizer pipe connecting the pressure relief device to the conservator shall be supplied. The device shall be provided with potential free contacts for alarm and tripping. Alternatively, a separate pressure relay shall be provided for this purpose.

The tank cover shall be bolted type and not welded, sealed type. The tank cover shall be removable and shall be suitably sloped so that it does not retain rainwater.

6.3.7 Bushings

Bushings shall be of porcelain. Stresses due to expansion and contraction in any part of the bushing shall not lead to deterioration.

6.3.8 Radiators

Radiators shall be designed to withstand the vacuum pressure conditions specified for the tank. They shall be so designed as to completely drain oil into the soak pit and to prevent formation of gas pockets when the tank is being filled. Transformers of rating above 500 kVA shall be equipped with detachable or separately mounted radiator banks. Radiators for the main transformers shall be with bolted and gasket flange connections. Transformers of rating 500 kVA and below shall be provided with fixed type radiators. Fins of the radiators shall not have sharp edges and shall be rounded in shape. When transformers are provided with separately mounted radiators, flexible joints shall be provided on the main oil pipes connecting the transformer tank to the radiator banks, to reduce vibration and facilitate erection and dismantling. The interconnecting pipes shall be provided with drain plug and air release vents.

6.3.9 Tap Changing Gear

On-Load Tap Changer (OLTC):

- a) OLTC gear shall safely carry and withstand through fault current of the transformer and shall incorporate protections to prevent tap change operation during flow of such fault current.
- b) Tap changing once initiated should be completed irrespective of status of the initiating devices or loss of control supply.
- c) OLTC gear shall have separate conservator connections and Buchholz relay so that the oil of OLTC does not mix with transformer oil. Alternately, OLTC shall have a separate conservator with accessories.
- d) Provision shall be available for filling, draining of the oil, release of air, etc.
- e) OLTC driving mechanism and its associated control equipment shall be mounted in a weatherproof cabinet having degree of protection of at least IP65. The cabinet shall incorporate the following:

- i. Driving motor with associated switch and fuse (or MCB) and raise and lower contactors with overload and single phasing protection
- ii. Remote / local selector switch
- iii. Control switch for raise / lower operations
- iv. Pressure relief device and pressure relay
- v. Over current blocking device
- vi. Parallel control device
- vii. Limit switches to prevent over travel and final mechanical stops
- viii. Manual operating device with interlocking switch
- ix. Tap position indicator
- x. Operation counter
- xi. Break or clutch to permit only one tap change at a time
- xii. Auxiliaries such as terminal blocks, space heaters, interior lighting, etc.
- f) Voltage sensing and regulating device for automatic control including a time delay relay for delaying the indication of tap changing shall be provided. Settings shall be adjustable at site.
- g) A remote control panel shall be provided in the electrical room and shall include, but not be limited to following:
 - i. Voltage regulator (solid state)
 - ii. Control switches for raise / lower
 - iii. Auto / manual selector switch
 - iv. Tap position indicator
 - v. Facia alarm annunciator with 'Acknowledge', 'Sound Cancel', 'Reset' and 'Lamp test' pushbuttons
 - vi. Audio signal for 'Tap Change in progress'
 - vii. Winding temperature indicator
 - viii. Indicating lamps for upper and lower limit of taps and for 'Tap Change in Progress'
 - ix. Auxiliary relays as required for remote annunciation, control
 - x. Auxiliaries such as terminals, fuses, space heaters, interior lighting, etc.

Off-circuit tap changer

Off circuit tap changer shall be provided for auxiliary transformers. It shall comprise

- a) Operating handle or wheel accessible from ground level
- b) Tap position indicator
- c) Padlocking arrangement with padlock.

6.3.10 Marshalling Box

The marshalling box shall be tank mounted, weatherproof, vermin proof, dust proof, sheet steel (2 mm thick), enclosed and with hinged door having padlock. Door and gland plate shall be fitted with neoprene gaskets. Bottom shall be at least 600 mm from grade level. Top surface shall be sloped. The degree of protection shall be IP65.

Contacts / terminals of electrical devices / relays, etc. mounted on the transformer shall be wired to the marshalling box. Interconnecting wires between the marshalling box and the accessories / devices shall be either PVC insulated wires in GI conduits or PVC insulated, armored cables together with provision of double compression type, brass cable glands at the marshalling box. The above-mentioned cables as well as terminating the cables shall be the Contractor's responsibility.

All contacts for alarm, trip and indication circuits shall each be electrically free, designed for the auxiliary DC supply of 110 V and brought out to separate terminals in the marshalling box. Terminals shall be rated for 10 A. Disconnecting / shorting type terminal block shall be used for CT circuits.

In case of main transformers, provision for remote annunciation shall be provided with two changeover contacts for alarm condition and two changeover contacts for trip condition for each of the following conditions including but not limited to:

- a) Buchholz alarm
- b) Buchholz Trip
- c) Oil Temperature high
- d) Oil Temperature very high
- e) Oil level low
- f) Pressure relief device operated
- g) Winding temperature high
- h) Winding temperature very high
- i) Conservator oil level low

6.3.11 Cable Terminations

Cable boxes shall have sufficient space for segregating the cable cores and for adequate clearance in air between bare conductors at the terminals. Cable boxes shall be complete with necessary glands, lugs and armour grips.

Air filled cable boxes shall be of adequate dimensions and designed in such a manner that they can be opened for inspection without disturbing the gland plate or incoming cable. Disconnecting chamber shall be provided for disconnecting and moving away the main transformer, without removing the cables or the cable box. Provision shall be made for earthing the body of each cable box.

6.3.12 Tests

All tests required by the specification including repeated tests and inspection that may be necessary owing to the failure to meet any tests specified, shall be carried out at the Contractor's expense.

The following tests shall be carried out on the assembled transformer during inspection at the manufacturer's works.

- a) Temperature rise test on one transformer
- b) Measurement of resistance of windings at principal and extreme taps
- c) Ratio at each tap, polarity, and phase relationships
- d) Measurement of impedance voltage at principal and extreme taps
- e) Measurement of no load current and no-load losses at rated frequency and at both the rated voltage and 110 % rated voltage
- f) Measurement of efficiency and regulation at $\frac{1}{2}$, $\frac{3}{4}$ and full load
- g) Measurement of insulation resistance
- h) Induced over voltage withstand test
- i) Separate source voltage withstand test
- j) Magnetic balance test
- k) Test on OLTC

Type test certificates shall be provided for verification. Whenever two nos. or more identical transformers are being offered, type tests on one of them shall be carried out, including heat run test.

All auxiliaries and accessories such as temperature indicators, Buchholz and pressure relays shall be tested as per the applicable standards and test certificates shall be furnished to the Employer's Representative for approval.

6.3.13 Rejection

The Employer may reject the transformer if anyone of the following conditions arises during testing:

- a) Any of the quantities / parameters of transformers subject to tolerances are outside the tolerances given in the applicable standards or such tolerance as guaranteed in the Contractor's

bid.

- b) Winding and / or top oil temperature rise exceeds the specified / guaranteed value; and
- c) Transformer fails to withstand any of the dielectric tests.

Additional tests shall be conducted to locate the failure and after rectification, all tests shall be repeated to prove that the rebuilt transformer meets the specification in all respects, all at the Contractor's expense.

Employer reserves the right to have the transformer replaced or repaired by the Contractor within reasonable period to Employer's satisfaction at no extra cost to the Employer. The Contractor shall also bear the costs, including but not limited to, incurred by the Employer in re-inspection / re-testing such as travel and incidental expense, etc. The Contractor shall note that any delay in completion time due to such repair / replacement shall be subject to liquidated damages as specified in the Conditions of Contract.

6.3.14 Miscellaneous

The following items shall also be included in the Contractor's scope for each transformer:

- a) Supply, installation, and commissioning of interconnecting cables between transformers mounted accessories, marshalling box, OLTC and remote panel in the electrical room along with associated compression type brass cable glands, lugs, etc.
- b) Ten percent extra oil, in addition to that required for first filling of complete transformer, in non- returnable drums
- c) A 10 liter can of paint for touching up the external surface after erection, and
- d) Terminal clamps / connectors suitable for connecting to specified sizes of conductor / tube / cable.

6.3.15 Design Criteria

The transformer size shall be determined from the estimation of the simultaneous maximum demand based on the power rating of all main and auxiliary motors and other loads (official buildings, residential quarters, etc.) and their operating / running periods. Appropriate values of load factor, diversity factor, power factor and efficiency shall be considered for each type of load. Improvement in power factor due to capacitors shall not be considered. Five percent (5%) contingency shall be added to the simultaneous maximum demand thus calculated and the next standard size of transformer as per IEC shall be selected. Two such transformers shall be provided for 100 % redundancy and the design calculations for transformer sizing shall be subject to the approval of the Employer's Representative.

6.4 HV AND MV INDOOR SWITCHBOARD

HV and MV indoor switchboard shall comply with the following Standards, including those referred to therein. IEC 60044, 60186, 60255, 60265, 60282, 60298, 60466, 60529, 60694, 60787, 62271 IEC/TR2 61233 and IS 9046, 9920, 9921, 13118, 3427, 4237, 2156, 2705, 3156, 10118, 722, 13118.

The technical parameters of HV and MV switchboards shall be as below:

HV switchboard

Description	Unit	Particulars
General		
Type		Metal enclosed, compartmentalized, draw-out type
Rated voltage, no. of phases and rated frequency	kV / - / Hz	36 kV, 3 Phase, 50Hz
System neutral earthing		Effectively Earthed

Description	Unit	Particulars
Rated Insulation Levels		
- Rated short duration power frequency withstand voltage	kV (rms)	70
- Rated lightning impulse withstand voltage	kV (peak)	170
Rated normal current of bus bars under design ambient temperature of 50°C and material of busbar	A / -	(*), Copper - suitable for 100% load including future loads
Rated short-time withstand current and time	kA (rms) /sec	16 kA for 1 sec
Dynamic rating	kA (peak)	40
Constructional Requirements		
Minimum thickness of sheet steel in mm Cold rolled (Frame/Enclosure/Covers)	mm	Frame – 2.5 Doors/Covers – 2.0
Degree of protection of enclosure		IP-5X
Color finish shade		
- Interior		Glossy White
- Exterior		Light Grey Semi Glossy
Cable connection		Bottom entry and exit
Circuit Breakers		
Type		Vacuum/ SF6
Rated current inside the cubicle under design ambient temperature at 50°C	A	(*)
Rated operating sequence		O–3 Min–CO-3 Min-CO
Rated short time breaking current	kA (rms)	16
Rated short time making current	kA (peak)	40
Rated short-time withstand current and time	kA (rms) /sec	16 kA for 1 sec
Rated peak withstand current	kA (peak)	40
Min. no. of auxiliary contacts		6 NO + 6 NC after internal use by manufacturer
Type of operating mechanism		
- Normal		Spring charging for closing and tripping
- Emergency		Manual and Spring charged for closing and tripping
Auxiliary control voltage		
- Closing coil / Tripping coil	V	110V DC
- Spring charging motor	V	110V DC
- Space heater and lighting	V	230V AC
Earthing switch		Required
Current and Voltage Transformers		
Details of ratio, taps, burden, accuracy		As per requirements
Protective Relays		

Type		Numerical (Microprocessor based)
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Description	Unit	Particulars
Details of protective relays		As per Single Line Diagram
Switch-Disconnecter		
Rated current under design ambient temperature of 50°C	A	(*)
Rated making current	kA (peak)	40
Rated peak withstand capacity	kA (peak)	40
Rated short-time withstand current and time	kA (rms) /sec	16 kA for 1 sec
Insulation levels		
Rated lightning impulse withstand voltage		
- Across the isolating distance	kV (peak)	70
- Phase to phase, between phases and across open switching devices	kV (peak)	60
Rated short duration power frequency withstand voltage		
- Across the isolating distance	kV(rms)	23
- Phase to phase, between phases and across open switching devices	kV(rms)	20
Operating mechanism		
- Closing and opening		Spring charged
- Control voltage	V	110V DC
Earthing switch		Required
HV Fuses		
Application		Indoor
Type		HRC
Rated current	A	(*)
Rated voltage	kV	36
Rated breaking capacity	kA (rms)	16
Auxiliary supply	V	110V DC

(*) Value to be ascertained by the Contractor after submitting design calculations subject to approval. MV switchboard

Description	Unit	Particulars
General		
Type		Metal enclosed, compartmentalized, draw-out type
Rated voltage, no. of phases and rated frequency	kV / - / Hz	7.2 kV, 3 Phase, 50Hz
System neutral earthing		Earthed through resistance to limit the earth fault current to 1000 A.
Rated Insulation Levels		
- Rated short duration power frequency withstand voltage	kV (rms)	20
- Rated lightning impulse withstand voltage	kV (peak)	60
Rated normal current of bus bars under design ambient temperature of 50°C and	A / -	(*), Copper

Description	Unit	Particulars
material of busbar Kalliteer lift SCGeme		Specification Section-VI
Rated short-time withstand current and time	kA (rms) /sec	40 kA for 1 sec
Dynamic rating	kA (peak)	100
Constructional Requirements		
Minimum thickness of sheet steel in mm Cold rolled (Frame/Enclosure/Covers)	mm	Frame – 2.5 Doors/Covers – 2.0
Degree of protection of enclosure		IP-4X
Color finish shade		
- Interior		Glossy White
- Exterior		Light Grey Semi Glossy
Cable connection		Bottom entry and exit
Circuit Breakers		
Type		Vacuum
Rated current inside the cubicle under design ambient temperature at 50°C	A	(*)
Rated operating sequence		O–3 Min–CO-3 Min-CO
Rated short time breaking current	kA (rms)	16
Rated short time making current	kA (peak)	40
Rated short-time withstand current and time	kA (rms) /sec	40 kA for 1 sec
Rated peak withstand current	kA (peak)	100
Min. no. of auxiliary contacts		6 NO + 6 NC after internal use by manufacturer
Type of operating mechanism		
- Normal		Spring charging for closing and tripping
- Emergency		Manual and Spring charged for closing and tripping
Auxiliary control voltage		
- Closing coil / Tripping coil	V	110V DC
- Spring charging motor	V	110V DC
- Space heater and lighting	V	230V AC
Earthing switch		Required
Current and Voltage Transformers		
Details of ratio, taps, burden, accuracy		(*)
Protective Relays		
Type		Numerical (Microprocessor based)
Auxiliary supply	V	110V DC
Details of protective relays		(*)
Switch-Disconnecter		
Rated current under design ambient temperature of 50°C	A	(*)
Rated making current	kA (peak)	100

Description	Unit	Particulars
Rated peak withstand capacity	kA (peak)	100
Rated short-time withstand current and time	kA (rms) /sec	40 kA for 1 sec
Insulation levels		
Rated lightning impulse withstand voltage		
- Across the isolating distance	kV (peak)	70
- Phase to phase, between phases and across open switching devices	kV (peak)	60
Rated short duration power frequency withstand voltage		
- Across the isolating distance	kV(rms)	23
- Phase to phase, between phases and across open switching devices	kV(rms)	20
Operating mechanism		
- Closing and opening		Spring charged
- Control voltage	V	110V DC
Earthing switch		Required
MV Fuses		
Application		Indoor
Type		HRC
Rated current	A	(*)
Rated voltage	kV	7.2
Rated breaking capacity	kA (rms)	16
Motor Contactors		
Type		Vacuum
Rated current	A	(*)
Rated voltage of coil	V	230 V AC, 1 phase, drawn from 6.6/0.433 kV control transformer (*) on each bus section

(*) Rating to be ascertained by the Contractor after submitting design calculations subject to approval.

6.4.1 Circuit Breaker

Circuit breakers shall preferably vacuum type. Circuit breaker along with its operating mechanism shall be mounted on a wheeled carriage moving on guides, designed to align correctly and allow easy movement. Plugs and sockets for power circuits shall be silver faced and shall be insulated with suitable insulating material shrouds. All corresponding components of circuit breaker cubicles of same rating shall be interchangeable with one another. There shall be 'Service', 'Test' 'Fully withdrawn' positions for the breakers. In the 'Test' position the circuit breaker shall be capable of being tested for operation without energizing the power circuits, i.e., the control circuits shall remain undisturbed while the power contacts shall remain disconnected. Separate limit switches, each having a minimum of 2 'NO' + 2 'NC' contacts, shall be provided for both 'Service' and 'Test' positions of the circuit breakers for future SCADA. Electrical tripping shall be performed by shunt trip coils. "Local / Remote" selector switch lockable in "Local" position shall be provided on the cubicle door. 'Red' and 'Green' indicating lamps shall be provided on cubicle door to indicate breaker close and

open positions. Breaker "Service" and "Test" positions shall be indicated by separate indicating lamps on the cubicle door, in case mechanical indication of "Service" and "Test" positions are not available on the cubicle door. Connection of the control / interlocking circuits between the fixed portion of the cubicle and the breaker carriage shall be preferably by means of plug socket arrangement.

6.4.1.1 Operating mechanism control

- a) Circuit breakers shall be operated by a motor spring charging type of mechanism. The mechanism shall be complete with motor, opening spring, closing spring and all accessories to make the mechanism a complete operating unit
- b) Operating mechanism shall normally be operated from the breaker cubicle itself.
- c) The tripping spring shall be charged by the closing action, to enable quick tripping. Closing of the circuit breaker shall automatically initiate recharging of the springs to enable the mechanism to be ready for the next closing stroke. Charging time for the springs shall not exceed 30 seconds. It shall be possible to manually charge the springs in an emergency. Transfer from motor to manual charging shall automatically disconnect the charging motor. All operating mechanisms shall be provided with "ON" - "OFF" mechanical indication. The charging mechanism shall be provided with mechanical indicators to show "charged" and "discharged" conditions of the spring. Failure of any spring, vibration or mechanical shock shall not cause tripping or closing of the circuit breaker.
- d) Only one closing operation of the circuit breaker shall result from each closing impulse (manual or electrical), even if the breaker trips while the control device (manual or electrical) is being held in the "close" position.
- e) The circuit breaker mechanism shall make one complete closing operation, once the push button (PB) or control switch has been operated and the first device in the control scheme has responded, even though the PB or control switch is released before the closing operation is complete, subject to the condition that there is no counter-impulse for tripping.
- f) Means shall be provided to manually open and close the breakers slowly, when the operating power is not available, for maintenance and adjustments. A local manual trip device shall also be provided on the operating mechanism.
- g) Circuit breaker control shall be on 110 V DC. Closing coils and other auxiliary devices shall operate satisfactorily at all voltages between 85-110 % of the control voltage. Trip coils shall operate satisfactorily between 70 -110 % the rated control voltage.
- h) Provision for remote control shall be provided for SCADA.

Safety interlocks and features

- a) Withdrawal or engagement of a circuit breaker / switch disconnecter shall not be possible unless it is in the open position.
- b) Operation of a circuit breaker / switch disconnecter shall not be possible unless it is in service position, withdrawn to test position or fully drawn out. It shall not be possible to close the circuit breaker electrically in the service position, without completing the auxiliary circuit between the fixed and moving portions.
- c) Circuit breaker / switch disconnecter cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker / switch disconnecter carriage to cover the stationary isolated contacts when the breaker / switch disconnecter is withdrawn. Padlocking facilities shall be provided for locking the shutters positively in the closed position. It shall, however, be possible to open the shutters intentionally against spring pressure for testing purposes.
- d) The circuit breaker / switch disconnecter carriage shall be earthed before the circuit breaker / switch disconnecter reaches the test position from fully withdrawn position. In case of breakers / switch disconnecter with automatic disconnecting type of auxiliary disconnects, the carriage shall be earthed before the auxiliary disconnects are made and the carriage earthing shall break only after the auxiliary disconnects break.

- e) Caution nameplate, “Caution Live Terminals” shall be provided at all points where the terminals are likely to remain live and isolation is possible only at remote end, i.e., incomer to the switchboard. Suitable interlock shall be wired for the purpose.

6.4.2 Current and Voltage Transformers

CTs and VTs shall have polarity marks indelibly marked on each transformer and at the associated terminal block. Facility shall be provided for short-circuiting and earthing the CT secondary at the terminal blocks. CT shall be able to withstand the thermal and mechanical stresses resulting from the maximum short circuit current. Core laminations shall be of high-grade silicon steel. VTs shall be of the single-phase type and mounted on a draw out trolley. VTs shall be protected on their primary and secondary sides by current limiting fuses with interrupting ratings corresponding to breaker rating. It shall be possible to replace the secondary fuses safely when the switchboard is energized. Alternatively, MCB having auxiliary contact shall be provided. Primary side fuses shall be replaceable only in the de-energized position. Secondary winding of voltage transformer (VT) shall be rated for a three-phase line to line voltage of 110 V. Identification labels giving type, ratio, output, and serial numbers shall be provided for CTs and VTs.

6.4.3 Vacuum Contactors

6.6 KV system comprises motor for driving pumps. The vacuum contactor shall be suitable for direct-on-line starting with maximum starting current of about 6 times the full load current. Vacuum contactors backed by suitable HRC fuses shall be used for controlling motor circuits. Vacuum contactors shall have three (3) vacuum interrupters, one for each pole. The arcing period shall not exceed one half of a cycle. Current shall be chopped at very low values such that the resulting induced voltage shall be within IEC recommendations. Surge suppressor for chopping shall be incorporated in the design, if required. A wear gauge shall be provided to check wearing of contacts at every half million operations. Vacuum contactor coil and control supply shall be suitable for 110V DC supply and shall be designed to operate over a range of 85% to 110% voltage. Auxiliary contacts rated for 10A continuous shall be provided with each contactor to affect specified interlocks / indications etc. Spare contacts shall be available. NC contacts should open first and NO contacts should close later i.e., break before make feature shall be adopted. Fuses shall be provided for short circuit protection. Vacuum contactors shall be interlocked with associated earthing switch such that when vacuum contactor is in ‘ON’ position, earthing switch cannot be made ‘ON’ and vacuum contactor cannot be closed unless earthing switch is in ‘OFF’ position. Contactor panel shall have a three position switch (local / remote / off) and start / stop push button for motors, the latter being in local circuit.

The motor feeder contactor shall be automatically tripped under the following conditions:

- a) Operation of any of the protective relays of the motor
- b) Bus under voltage
- c) Motor winding / bearing temperature too high
- d) Starter fault
- e) Any other protection / event as required by the system

6.4.4 Relays

Protection relays shall be Numerical (microprocessor based) type. Relays shall have interfacing facilities to communicate data to SCADA system. All relays shall be enclosed in rectangular shaped, dustproof cases and shall be suitable for flush mounting. All relays shall be accessible from the front for setting and resetting. Access to setting devices shall be possible only after the front covers of the relays are removed. All protective relays shall be of the draw-out type and shall be provided with operation indicators visible from the front.

6.4.4.1 Transformer differential Protection

- a) This shall be provided for main transformers. This protection shall trip for all the phase and earth faults inside the zone and shall be stable for all faults outside the zone. This protection shall have restrained inrush-proof feature, which shall never prevent operation for tripping in case a real fault exists within the relay zone during energization of the transformer.
- b) The protection shall be immune to the zero-sequence current, which may circulate, during certain conditions through the neutral of only one side of the transformer. It shall be a phase segregated relay of low burden with absolute stability at design short circuit current rating and shall have an operating time of not more than 25 m sec, at a flow of one side current equal to twice the nominal current. The output of the relay shall have enough contacts of suitable switching capacity to trip all the circuit breakers which are supposed to be tripped through this protection and initiate the lock-out relay.
- c) The setting of bias and basic setting must be adjustable in steps in order to cover the maximum mismatch between the primary and secondary due to error of the CTs and range of regulation of the tapchanger.
- d) This protection should be wired to enable the measurement of differential and stabilization current in service without any possibility of causing open circuits on the secondary side of the current transformers.

6.4.4.2 Over current / Earth Fault Protection

- a) This relay shall be of the multi-characteristics type which has a flexible mode selection facility so that it is possible to select one mode for the over current elements and another for the earth fault element.
- b) Phase current range shall cover at least 50-300% of 'In' in steps of not more than 10% while the earthcurrent range shall cover at least 5-100% of 'In' in steps of not more than 5%.
- c) The time setting range of the definite time mode shall not be less than 5 seconds in steps of 0.1 secondeach.
- d) The time multiplier setting for the inverse time-current characteristic modes shall have a range not less than 0.05- 1.6 in steps of 0.05.
- e) Over current and earth fault relays shall have separate timers and operation indicators.
- f) The high set element shall have a range of 2 - 15 times the nominal current in steps of 'In' and shall be of low transient overreach, with a tripping time of less than 25 ms and possible to be selected on "blocked" position. Reset time shall be not more than 50 ms for both elements.
- g) The relays that are installed on the transformer neutral side shall be of single-phase version, but they shall have the same characteristics as the phase side relays.

6.4.4.3 Restricted Earth Fault Protection

- a) The restricted earth fault relay shall be operated from a completely separate core of line and neutral current transformers. The dedicated CTs shall be of class PS and have the same magnetization characteristics with a knee 'emf' value higher than the highest possible setting of the relay. Intermediate CTs for ratio correction are not acceptable. CT sizing shall be matched with the requirements of the relay.
- b) For this protection, 1-phase high impedance relay shall be provided and all the aspects regarding stability of the protection, dimensioning of current transformer, considering the peak short circuit current, etc. and all the auxiliary equipment such as non-linear VDR resistor for voltage limiting, filter for harmonics and DC component suppression and variable shunt resistor for sensitivity adjustment, if required, shall be provided. The total fault clearing time shall not exceed 20 m sec. at $3 \times I_n$.
- c) The stability of this protection against out-zone faults shall be confirmed. A calculation to show the proper selection of the relay up to the maximum short circuit of the switchboard shall be submitted.

6.4.4.4 Under voltage relays

- a) Suitable voltage operated relays for sensing loss of voltage shall be provided. The relay shall have a drop off to pick up ratio of the order 90%. The relays shall be fast operating type and shall be fitted with operation indication. The indication shall come on drop off or loss of voltage.
- b) Additional potential free contacts for all the relay outputs i.e. trip as well as alarm signals shall be provided for connection to future SCADA.

6.4.4.5 Motor Protection Relay

- a) It shall be designed to protect the motor against thermal overload, locked rotor, over current and earthfault protection, under voltage, over voltage, phase reversal and negative sequence.
- b) Thermal setting range shall cover at least 50% to 200% of 'In' in steps of not more than 5 % of 'In'.
- c) Phase current range shall cover at least 5-200% of 'In' in steps of not more than 1% while the earthcurrent range shall cover at least 1-100% of 'In' in steps of not more than 5%.

6.4.4.6 Motor Differential Relay

- a) This shall be provided for motor ratings greater than 1000 kW.
- b) This protection shall trip for all the phase and earth faults inside the zone and shall be stable for all faults outside the zone. This protection shall have restrained starting current feature, which shall never prevent operation for tripping in case a real fault exists within the relay zone during starting of the motor.
- c) The output of the relay shall have sufficient number of contacts of suitable switching capacity to trip the circuit breaker.
- d) This protection should be wired to enable the measurement of differential and stabilization current in service without any possibility of causing open circuits on the secondary side of the current transformers.

6.4.4.7 Auxiliary Relays and Timers

- a) Following auxiliary relays shall be provided on each breaker cubicle:
 - i. Trip circuit supervision relay
 - ii. Anti- pumping relay
- b) Hand reset type lockout (tripping) relays and timers shall be provided as required in addition to the protection relays given in the single line diagram.
- c) Auxiliary relays and timers shall be rated to operate satisfactorily between 70 % and 110 % of the rated voltage.
- d) Voltage operated relays with sufficient contacts to initiate tripping, alarm, annunciation for various trip functions like Buchholz relay operation, high oil temperature, high winding temperature, pressure relief device (PRD) operation etc. shall be provided. Each relay shall have four (4) pairs of self-reset contacts except for Buchholz and "PRD" trip which shall have hand-reset contact. The relays shall have hand- reset operation indicators.
- e) Voltage operated relays with sufficient contacts to initiate alarm and data logging for various alarm functions for transformers, etc. shall be provided. Each relay shall have four (4) normally open self-reset contacts. The auxiliary relay for Buchholz alarm shall be slugged to have delay on drop off at 100 ms. The relays shall have hand reset operation indicator.

6.4.5 Switch Disconnects and Fuses

Switch disconnectors when switched, shall be of the load break, fault make, grouping operated type. For use on 3-phase systems, the switches shall be of the triple pole type with a link for neutral connection. Switch disconnectors shall be of the heavy duty, quick make and quick break type. It shall be electrically and manually operated. Their contacts shall be silver plated and contact springs shall be of stainless steel. Their handles shall have provision for locking in both fully open and fully closed

positions. Mechanical 'ON-OFF' indication shall be provided.

For combination units of switch disconnecter and fuses, the following interlocks shall be incorporated:

- a) The fuses should not be accessible unless the switch disconnecter is in fully open condition.
- b) It should not be possible to close the switch disconnecter when the fuse cover is open, but an authorized person may override the interlock and operate the switch disconnecter. After such an operation, the cover shall be prevented from closing if the switch disconnecter is left in the "ON" position.

All fuses shall be of the HRC cartridge type in accordance with IEC 60269 mounted on plug-in type of fuse bases. Fuses shall be provided with visible indicators to show that they have operated. Current vs. time characteristics of all types of fuses shall be furnished to the Employer's Representative. Fuses and links functionally associated with the same circuit shall be mounted side by side. An adequate number of spare fuse cartridges of each rating shall be supplied and fitted in clips inside the panel.

6.4.6 Constructional Features of Switchboard

Switchboard design shall comprise metal enclosed, fully compartmental execution having separate sections for each circuit. Compartments with doors for access to operating mechanism shall be so arranged as not to expose high voltage circuits. Switchboard cubicle shall be provided with hinged door on the front with facility for locking door handle. Switchboard shall be dust and vermin-proof and shall have a degree of protection of enclosure of IP 4X. All removable covers shall be gasketed all around with neoprene or superior gaskets. Instruments, relays and control devices shall be flush mounted on hinged door of the metering compartment located in the front portion of cubicle. The metering compartment shall be properly shielded to prevent mal-operation of electronic equipment such as numerical / static relays due to electro-magnetic fields. Separate signal earth shall be provided for such devices, if necessary. Each switchboard cubicle shall be fitted with a label on the front and rear of the cubicle. Each switchboard shall also be fitted with label indicating the switchboard designation, rating and duty. Each relay, instrument, switch, fuse and other devices shall be provided with separate label. Sheet steel used for fabrication of switchboards, control cabinets, marshalling boxes, etc shall be cold rolled. All panels, cabinets, kiosks and boards shall comprise rigid welded structural frames made of structural steel sections or of pressed and formed cold rolled sheet steel of thickness not less than 2.5 mm. The frames shall be enclosed by sheet steel of at least 2 mm thickness. Stiffeners shall be provided wherever necessary.

All doors, removable covers, gland plates, etc. shall be of at least 2 mm thickness and shall be gasketed all-round the perimeter. All doors shall be supported by strong hinges of the disappearing or internal type and braced in such a manner as to ensure freedom from sagging, bending and general distortion of panel or hinged parts. All floor mounted panels / boards shall be provided with a channel base frame. It shall be possible to extend the switchboard on both sides.

The fully draw-out modules shall have all the circuit components mounted on withdrawable type steel chassis. All power and control connections shall be of the draw out type. It shall be possible to withdraw the chassis mounted circuit components without disconnecting any connections. All draw-out contacts shall be of silver-plated copper.

In case of circuit breaker compartments, suitable barriers shall be provided between breaker and all control, protective and indication circuit equipment including instrument transformers such that no live parts are accessible. External cable connections shall be through separate cable compartments for power and control cables. One metal sheet shall be provided between two adjacent vertical sections running to the full height of the switchboard except for the horizontal bulbar compartment. However, each shipping section shall have metal sheets at both ends. After isolation of the power and control connections of a circuit, it shall be possible to carry out maintenance in a compartment safely, with the bus bars and adjacent circuits alive.

6.4.7 Earthing

A copper earthing bus shall be provided and extended throughout the length of the switchboard. It shall be bolted to the framework of each unit and brazed to each breaker earthing contact bar. It shall be located at the bottom of the board. The earth bus shall have sufficient cross section to carry the momentary short circuit and short time fault current for at least 1 second or higher as specified, without exceeding maximum allowable temperature rise. The earth bus shall be properly supported to withstand stresses induced by the momentary short circuit current. Suitable clamp type terminals at each end of the earth bus shall be provided to suit the size of the earthing conductors. Bolted joints, slices, tap, etc. to the earth bus shall be made with at least two bolts.

Positive earthing of circuit breaker frame shall be maintained when it is in the connected position and in all other positions whilst the auxiliary circuits are not totally disconnected. Hinged doors shall be earthed through flexible earthing braid of adequate cross section.

All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Positive connection of the frames of all the equipment mounted in the switchboard to the earth bulbar shall be maintained through insulated conductors of size equal to the earth bulbar or the load current carrying conductor, whichever is smaller. All instrument and relay cases shall be connected to earth bulbar by means of 1100V grade, green colored, PVC insulated, stranded, tinned copper, 2.5 sq. mm conductor looped through each of the earth terminals.

6.4.8 Circuit / Bulbar Earthing Facility

It shall be possible to connect each circuit or set of 3 phase bus bars of the switchboard to earth through earthing switches. Earthing switches / earthing devices shall be mechanically interlocked with the associated breakers / switch disconnectors to prevent accidental earthing of live circuit or bus bars. In case the earthing facility comprises earthing trucks to be inserted in place of circuit breakers, separate earthing trucks shall be supplied for each type / size of breaker. The earthing facilities proposed to be provided by the Bidder shall be clearly detailed in the Bid and shall be subject to Employer's approval.

Auxiliary contacts (min. 2 NO + 2 NC) shall be provided on each earth switch / earthing device and shall be wired to the terminal block for interlocking purpose.

6.4.9 Annunciators

Annunciators shall be of facia type with translucent plastic window for each alarm point. Annunciator facia plates shall be engraved in block lettering with respective alarm inscriptions. The inscriptions shall be clearly readable and visible when the respective facia light is lighted. Each annunciation window shall be provided with two lamps to provide redundancy against lamp failure. Lamps shall be replaceable from the front. Lamps shall be of clustered LED type. All facia annunciator points shall be suitable to accept external contacts of either 'NO' or 'NC' self or hand reset type for initiating the annunciation sequence. Annunciators shall be suitable for accepting fleeting faults of duration as less as 15 milliseconds.

For static annunciator schemes, special precaution shall be taken by the Contractor to ensure that spurious alarm conditions do not appear due to influence of external magnetic fields on the annunciator wiring and switching disturbances from the neighboring circuits within the panels / desks.

A "Lamp Test" push button shall be provided for each individual panel's group of annunciators to limit the sudden drain on the battery. Provision of testing facilities for flasher and audible alarm circuits of annunciators is desirable. The Contractor shall give the details of the offered scheme.

Annunciators shall have following features:

- a) Suitable for annunciating subsequent faults immediately after the sound cancel of the previous fault.
- b) During lamp test, if a fault occurs, the corresponding lamp circuit shall be automatically disconnected from the "lamp test" circuit and shall start flashing.
- c) Designed to prevent mal operation of the scheme or sequence when the push buttons are pressed incorrectly or in the wrong order.
- d) "Alarm Supply Failure" Alarm scheme similar to the normal annunciation sequence but shall operate on a different DC supply or on AC auxiliary supply.

6.4.10 Instruments

All electrical instruments and meters shall comply with IEC 60051, 61010 and IS 722, 1248.

All indicating and recording instruments shall be flush mounted in dust proof cases complying with IEC 60068 and dimensions to IEC 61554. All digital instruments shall have interface facilities to communicate data to SCADA system.

6.4.10.1 Indicating Instruments

- a) Electrical indicating instruments shall be 96- or 110-mm square with 2400 scale. Taut band type of instruments is preferred. Taut band moving coil instruments for use on AC systems shall incorporate built-in transducers.
- b) Instrument dials shall be white with black numbers and lettering. A red line shall be drawn on each scale to represent rated conditions.
- c) Normal maximum meter reading shall be of the order of 60 % normal full-scale deflection. Ammeters for motor feeders shall have suppressed scale to show current from full load up to six times the full load current.
- d) Instruments shall have accuracy class of 1.0 or better. The design of the scales shall be such that it can read to a resolution corresponding to 50% of the accuracy class index.
- e) Ammeters and current coils of Watt meters and Voltmeters shall continuously withstand 120% of rated current and 10 times the rated current for 0.5 sec., without loss of accuracy. Voltmeters and potential coils of Watt meters and Varmeters shall withstand 120% of rated voltage continuously and twice the rated voltage for 0.5 sec. without loss of accuracy.
- f) Alternatively, instruments can be electronic / digital type with LCD display. These instruments should have high performance ratio and can be equipped with digital output (for alarms) or with interfacing facilities for communication and remote reading of parameters.

6.4.10.2 Metering instruments

- a) Watt-hour meters shall be of the induction type and shall be provided with reverse running stops.
- b) Watt-hour and Var hour meters shall be of the three phase two element type of accuracy class 1.0, suitable for measurement of unbalanced loads in three phase three wire circuits.
- c) Watt-hour and Var hour meters shall be suitable for operation from the secondary of CTs and VTs. They shall be provided with a separate 3 phase 4 wire type test blocks for the testing of the meters without disturbing the CT and VT secondary connections.
- d) Meters shall have digital or cyclometer type of registers. They shall read kWh, kVARh or MWh, MVARh as the case may be without the use of additional multiplying factors. Multiplying factors if unavoidable shall be multiples of 10 (ten). Number of digits provided shall be adequate to cover at least 1000 hrs. of operation.
- g) Alternatively, instruments can be electronic / digital type with LCD display. These instruments should have high performance ratio and can be equipped with digital output (for alarms) or with interfacing facilities for communication and remote reading of parameters.

6.4.11 Control and Selector Switches

Control and instrument switches shall be rotary type, provided with escutcheon plates clearly marked to show operating position and suitable for semi-flush mounting with only the switch front plate and operating handle projecting out. The connections shall be from the back. The contact assembly at the back of the switch shall be enclosed in dust tight removable covers.

The control switches shall be 3 position, spring return to neutral type. They shall be provided with contacts to close in 'normal after close' and 'normal after trip' position. Each switch shall have external red and green indicating lamps, (except when discrepancy type switches are called for). In addition, a semaphore indicator shall be provided for earthing switch.

Contacts of the switches shall be spring assisted and contact faces shall be of silver / silver alloy. Springs shall not be used as current carrying parts. Contact rating and configurations of the switches shall be adequate for the functions desired. Instrument selector switches shall be of the maintained (stay-put) type. Ammeter selector switches shall have make-before-break type contacts so as to prevent open circuiting of CT secondary when changing the position of the switch. Lockable type switches, which can be locked in a particular position, shall be provided, if required. Emergency stop buttons, if any, shall incorporate 'stay-put' features with independent reset facilities.

6.4.12 Indicating Lamps / Pilot Lights

Indicating lamp shall be of the double contact, bayonet cap type rated for operation at either 230 V AC or at the specified DC system voltage as applicable. Lamps shall be provided with translucent lamp covers. Clustered LED type lamps shall be provided. Lenses shall be glass or plastic in standard colors, red, green, blue, white and amber, in accordance with IEC 60073.

Bulbs and lenses shall be interchangeable and easily replaceable from the front of the panel. Tools, if any, which are required for replacing the bulbs and lenses, shall also be included in the scope of supply. Miniature pilot lamps may be provided with plastic marking plate contained inside square (or rectangular) front lens to provide indication of legend or symbols engraved on the marking plate.

The basis of colors shall be as follows:

- Red : Flow of energy.
- Green : No flow of energy.
- White : Supervision of power available, relay coil healthy, etc.
- Amber : Disagreement with original condition, 'abnormal' condition or 'sequence-on' condition.

6.4.13 Push Buttons

Push buttons shall be of momentary contact type with rear terminal connections. The color of the push button actuator shall be red for 'OPEN / STOP' and green for 'CLOSE / START' and for other applications shall be as per specified requirements. The push button knob shall be suitably shrouded to prevent inadvertent operation. The push buttons shall be provided with integral inscription plates engraved with their designation. All push buttons shall have independent, potential free, 2NO + 2NC contacts. The contact faces shall be of silver / Silver alloy. The contacts shall be rated 10A and capable of breaking inductive load of 1A at 110V DC and 5A at 110V AC.

6.4.14 Space Heaters

Adequately rated anti-condensation space heaters shall be provided for each switchboard / cubicle.

Space heater shall be of the industrial strip continuous duty type, rated for operation on a 230 V, 1 phase, 50 Hz, AC system. Space heater shall be provided with a single pole MCB with overload and short circuit release, a neutral link and a thermostat to cut off the heaters at 35⁰ C.

6.4.15 Cubicle Lighting / Receptacle

Each cubicle shall be provided with interior lighting by means of 18 W fluorescent tube lighting fixture. An MCB shall be provided for the lighting circuit. The lighting fixture shall be suitable for operation from a 230 V, 1 ph, 50 Hz, AC supply. A 230 V, 1 phase, AC receptacle (socket) plug point shall be provided in the interior of each panel with an MCB.

6.4.16 Power and Control Cable Terminations

Terminals for power connections shall be complete with adequate phase segregating insulating barriers, shrouds and suitable crimping type of lugs for terminating the cables. Double compression type glands with armour and bonding clamps for the termination of all solid dielectric multicore cables shall be provided. They shall be designed to secure the armour wires to provide electrical continuity between the armour and the threaded fixing component of the gland and to provide watertight seals between the cable outer sheath and gland and between the inner sheath and threaded fixing component. The gland shall preferably project above the gland plate to avoid entry of moisture.

Earthing connectors between cable armour and earth shall be routed outside the cable gland in an approved manner. Gland insulation shall be capable of withstanding test for appropriate high voltage for one minute. Cable terminations for HV / MV cables shall be heat / cold shrinkable type. Adequately sized shrouds / bolts shall be provided at connections to completely cover the terminations. Where core-balance type current transformers are provided on the feeder cables for earth fault protection, glands for cables shall be insulated from earth in an approved manner.

6.4.17 Wiring for Control and Protective Circuits

All low voltage wiring for control, protection and indication circuits shall be carried out with 1100 V grade, PVC insulated cable with stranded, tinned copper conductor of minimum 1.5 sq. mm size. The size of conductor for CT circuits shall be minimum 2.5 sq. mm. All wiring shall be run on the sides of panels and shall be neatly bunched and cleated without affecting access to equipment mounted in the panel. The wiring shall be bound and supported by clamping, roughing or lacing. Spiral wrapping will not be accepted. Wireways shall not be more than 50% full. Adequate slack wire shall be provided to allow for one restripping and reconnection at the end of each wire. When screened cables or wires are necessary, an insulating sheath shall be included. Wiring and supports shall be of fire resistant material.

Wiring shall only be jointed or teed at terminals. Terminals of the clamp type shall not have more than two wires connected.

6.4.18 Terminations and Ferrules

Engraved core identification ferrules, marked to correspond with the wiring diagram, shall be fitted to each wire and each core of multicore cables terminated on the panels. Moisture and oil resisting insulating material shall be used. The ferrules shall be of the interlocking type and shall grip the insulation firmly without falling off when the wire is removed. All wires forming part of a tripping circuit shall be distinctively marked. Spare auxiliary contacts of electrical equipment shall be wired to terminal blocks.

6.4.19 Control Wiring Terminal Blocks

Terminal blocks shall be of 1000 V grade and stud type. Brass stud of at least 6 mm dia. with fine threads shall be used and securely locked within the mounting base to prevent turning. Each terminal shall comprise two threaded studs, with a link between them, washers, and matching nuts and locknuts for each stud. Connections to the terminals shall be at the front. Terminals shall be numbered for identification, grouped according to function. Engraved 'black on-white' labels shall be provided on the terminal blocks describing the function of the circuit. Terminals for circuits with voltage exceeding 110 V shall be shrouded. Terminal blocks at different voltages shall be segregated into groups and distinctively labeled. Terminals used for connecting current transformer secondary leads shall be 'disconnecting and shorting' type with a facility for earthing the secondary. Terminal blocks shall be arranged with 100 mm clearance, between any two sets. Separate terminal stems shall be provided for internal and external wiring respectively. All wiring shall be terminated on terminal blocks, using crimping type lugs or claw type of terminations.

6.4.20 Electronic Equipment

Electronic equipment shall be capable of withstanding randomly phased transient over voltages of either polarity on the power supply or interruptions of the power supply without damage or impairment to the equipment's subsequent performance. In the case of controls, no mal-operation shall occur. Where manufacturers require that electronic equipment supplied under this Contract should not be subjected to insulation resistance tests ('Meagering'), suitable warning notices shall be provided and installed in appropriate locations. When specified by manufacturers, separate shield / signal earthing shall be provided. It shall be possible to remove / replace cards from / to electronic equipment without damage and without interfering with the operation of the rest of the equipment or system. If necessary, consideration should be given to switching off the supplies locally to a card to prevent inadvertent interference to the equipment or system during removing / replacing a card. Electronic equipment shall not use local internal batteries unless the approval of the Employer's Representative has been obtained. Where approval is given, batteries used inside equipment shall be of the totally sealed, leak proof type.

6.4.20.1 Interference

a) Self-Generated Interference

Equipment shall not generate any type of interference at a level, which could be detrimental to the performance of any other equipment / component, or which could cause annoyance or discomfort to personnel.

The earthing and cabling arrangements shall be such that detrimental interference is not generated.

b) External Interference

In the presence of interference expected in substation environments, the design of the equipment shall be such that no damage occurs, and performance is maintained to the requirements of the individual specifications.

c) Spark Quenching

Spark quenching devices shall be fitted wherever necessary to ensure continued satisfactory operation of contacts and prevent mal operation of electronic devices.

d) Noise and Vibration

The acoustical noise levels and / or vibration produced by the equipment in operation shall be as low as is reasonably practicable for the type of equipment concerned and shall be agreed with the Employer's Representative.

6.4.20.2 Setting-Up and Maintenance Facilities

All equipment shall be provided with sufficient easily accessible test points to facilitate setting-up and fault location together with maintenance aids such as extension boards, jumper leads and special maintenance tools. Pin or terminal numbering of all cards in all crates shall be consistently uniform throughout. Power supplies shall use the same pin positions on all cards in an equipment or system.

6.4.20.3 Loose Equipment

Special connecting leads, extension boards and any special item required for calibration or maintenance purposes, together with the mating half of all necessary connectors shall be supplied.

6.4.20.4 Printed Circuit Boards

Printed circuit boards shall be epoxy glass fabric boards to comply with IEC - 60321 suitable for use in hot humid climates. Printed circuit boards may be single-sided, double-sided or multi-layer. Printed boards shall, in general, comply with IEC 60326. They shall not bow perceptibly when they are mounted in their shelves or racks. Means shall be provided to prevent boards being plugged into the wrong sockets and the plugging in / out action shall be arranged in a positive manner. An approved protective coat shall be applied to the printed circuit side of the board to protect against tracking,

tarnishing and general deterioration due to moisture and deposition of dust. The coating shall not have any adverse reaction with any other material or components used and shall be suitable for use under tropical conditions. When boards are repaired in the field it shall be possible to apply (or 'touch up') such a finish by simple convenient means.

6.4.20.5 Component Identification

- a) A component reference number shall be marked adjacent to each component. Where this is impossible, components shall be identifiable from the layout drawings provided.
- b) The following shall be marked in all instances:
 - i. Fuses
The rating and the circuit identification of each fuse shall be marked adjacent to the fuse base.
 - ii. Control, Protection, and Indication Devices
The function of each control, protection and indication device shall be marked. The caption and its arrangement shall be subject to the approval of the Employer's Representative.
 - iii. Preset Controls
The circuit reference and if possible, the function shall be marked adjacent to each preset control in a position where it will be clearly visible while the adjustment is being made.
 - iv. Connectors

The diagram reference number shall be marked on or adjacent to each connector.

- c) Test points shall be individually marked with the diagram reference number.
- d) The polarity of any polarized devices (e.g., diodes) shall be marked.

6.4.21 Test Terminal Blocks

Test terminal blocks, if any, shall be provided for secondary injection and testing of relays. A suitable metering block shall be provided where specified for the connection of a portable precision instrument to be operated when required for specific plant testing purposes.

6.4.22 Tests

The following routine tests shall be carried out on the assembled switchboard / panel during inspection at the manufacturer's works in addition to other tests as per applicable standards.

- (i) Primary injection tests to ensure correct ratios and polarity of current and voltage transformers and of the current operated protection relays and direct acting coils, over their full range of settings.
- (ii) Balance earth fault stability test by primary current injection. Care must be taken to reproduce accurately the burdens of interconnecting cables. A further test to ensure correct polarity must be made after assembly.
- (iii) Tests on auxiliary relays at normal operating voltages by operation of associated remote relays.
- (iv) Correct operation of sequencing and control circuits at normal operating voltages by operation of local control switches, and simulation of operation from remote control positions.
- (v) Carry out functionality tests, check interfacing status contacts and instrumentation.
- (vi) Checking of Differential protection relay.
- (vii) One minute power-frequency voltage dry withstand tests on the main circuits
- (viii) One minute power-frequency voltage dry withstand tests on auxiliary circuits
- (ix) Insulation resistance tests

All circuit breakers shall be subject to the following tests:

- (i) Routine tests including HV pressure test, millivolt drop tests and mechanical tests.
- (ii) To ensure the operation of the dc closing coil and satisfactory closing of the circuit breaker with the voltage of the coil down to 80% of its rated voltage, and that mal operation does not occur with a voltage on the coil of 120% of its rated voltage.
- (iii) Interchangeability of withdrawable identically equipped circuit breakers and checking of all mechanical and electrical interlocks.

Type test figures for heat test runs performed on identical panel types shall be made available.

6.5 MV AND LV MOTORS

All motors shall comply with IEC 60034, 60072/ IS 325, 4691, 6362,4029,12065, 12075, including standardsreferred to therein.

The technical parameters of main MV motors shall be as below:

Description	Unit	Particulars	
Type		Squirrel cage Induction motor (TETV or CACA)	
Rating	kW	(*)	(*)
Rated voltage	kV	6.6	
Synchronous speed	rpm		
Quantity	Nos.	As required	
Type of mounting		Vertical	
Duty type		Continuous (S1)	
Method of starting		By soft starter (Line or Neutral side)/Star/Delta	
Type of system earthing		Earthed through resistance to limit the earth fault current to1000 A.	
Class of insulation		F	
Design ambient temperature	°C	50	
Limits of temperature rise of winding			
- Determination by resistancemethod	°C	70	
- Determination by ETD method	°C	80	
Location		Indoor	
Degree of Protection		IP55	
Cooling designation		IC411	
Terminal box		Two terminal boxes (on opposite sides)	
External cable details		As Required	
Space heater for motor		Required	

(*) Value to be ascertained by the Contractor after submitting design calculations subject to

approval.The technical parameters of LV motors shall be as below:

Description	Unit	Particulars
Type		Squirrel cage Induction motor (TEFC)
Rating	kW	(*)
Rated voltage	kV	0.415
Type of mounting		Vertical / Horizontal (As required)

Description	Unit	Particulars
Duty type		Continuous (S1)
Method of starting		Direct online- for motors up to 7.5 kW Star-Delta (Close transition type) – For motors above 7.5 kW upto 55kW Soft Starter – For motors above 55kW
Type of system earthing		Effectively earthed
Class of insulation		F
Design ambient temperature	°C	50
Limits of temperature rise of winding		
- Determination by resistance method	°C	70
- Determination by ETD method	°C	80
Location		Indoor
Degree of Protection		IP55
Cooling designation		IC411
External cable details		As required
Space heater for motor		Required for rating 30kW and above

(*) Value to be ascertained by the Contractor after submitting design calculations subject to approval.

The LV motors shall be of the totally enclosed fan cooled type, with degree of protection for enclosure of IP 55 and shall be suitable for continuous operation and direct-on-line starting, unless otherwise specified. They shall be suitable in all respects for service in extreme climatic conditions. Main conductor and slot insulation shall be non-hygroscopic and in accordance with Class F of IEC 60085.

Motors shall be capable of operating continuously at rated output at any frequency between 49 and 51 Hz and at any voltage within + 10% of the nominal value. Motors shall be designed to be operated for a period of not less than five minutes at a voltage of 20% below the nominal value and at normal frequency without injurious overheating. The starting current at rated voltage when started direct-on-line shall not exceed 6 times the rated full load current. When started with soft starter it should be 2.5 to 3 times the rated full load current. The motor characteristics shall be co-ordinated with soft starter manufacturer. All bearings shall be fitted with oil or grease lubricators. Vertical shaft motors shall have thrust bearings. All terminals shall be of the stud type of adequate size for the particular duty, marked in accordance with an approved standard and enclosed in a weatherproof box. All terminal boxes shall be fitted with an approved sealing chamber, conduit entry or adapter plate, as required, together with the necessary fittings to suit the type of cable specified.

The power rating of the motors shall be larger of the following:

- 115% of the power input to the pump at duty point at a speed corresponding to a frequency of 50 Hz.
- Maximum power input while operating with maximum and minimum system resistance considering 4 to 12 pumps operating in parallel at a speed corresponding to a frequency of 50 Hz.

Motors shall be capable of starting and accelerating the load with the applicable method of starting, without exceeding permissible winding temperatures, when the supply voltage is 80% of the rated voltage. Motors shall be capable of satisfactory operation at a supply voltage of

80% of the rated voltage for 5 minutes, commencing from hot condition.

The locked rotor withstand time under hot conditions at 110% rated voltage shall be more than the starting time at minimum permissible voltage by at least two seconds or 15% of the accelerating time, whichever is greater. The locked rotor current of motors shall not exceed 600% of full load current of motor, which is inclusive of 20% tolerance. Motors when started with the drive imposing its full starting torque under the specified supply voltage variations shall be capable of withstanding at least two successive starts from cold conditions and one start from hot condition without injurious heating of windings. The motors shall also be suitable for three equally spread starts per hour under the above referred supply conditions. In case of motors started by soft starters, the three phases shall be segregated by metal barriers within both line and neutral side terminal boxes. The two terminal boxes shall be on opposite sides. The earthing pad shall be of non-corrodible metal, welded / brazed at two locations on opposite sides. The pad size shall be 75x65x25 mm with two holes drilled at 40mm centers, tapped and provided with suitable bolts and washers for connecting the earthing strip.

Motors shall have space heaters suitable for 230 V, single phase 50 Hz AC supply. These shall be placed in easily accessible positions in the lower part of motor frame. Provision shall be made to measure temperature of bearing by inserting handheld temperature measuring device. Motors shall have drain plugs so located that they will drain water, resulting from condensation or other causes from all pockets in the motor casing. Pockets shall be provided in the motor bearing housings for insertion of portable instrument probes for measuring bearing temperature. One portable handheld instrument per pumping station shall be provided for measuring motor bearing temperature. The same instrument shall also be used to measure the pump bearing temperature.

6.5.1 Insulation

Any joints in the motor insulation such as at coil connections or between slot and winding sections, shall have strength equivalent to that of slot sections of the coil. The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in extreme climate. The motors shall be provided with class F insulation with temperature rise limited to that of class B insulation.

6.5.2 Constructional Features

The motor construction shall be suitable for easy disassembly and re-assembly. The enclosure shall be sturdy and shall permit easy removal of any part of the motor for inspection and repair. Motors weighing more than 25 kg shall be provided with eyebolts, lugs or other means to facilitate safe lifting.

The rotor bars shall not be insulated in the slot portion between the inner core laminations for squirrel cage motors. At least six numbers. Resistance type temperature detectors (RTDs) each having a DC resistance of 100 ohms at 0 degree Celsius, embedded in the stator winding at locations, where highest temperatures may be expected, shall be provided. The material of RTDs shall be platinum.

6.5.3 Terminal Box

Terminal boxes shall be of weatherproof construction designed for outdoor service. To eliminate entry of dust and water, gaskets of neoprene or equivalent approved shall be provided at cover joints and between box and motor frame. It shall be suitable for bottom entry of cables. It shall be suitable of being turned through 3600 in steps of 900. The terminals shall be of stud type with necessary plain washers, spring washers and check nuts. They shall be designed for rated current carrying capacity and shall ensure ample phase to phase and phase to earth clearances. Suitable cable glands and lugs shall be supplied to match specified

cables. Separate terminal box shall be provided for termination of cables for RTDs.

6.5.4 Accessories

Two independent earthing points shall be provided on opposite sides of the motor for bolted connections. These earthing points shall be in addition to earthing stud provided in the terminal box.

6.5.5 Tests

Motors shall be subject to routine tests which shall also include the following:

- insulation resistance
- Measurement of winding resistance
- high voltage test
- no load / full load tests to determine efficiency, power-factor and slip
- momentary overload test
- test for noise levels of motor
- test for vibration severity of motor
- overspeed test
- locked rotor reading of voltage, current and power input at a reduced voltage.

Type test certificates for test runs performed on identical motors (below 11 kW rating) shall be made available. Whenever two nos. or more identical motors (above 11 kW rating) are being offered, type tests on one of them shall be carried out, including heat run test.

6.6 SOFT STARTERS FOR MV MOTORS

The soft starters shall comply with the requirements of IEC 60034, 60947 and IS 325 including those standards referred to therein.

Makes

The technical parameters of soft starters shall be as given below:

Description	Unit	Particulars
Type, Application and criteria for sizing		Automatic soft starter for (*)kW (Starting current to be limited to 2.5 to 3 times the rated current of the motor)
Connection		On phase/neutral side of stator winding
Quantity	Nos.	As required
Rated voltage	kV	6.6
Insulation levels		
Rated lightning impulse withstand voltage		
- Across the isolating distance	kV (peak)	46
- Phase to phase, between phases and across open switching devices	kV (peak)	40
Rated short duration power frequency withstand voltage		
- Across the isolating distance	kV (rms)	12
- Phase to phase, between phases and across open switching devices	kV (rms)	10
Installation		Indoor

Enclosure		
- Sheet steel thickness	mm	2
- Degree of protection		IP4X
- Color finish shade		Light Grey Semi Glossy
External cable details		As required
Type of cooling		Air cooled
Bypass arrangement	Required	By Vacuum contactor
Control supply	V	110V DC / 230 V AC as required for the control

(*) Value to be ascertained by the Contractor after submitting design calculations subject to approval.

6.6.1 Constructional and Performance Features

Motor soft starters shall be switched reactance type or flux compensated type or electronic type.

Soft starter panel shall be indoor, metal clad with separate metal enclosed compartments for

- a) control, metering and current transformers for differential protection, if specified
- b) shorting (bypass) arrangement
- c) bus bars
- d) power cable terminations
- e) push buttons with indicating lamps.

Soft starter shall achieve smooth starting by torque control for gradual acceleration of the drive thus preventing jerks and extending the life of equipment. Starting current shall be limited to 2.5 to 3 times the rated current of the motor. The soft starter manufacturer shall co-ordinate with motor manufacturer for this purpose. Separate removable gland plates shall be provided for power and control cables. Each cubicle shall be fitted with a label in the front and rear of the cubicle, indicating the panel designation, rating and duty. Each relay, instrument, switch, fuse and other devices shall be provided with separate labels. Necessary wiring diagram shall be provided considering starting interlock, trip circuit, starting and running mode signal. It shall be possible to manually start the motor locally from the starter panel or in Auto mode through PLC.

6.6.2 Main Bus bars

Bus bars shall be fully insulated by encapsulation in epoxy resin, with moulded caps protecting all joints. Bus bars shall be supported on insulators capable of withstanding dynamic stresses due to short circuit. Bus bars shall be of hard drawn copper conductor and of high conductivity, EC grade copper of 99.7% purity.

6.6.3 Earthing

A copper earthing bus shall be provided at the bottom and extended throughout the length of the panel. It shall be bolted / welded to the framework. All non-current carrying metal work of the panel shall be effectively bonded to the earth bus. Hinged doors shall be earthed through flexible earthing braid.

6.6.4 Panel Accessories and Wiring

Panel shall be supplied completely wired internally upto equipment and terminal blocks and ready for the external cable connections at the terminal blocks. Inter panel wiring between compartment of the same panel shall be provided. All auxiliary wiring shall be carried out with 1100 volts grade, single core, stranded copper conductor with PVC insulation. The sizes of wire shall be not less than 1.5 sq. mm. Terminal blocks shall be of stud type, 10 A rated,

complete with insulated barriers. Terminal blocks for CTs shall be provided with test links and isolating facilities. All spare contacts and terminals of cubicle mounted equipment and devices shall be wired to terminal blocks. Accuracy class for indicating instruments shall be 1.0 or better. Instruments shall be 110 mm square, 240 • scale

for flush mounting with only flanges projecting. Push buttons shall be provided with inscription plates engraved with their functions. Indicating lamps shall be of clustered LED type. Space heaters of adequate capacity shall be provided inside each panel. They shall be suitable for 230 V, 1 ph, 50 Hz supply. They shall be complete with MCB and thermostat. Each panel shall be provided with 230 Volts, 1 phase, 50 Hz, 5 A, 3 pin receptacle with MCB located in a convenient position. An interior illuminating lamp together with the operating door switch and protective MCBs shall be provided. The DC and AC auxiliary supply shall be distributed inside the panel with necessary isolating arrangements at the point of entry and with sub-circuit MCBs as required.

6.6.5 Tests

Each unit of soft starter shall be tested at the manufacturer's work. Test result must satisfy all the characteristics during starting and acceleration against their quoted values during bidding.

6.7 NEUTRAL EARTHING RESISTOR

Neutral earthing resistors shall comply with IEEE 32 including those standards referred to therein. The technical parameters of Neutral earthing resistors shall be as given below:

Description	Unit	Particulars
Application and criteria for sizing		For earthing of main transformer neutral and to limit the earth fault current on secondary side to 1000 A
Quantity	Nos.	2
Material of resistor		Wire wound – Stainless steel
Installation		Outdoor, Insulator mounted
Enclosure		
- Sheet steel thickness	mm	2
- Degree of protection		IP 34
- Color finish shade		Light Grey Semi Glossy
Type of cooling		Natural air cooled
Rated voltage	kV	6.6
Rated current	A	1000
Ohmic value	Ohm	(*)
Rated time	sec	10

(*) Value to be ascertained by the Contractor after submitting design calculations subject to approval.

6.7.1 Resistor Element

The element material shall possess a balanced combination of properties, uniformity of resistance and mechanical stability over the intended temperature range, without any injurious effects on the elements and its associated insulation. The resistor assembly shall be designed for a maximum temperature rise as per IEEE 32, Table 6, Column 7. The maximum operating temperature shall not be higher than 80% of the maximum design temperature.

6.7.2 Construction

The construction of the resistor assembly shall be such that the minimum required insulation

resistance is available under all atmospheric conditions. A space heater shall be provided, if necessary. The minimum degree of protection for the resistor enclosure shall be IP-34. The front and back covers shall be removable for access to internal resistor connection and for removal of resistor banks. The resistor shall be housed in a free standing and self-supporting metal enclosure suitable for installation in outdoor, extreme climatic conditions. The enclosure shall be suitable for mounting on insulators fixed on a 2.5m high structure. The resistor elements and the cable and earthing termination connection shall be insulated from the enclosure. The main and earth connection boxes and terminals shall be suitable for the cable specified and adequate space shall be provided for termination of cables. All cable terminations shall be bolted. Low melting alloys used to join connectors, which would be adversely affected by the resistor operating temperatures, shall not be used. All conductor terminations must be mechanically secured to provide continuous electrical continuity. Terminal box shall have a degree of protection of IP 55. Cable gland plates shall be made of non-magnetic material.

6.7.3 Tests

Type and routine test certificates including Quality Assurance Plan (QAP) for neutral grounding resistors shall be submitted for Employer Representative's approval.

6.8 CAPACITORS AND APFC PANEL

Capacitors shall comply with IEC 60871 and IS 5553, 13925 including those standards referred to therein. The technical parameters of capacitors shall be as given below:

MV Capacitors

Description	Unit	Particulars
Capacitor Bank		
Application		Power factor improvement
Type of insulation		Polypropylene (APP) / Mixed Dielectric (MD)
Rated output	kVAR	As required
Rated voltage	kV	6.6
Rated frequency and no. of phases	Hz / -	50, 3 Phase
Capacitor bank connection		Delta
Type of mounting and location		Floor mounted and Indoor
Design ambient temperature	°C	50
Type of switching		Manual
Color finish shade		Light Grey Semi Glossy
External cable details		As required

(*) Value to be ascertained by the Contractor after submitting design calculations subject to approval.

LV Capacitors and Control Panel

Description	Unit	Particulars
Capacitor Bank		
Application		Power factor improvement

Arrangement		Automatic Power Factor Correction (APFC)
Type of insulation		Polypropylene (APP) / Mixed Dielectric (MD)
Rated output	kVAR	(*)
Rated voltage	V	415
Rated frequency and no. of phases	Hz / -	50, 3 Phase
Capacitor bank connection		Delta
Type of mounting and location		Floor mounted and Indoor
Design ambient temperature	°C	50
Type of switching		Automatic
Control supply		110V DC
No. of steps for control	Nos.	Minimum 8
Degree of protection of enclosure		IP5X
Color finish shade		Light Grey Semi Glossy
Type of APFC relay		Microprocessor based automatic power-factor correction relay (maximum setting 0.99 lag)

(*) Value to be ascertained by the Contractor after submitting design calculations subject to approval.

MV capacitors shall be provided for connection across MV motor terminals while LV capacitors with APFC relay and a panel shall be provided for connection to LV switchboard bus, where specified.

6.8.1 Design Criteria

- MV capacitors – Capacitor rating shall be such that capacitor current is less than 90% of the magnetizing current of the motor or for improvement of rated motor power factor to 0.98, whichever is lesser.
- LV capacitors – Rated for improvement of power factor on LV side to 0.98

6.8.2 General

The capacitor bank shall be complete with all parts that are necessary or essential for efficient operation. Such parts shall be deemed to be within the scope of supply whether specifically mentioned or not. It shall be complete with the required capacitors along with the supporting post insulators, steel rack assembly, copper bus bars, copper connecting strips, foundation channels, fuses, fuse clips, etc. The steel rack assembly shall be hot dip galvanized. The capacitor bank shall comprise of suitable number of single-phase units in series parallel combination. However, the number of parallel units in each of the series racks shall be such that failure of one unit shall not create an over voltage on the units in parallel with it, which will result in the failure of the parallel units. The assembly of the banks shall be such that it provides sufficient ventilation for each unit. Each capacitor case and the cubicle shall be earthed to a separate earth bus. Capacitors shall be of polypropylene type. Each unit shall satisfactorily operate at 135% of rated kVAR including factors of over voltage, harmonic currents and manufacturing tolerance. The units shall be capable of continuously withstanding satisfactorily any over voltage up to a maximum of 10 % above the rated voltage, excluding transients. Each capacitor unit / bank shall be fitted with a directly connected, continuously rated, low loss discharge device, if required, to discharge the capacitors to reduce the voltage to 50 volts within one minute upon disconnection.

6.8.3 Unit Protection

Each capacitor unit shall be individually protected by a HRC fuse suitably rated for load current and interrupting capacity, so that only the faulty capacitor unit will be disconnected without causing the bank to be disconnected. An operated fuse shall give visual indication so that it may be detected during periodic inspection. The fuse breaking time shall co-ordinate with the pressure built up within the unit to avoid explosion. Mounting of the individual fuse should be internal to the capacitor case.

6.8.4 Capacitor (APFC) Control Panel for LV Application

APFC microprocessor-based relay shall automatically switch ON / OFF the capacitor banks to attain the value of 'pf' close to the set value. Switching shall follow first in first out (FIFO) method to ensure uniform use of all capacitor banks. At least eight steps shall be provided for switching. Harmonic filter (inbuilt with APFC panel) shall be provided to restrict Total Harmonic Distortion (THD) to 3% or less.

Capacitor and capacitor control shall be housed in a metal enclosed cubicle. Capacitor shall be housed in the lower compartment and capacitor control unit at the top compartment, the two compartments being segregated. The cubicle shall be fabricated out of 2 mm thick cold rolled sheet steel and shall of a degree of protection of IP 5X. The panel shall be of indoor type and shall consist of:

- a) Isolating MCCB
- b) Contactors with overload element
- c) Relays responsive to current / voltage / kVAR / pf for automatic switching
- d) Sequencing devices, timers and auxiliary relays for automatic sequential switching of capacitor units in and out of circuit
- e) Auto-manual selector switch
- f) Microprocessor based Automatic Power Factor Correction (APFC) Relay
- g) Push button for opening and closing the power circuit
- h) Red and Green lamps for capacitors ON / OFF indication
- i) Protective relays to protect the healthy capacitor units when one unit fails in a series connection
- j) Space heater and cubicle lighting

6.8.5 Tests and Test Reports

Capacitors shall be subjected to routine tests as per IS: 13925. Test for capacitor losses shall also be carried out on one capacitor bank of each type ordered.

In addition to the above, the capacitor units shall be subjected to the following tests:

1. Load test at 110% rated voltage at an ambient of 45 to 50 °C for a period of 8 hours or more.
2. Leak proofness test-initially after impregnation and total sealing, each capacitor shall be heated up to 80° C to 110° C for a few minutes. After the load test each capacitor unit shall be carefully inspected for leakage.

Type tests shall be carried out as per IS: 13925 on capacitors above 1000V rating of identical design. Certificates of type tests carried out in the last three years for similar capacitor units shall be furnished.

6.9 HV, MV AND LV CABLES

HV / MV / LV Cables shall comply with the following International Standards, including those referred to therein.

IEC 60183, 60227, 60502, 60885 and IS 7098, 5831, 8130, 1554, 10810.

The technical parameters of cables shall be as given below:

Description	Unit	Particulars
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HV and MV XLPE Power Cables		
Rated voltage U / U ₀ (U _m)	kV	As per requirement
Material of conductor		Aluminum (stranded)
Cross-sectional area		(*)
Type of insulation		XLPE
Inner sheath		Extruded
Outer sheath		Extruded
Conductor and insulation screening		Required
Material of armour		Galvanized Steel (Aluminum for single core cable)
LV Power, Control and Lighting Cables		
Rated voltage U / U ₀ (U _m)	kV	As per requirement
Material of conductor		Aluminum for Power and Tinned Copper for Control cable (stranded)
Cross-sectional area		(*)
Type of insulation		XLPE for power and PVC for control cables
Inner sheath		Extruded
Outer sheath		Extruded
Material of armour		Galvanized Steel (Aluminum for single core cable)
Cable Protection		Compound of outer sheath of all HV/MV/LV cables shall contain suitable chemicals for preventing attack by rodents.

(*) Value to be ascertained by the Contractor after submitting design calculations subject to approval.

6.9.1 Installation

- In air or buried in ground
- Depth of laying in ground 1000 mm for directly buried HV / MV cables and 750 mm for LV cables
- In conduit: space factor not more than 40 % (ratio of total cable area to internal conduit area)
- In trays: single layer with spacing of one diameter for HV / MV and main LV cables and touching for small LV cables

Control cables shall be 2C, 4C, 7C, 12C and 19C type. Minimum size of conductor for control cables shall be 2.5 sq.mm. copper. All power cables shall be sized based on continuous current capacity, maximum permissible voltage drop of 2.5% and rated short circuit current withstand. In addition, rating factors for variation in ground/air temperature, grouping of cables, depth of laying, number of racks, etc. shall be considered for cable sizing.

6.9.2 Tests

All HV, MV and LV cables shall be subject to routine tests in accordance with the relevant Indian Standard Specifications. Test certificates shall be provided against each drum and/or cable length. The tests carried out on every cable length and / or drum at manufacturer's premises shall include following tests as applicable but not limited to:

- high voltage dc insulation pressure test, between cores, each core to earth, metallic sheath or armor as applicable.

- insulation resistance test.
- core continuity and identification.
- conductor resistance test
- Elongation test
- Smoke density test
- HCl gas generation test
- Anti-rodent test (Presence of lead)

6.10 LV INDOOR SWITCHBOARD

LV indoor switchboard and its components shall comply with the following International Standards, including those referred to therein. IEC 60269, 60947, 61459, 60529 and IS 4237, 8623, 1248, 722, 2705, 3156, 10118, 11353, 13947 The technical parameters of LV switchboard shall be as given below:

Description	Unit	Particulars
General		
Rated voltage, no. of phases and rated frequency	V / - / Hz	415V, 3, 50Hz
System neutral earthing		Effectively Earthed
Rated short duration power frequency withstand voltage		
- Power circuit	kV (rms)	3.5
- Control circuit	kV (rms)	1.5
Rated normal current of bus bars under design ambient temperature of 50°C and material of busbar	A / -	(*)
Rated short-time withstand current and time	kA (rms) / sec	25 kA for 1 sec
Constructional Requirements		
Thickness of sheet steel in mm Cold rolled (Frame/Enclosure/Covers)	mm	Frame – 2.5 Doors/Covers – 2.0
Degree of protection of enclosure		IP-5X, Form-4 enclosure
Color finish shade		
- Interior		Glossy White
- Exterior		Light Grey
Cable connection		Bottom entry and exit

Description	Unit	Particulars
Circuit Breakers		
Type		Air
Rated current inside the cubicle under design ambient temperature at 50°C	A	(*)
Rated operating sequence		O–3 Min–CO-3 Min–CO
Rated short-time withstand current and time	kA (rms)/ sec	25(*)
Min. no. of auxiliary contacts		6 NO + 6 NC after internal use by manufacturer

Type of operating mechanism		
- Normal		Spring charging for closing and tripping
- Emergency		Manual and Spring charged for closing and tripping
Auxiliary control voltage		
- Closing coil / Tripping coil	V	110V DC
- Spring charging motor	V	110V DC
- Space heater and lighting	V	230V AC
Earthing switch		Required
Current and Voltage Transformers		
Details of ratio, taps, burden, accuracy		As per requirements
Protective Relays		
Type		Numerical (Microprocessor based)
Auxiliary supply	V	110V DC
Details of protective relays		As per requirements
Moulded Case Circuit Breakers		
Type		Moulded Case (microprocessor based)
Rated current when installed within cubicle under design ambient temperature of 50°C	A	As required (*)
Rated short-time withstand current	kA (rms)	25 kA
Miniature Circuit Breakers		
Type		Miniature
Rated current when installed within cubicle under design ambient temperature of 50°C	A	(*)
Rated short-time withstand current	kA (rms)	10
Motor Starters and Contactors		
Type		Star-Delta / Direct-on line
Rated current	A	(*)
Rated voltage of coil	V	230V AC / 110V DC
Utilization category		AC-3

(*) Value to be ascertained by the Contractor after submitting design calculations subject to approval.

These cover the main switchboard and distribution boards. The distribution board shall be of floor / wall mounting type. Entry for incoming and outgoing cables shall be from bottom. Bus bars shall be of copper. Degree of protection of the panel shall be IP 5X. The board shall be provided with circuits as required, ammeter with ammeter selector switch and voltmeter with voltmeter selector switch. Bidder shall furnish proposed single line diagram of the board along with the Bid Incoming and outgoing circuit shall be protected by suitably rated ACBs/MCCBs. The switchboard and its components shall be subjected to tests as per the applicable standards. The current rating of outgoing feeders of any switchboard shall not be less than 10% of

that of the incoming feeder. Deviation from this requirement shall be subject to the approval of the Employer's Representative.

6.10.1 Bus bars

The phase and neutral bus bars shall be of rating indicated in the corresponding single line diagram. Bus bars shall be of copper and shall be provided with minimum clearances as per standards. All bus bars and bus taps shall be insulated with close fitting sleeve of hard, smooth, dust and dirt free, heat shrunk PVC insulation of high dielectric strength, to provide a permanent non-ageing and non-tracking protection, impervious to water, tropical conditions and fungi. The insulation shall be non-inflammable and self-extinguishing type and in fast colors to indicate phases. The dielectric strength and properties shall hold good for the temperature range of 0 to 95 degree centigrade. If the insulating sleeve is not colored, bus bars shall be color coded with colored PVC tape at suitable intervals.

Bulbar joints, if any, shall be of the bolted type with minimum 4 bolts. Spring washers shall be provided to ensure good contact at the joints. Bus bars shall be thoroughly cleaned at the joints and suitable contact grease shall be applied just before making a joint. Direct access to, or accidental contact with bus bars and primary connections shall not be possible. All apertures and slots shall be protected by baffles to prevent accidental shorting of bus bars due to insertion of maintenance tools. Sequence of red, yellow and blue phases and neutral for four-pole equipment shall be left to right and top to bottom, for horizontal and vertical layouts respectively.

6.10.2 Moulded Case Circuit Breaker (MCCB)

MCCBs shall be of the air brake, quick make, quick break and trip free type and shall be totally enclosed in a heat resistant, moulded, insulating material housing. MCCBs shall have an ultimate short circuit capacity not less than the prospective short circuit current at the point of installation. MCCBs shall have a service short circuit breaking capacity equal to the ultimate short-circuit capacity. Each pole of MCCB shall be fitted with microprocessor-based protection for over current, earth fault and short circuit (L-S-I-G). Such a protection system shall be fully self-contained, needing no separate power supply. The elements shall be adjustable. Adjustments shall be made simultaneously on all poles from a common facility. MCCB shall be suitable for remote On-Off-Trip operation. Necessary spare auxiliary contacts (minimum 2NO+2NC) shall be provided for future use. Motor protection circuit breaker (MPCB) shall be used for motor feeder instead of MCCBs.

6.10.3 Miniature Circuit Breaker (MCB)

Miniature circuit breakers shall be of the thermal and magnetic tripping type and comply with IEC 60898 and IEC 60947-2. MCB shall be hand operated, air brake, quick make, quick break type. Operating mechanisms shall be mechanically trip-free from the operating knob to prevent the contacts being held closed under overload or short-circuit conditions. Each pole shall be fitted with a bi-metallic element for overload protection and a magnetic element for short-circuit protection. Multiple pole MCBs shall be mechanically linked such that tripping of one pole simultaneously trips all the other poles. For motor feeders, MCB shall have type C characteristics. The short circuit rating shall be not less than that of the system to which they are connected with a minimum of 10 kA.

6.10.4 Contactors and Starters

The power contactors used in the switchboard shall be of air brake, single throw, triple pole, and electromagnetic type. Contactors shall be suitable for uninterrupted duty and rated for Class AC3 duty in accordance with IEC 60947-4. Operating coils of all contactors shall be

suitable for operation on 230 V, single phase, 50 Hz supply. Contactors shall be provided with at least two pairs of NO and NC auxiliary contacts. Contactors shall not drop out at voltages down to 70 % of coil rated voltage. All motor contactors and their associated apparatus must be designed to operate for a period of not less than 5 minutes at a voltage of 20% below the nominal value and at normal frequency without injurious overheating.

Contactors shall be provided with a three element, positive acting, ambient temperature compensated, time lagged, hand reset type thermal overload relay with adjustable settings. The hand reset button shall be flush with the front door of the control module and shall be suitable for resetting the overload relay with the module door closed. Relays shall be either direct connected or CT operated. Overload relay and reset button shall be independent of the "Start" and "Stop" push buttons. All contactors shall all be provided with single phasing preventer (SPP). Motor starters shall be complete with auxiliary relays, timers, and necessary indications. Starters shall be of the electrically held-in type with integral "start" and "stop" push buttons mounted externally on the door, with integral interlocked isolators. Where required, auxiliary switches shall be included for the operation of "red" and "green" indicating lights in remote instrument panels. For details of other equipment/ accessories of LV switchboard (e.g., circuit breaker, current and voltage transformer, relay, constructional features of switchboard, earthing, annunciator, indicating and measuring instrument, control and selector switch, indicating lamp, push button, space heater, cubicle lighting/ receptacles, power and control cable termination, wiring, terminal blocks, etc.), refer specification of HV/MV switchboard.

6.10.5 Tests

The following routine tests shall be carried out on the assembled switchboard / panel during inspection at the manufacturer's works in addition to other tests as per applicable standards.

- (i) Primary injection tests to ensure correct ratios and polarity of current and voltage transformers and of the current operated protection relays and direct acting coils, over their full range of settings.
- (ii) Balance earth fault stability test by primary current injection. Care must be taken to reproduce accurately the burdens of interconnecting cables. A further test to ensure correct polarity must be made after assembly.
- (iii) Tests on auxiliary relays at normal operating voltages by operation of associated remote relays.
- (iv) Correct operation of sequencing and control circuits at normal operating voltages by operation of local control switches, and simulation of operation from remote control positions.
- (v) Carry out functionality tests, check interfacing status contacts and instrumentation.
- (vi) Checking of Differential protection relay.
- (vii) One minute power-frequency voltage dry withstand tests on the main circuits
- (viii) One minute power-frequency voltage dry withstand tests on auxiliary circuits
- (ix) Insulation resistance tests

All circuit breakers shall be subject to the following tests:

- (i) Routine tests including HV pressure test, millivolt drop tests and mechanical tests.
- (ii) To ensure the operation of the dc closing coil and satisfactory closing of the circuit breaker with the voltage of the coil down to 80% of its rated voltage, and that mal operation does not occur with a voltage on the coil of 120% of its rated voltage.
- (iii) Interchangeability of withdrawable identically equipped circuit breakers and checking

of all mechanical and electrical interlocks.

Type test figures for heat test runs performed on identical panel types shall be made available.

6.11 DC EQUIPMENT

DC equipment shall comply with IEC 60896 including those standards referred to therein.

6.11.1 Requirements

Following items shall be covered in the Contract:

- a) One no. 110 V Nickel Cadmium type Battery (Minimum capacity of Battery – 200AH)
- b) Two nos. Float-cum-boost chargers for 110 V battery
- c) DC distribution board.

All connections between battery, battery chargers and DC distribution board shall be designed for effective segregation between positive and negative leads.

6.11.2 110 V Battery

Battery offered shall be Nickel Cadmium (Ni-Cd) type. Nickel hydroxide and Cadmium hydroxide shall be used for positive and negative electrode respectively. Aqueous solution of Potassium hydroxide with small quantities of lithium hydroxide shall be used as electrolyte. It shall be used only for ion transfer and shall not chemically changed during charging/discharging. The containers shall be transparent and preferably be made of toughened glass or plastic and provided with acid level indicator. The battery shall be rated on 5-hour basis and for the specified ambient temperature. The battery shall have maximum recharge time of 8 hours. The batteries shall be sized for a backup of 24 hours, in case of power failure. The ampere-hour capacity shall be selected to cater to all the emergency loads, operation of control gear, indication lamps, annunciation panels, emergency lighting, incoming breaker(s) spring charging currents, short time loads etc. A margin of about 25% shall be taken to cater to the contingencies. Terminal posts shall be designed to accommodate external bolted connection conveniently and positively. Each terminal post shall have two bolt holes of the same diameter, preferably at right angles to each other. The bottom hole shall be used to terminate the inter-cell connection. The top hole shall be left for external terminal connections. Bolts, heads and nuts, except seal nuts, shall be hexagonal and shall be lead covered. The junction between terminal posts and cover, and between cover and container shall be so sealed as to prevent any seepage of electrolyte.

Required quantity of electrolyte for first filling with 10% extra shall be supplied in non-returnable containers. Each battery shall be complete with following accessories, as applicable, that include, but are not limited to:

- a) Battery racks
- b) Porcelain insulators, rubber pads, etc.
- c) Set of inter-cell, inter-tier and inter-bank connectors as required for the complete installation.
- d) Electrolyte for first filling + 10% extra.

Accessories for testing and maintenance

- | | | | |
|------|-------|---|--|
| i. | One | - | -3, 0, +3 volts DC voltmeter with built-in discharging resistor and suitable leads for measuring cell voltage. |
| ii. | One | - | Filler hole thermometer fitted with plug and cap and having specific gravity correction scale. |
| iii. | Three | - | Pocket thermometers |
| iv | Two | - | Cell lifting straps |

v	One set Each of	-	Terminals and cable boxes with glands for connecting cable asrequired. Spare connectors Spare vent plugs Spare nuts and bolts Suitable set of spanners
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Each battery shall be mounted in a manner that permits easy accessibility to any cell. The racks shall be suitable for fixing on flat concrete floor. The complete racks shall be suitable for bolting end to end. It shall be the responsibility of the Contractor to provide batteries of adequate capacities to meet specified requirements pertaining to control, indication, annunciation, etc. and emergency lighting. For computing battery capacity, it shall be assumed that the battery is fully charged at the beginning of loading cycle and is discharged to a voltage of 1.2 volts per cell at the end of the loading cycle.

The battery shall have minimal difference (approx. 0.3 V per cell) between float and boost charging voltages.

6.11.3 Battery Charger (110 V)

The float-cum-boost type battery charger shall comprise silicon-controlled rectifiers (SCRs) connected in a full wave bridge circuit. Each battery charger shall be suitable for float charging the battery under normal conditions and boost charging the battery when it has discharged during service conditions. The changeover from float to boost mode and vice versa shall be automatic. The rectifier transformer shall be dry type and double wound with required number of taps. The DC output voltage during float charging shall be stabilized within + 1% of the set DC bus voltage for AC input voltage variation of +10%, frequency variation of + 5% and DC load variation from 0 - 100%. The voltage regulation shall be achieved by a constant voltage regulator having fast response SCR control. The ripple content shall be within 1% of DC output nominal voltage with battery disconnected and shall be designed to have voltage regulation of 1%. Also, in any mode of operation, the maximum harmonics in the charger output shall not exceed 5%. The setting of the output DC bus voltage shall be adjustable between + 10% of nominal rated voltage. There shall be provision for manual control if automode fails. Line surge suppressers shall be provided. For boost charging the discharged battery after a mains failure, the rectifier shall charge the battery at high rate limited to the maximum boost charging voltage. The boost charging shall come on only when selected for boost mode manually. In auto control, the DC output current shall be stabilized within +2% for AC input voltage and frequency variation of + 10% and + 5% respectively. There shall be provision for manual control if auto-mode fails. Boost charging time for charging the battery to full capacity from fully discharged condition shall not exceed 8 hours.

In the float charging mode, the charger shall be designed for supplying:

- a) The DC loads of control, indication and annunciation circuits that remain energized during normal operation and the momentary closing and trip coil loads of circuit breakers, vacuum contactors; and
- b) The float charging current of the battery.
- c) 25% margin over the above load

Battery charging equipment complete with all accessories shall be housed in a free-standing sheet steel cubicle having degree of protection of IP 5X. Sheet steel used for construction shall be 2 mm thick. The units shall be wired using 1100 V grade, PVC insulated, stranded copper conductor cables.

Each battery charger shall be provided with accessories that include, but not limited to the following:

- a) Silicon controlled rectifiers connected in full wave bridge circuit with ripple control devices and transient suppression network.
- b) Double wound dry type transformer with taps
- c) Automatic voltage regulator unit with manual / auto control switch
- d) Coarse and fine control potentiometers for manual control
- e) Selector switch for mode of charging i.e., float charging / boost charging
- f) Off-load tap changing switch for changing the taps of the transformer
- g) DC voltmeter with fuses and a three-position selector switch
- h) DC ammeter with shunt
- i) AC ammeter with selector switch for incoming AC power
- j) AC voltmeter with selector switch for incoming AC power
- k) MCB for incoming AC supply along with surge suppressers
- l) Switch-fuse / MCB on DC output side with kick fuses and alarm contacts
- m) Voltage dropping diodes in load circuit during boost charging mode
- n) DC undervoltage relay and earth fault relay
- o) AC / DC switching relays for alarm and indication circuits including buzzer
- p) Cubicle space heater suitable for 230 V AC, 1 ph., 50 Hz supply, with MCB and thermostat
- q) 230 V AC compact fluorescent lamp fixture for internal

lighting with MCB Each battery charger shall be provided with the following alarms / indications:

- a) AC and DC supply 'ON'
- b) AC and DC supply fail
- c) Modes of charging
- d) Over voltage
- e) Under voltage on DC side
- f) Earth fault on DC side
- g) AC / DC MCB trip

The Bidder shall include in the bid, detailed AC and DC scheme for battery charger offered.

6.11.4 110 V DC Distribution Board (DB)

The distribution board shall be of floor mounting design. Entry for incoming and outgoing cables shall be from the bottom. Bus bars shall be of copper. Incomers, bus coupler and outgoing circuits shall be controlled by suitably rated double pole MCBs typesuitable for DC application. Contractor shall furnish proposed single line diagram of the board along with the Bid. Constructional features, pre-treatment, painting and other aspects shall comply with the specifications for LV switchboard. An earth bulbar of 25x3 mm copper flat shall be provided along the length of the DB at the bottom. Two nos. earthing terminals shall be provided on the external face of the board for connection to the earthing grid.

6.11.5 Tests

The batteries, chargers and distribution boards and their components shall be subjected to routine/ acceptance tests as per the applicable standards. For battery, following tests are also to be carried out:

- Capacity test

- Test for voltage charging and discharging
- Ampere-hour and watt-hour efficiency test

Certificates of type tests carried out on similar equipment shall be furnished.

6.12 LIGHTING SYSTEM EQUIPMENT

Lighting system shall comply with the following International Standards, including those referred to therein. IEC 60083, 60598, 60669, 60884, 60906 and 60947

General Requirements

Lighting system equipment shall cover lighting panels, lighting fixtures, switches, receptacles with switches, for outdoor lighting - lighting masts, street lighting poles, etc. Normal and emergency lighting for indoor and outdoor areas shall be provided. Supply for emergency lighting shall be derived from 110 V DC distribution board to be provided under this Contract. The Contractor shall provide emergency lighting in the vital installation including pump house, switchboard room, office building, administration areas, etc. 10% of the total normal lighting shall be emergency type.

Galvanized conduits shall be used for all exposed wiring and black enameled MS conduit shall be employed for all concealed wiring. Minimum size of conduit shall be 20 mm / 25mm for exposed / concealed conduits respectively. Wiring inside the pump house, switchboard room and other areas shall be concealed type. Wires used for conduit wiring of lighting fixtures / ceiling fans and receptacles shall be 250/440V grade, PVC insulated, single core, stranded copper conductor wires of sizes not less than 2.5 sq. mm and 4 sq. mm respectively. Wires shall conform to IS standards. Three individual wires with proper color coding (P-N-E) shall be used for wiring and no joint in wires between conduit is allowed. 3 core x 2.5 sq. mm. copper cable shall be used for circuiting of peripheral lighting.

6.12.1 Lighting Panels

Lighting panels shall be of wall mounting type and fabricated out of 1.6 mm. thick cold rolled sheet steel. Incomer circuit shall be controlled by a switch disconnector with a link in the neutral circuit. Outgoing circuits shall be controlled by single pole MCBs of minimum 10A rating and a link in the neutral circuit. TPN MCB shall be provided for street lighting/ area lighting purposes. Breaking capacity of MCBs shall not be less than 10 kA. Residual circuit breakers (RCCBs) shall be used on all lighting and receptacle circuits. It shall be possible to terminate incoming and outgoing circuits from top and bottom. Knock-out for cable / conduit entries for all the circuits shall be provided. Separate circuits shall be provided for control of lighting fixtures and receptacles. Each phase shall have at least one spare circuit. The panel shall be provided with 3 phase and neutral copper busbar adequately rated to cater to the requirement of all the outgoing circuits. Two earthing terminals shall be provided external to the panels for terminating the external earthing conductor. The panel shall be internally wired using color coded, stranded copper conductor, PVC insulated wires of 1100 V grade. The panels shall have hinged door, gasketed all round and provided with handle lock. Operation of incomer switch or MCBs shall be possible without opening the door. Detailed specification of lighting panel and its accessories (e.g., busbar, MCB, indicating instrument, indicating lamp, etc.) are described at MV and LV switchboard.

6.12.2 Lighting Fixtures and its Accessories

Lighting fixtures for illumination of outdoor and indoor areas shall be supplied. Fixtures for outdoor installation shall be of weatherproof design with degree of protection of IP65. The fixtures shall be suitable for operation on a nominal supply of 240 V, single phase, 50 Hz, AC

with a voltage variation of + 10 %. Fixtures shall be complete with internal wiring, lamp, capacitor, starter, holder, ballast, reflector, louvres / Perspex, etc. as required for their satisfactory operation. Fixtures shall be energy efficient, and ballast shall be electronic low loss type. All indoor lighting fixture for office and control room shall be decorative type and for remaining areas it shall be industrial type. All the lighting fixtures shall be of LED type. Size of wire chosen shall be such as to limit the voltage drop to within 3 %. Minimum area of conductor shall be 1.5 sq mm stranded copper for lighting and 2.5 sq mm / 4 sq mm for 5A / 15A receptacle circuits respectively, and current density shall not exceed 2.5 A/sq mm. Generally, not more than 8 to 10 lighting points shall be wired in one circuit. Wires belonging to different phases shall not be run in the same conduit. However, more than one circuit on the same phase can be run in the same conduit. For every phase wire, a separate neutral wire shall be run. Neutral wire for different phases shall not be looped. Street lighting fixtures for the approach road shall be weather-proof. The degree of protection shall be IP67. Street lighting control (switching ON and OFF automatically) shall be done by photo-electric sensor or by timer.

1200mm sweep ceiling fans shall be provided in areas such as offices, etc. as per design requirement. Adequate ventilation arrangements shall be made for enclosed areas where ceiling fans are not proposed to be installed or cannot be provided. Power supply for the ceiling fans shall be derived from lighting circuits. Ceiling fans shall be complete with all accessories. Regulators shall be electronic (trial) type. The work shall comprise wiring in heavy gauge (minimum 16 SWG) GI conduits, fixed and supported at intervals of 300 mm on walls, ceiling etc.; installation of light control switches and receptacles housed in GS boxes; earthing with 16 SWG copper wire run along the conduit and clamped to it at every 300 mm; and termination of cables/wires at lighting panels, light control switches, receptacles, lighting fixtures etc., as required. The minimum size of conduit shall be 20 mm. Space factor (ratio of total wire area to internal conduit area) shall be 40 %. Concealed conduiting shall be provided to all building / office areas. For pump house area, the Contractor shall adopt surface conduiting also. Receptacles and Switches – It shall be weather-proof for outdoor application. For Pump-house area and Switchgear room, industrial type receptacles with switch shall be provided. For Office areas, it shall be decorative type. 3 phase welding receptacles shall also be provided as per requirement. Types of fixtures proposed by the Contractor for various areas shall be subject to Employer's Representative approval. The lighting poles for streetlights shall be of tubular / swaged GI type steel poles, circular in construction. The brackets shall be welded to the pole and shall ensure a suitable overhang depending on height of the pole.

Junction boxes with terminals shall be supplied for branching and terminating the lighting cables, weatherproof and suitable for usage in outdoor areas. The junction boxes shall be dust and vermin proof and shall be fabricated from 2 mm CRCA sheet steel and shall be complete with removable cover plate with gaskets, two earthing terminals each with nut, bolt and washer. The Bidder shall provide support arrangement (through 25 x 4 mm GI flat U clamp) for proper fixing of the junction box to the pole. The boxes shall be hot dipped galvanized / painted with on shop coat of red oxide zinc chromate primer followed by a finishing coat of paint. Suitable rubber gaskets shall be provided on the doors of the junction boxes. The junction boxes shall have a locking facility, suitable to be opened by a common panel key for all the junction boxes. The boxes shall have provision for mounting on the poles. Suitable knockouts for the entry for cable / conduit entry shall be provided with terminal blocks, HRC fuses etc. The terminal blocks shall be mounted securely on brackets welded to the back sheet of the box. The terminals shall be 1.1kV grade, one piece construction complete with barriers, galvanized nuts, bolts, washers and provided with identification strips of PVC. The terminals

shall be made of copper alloy and shall be of box clamp type. Double compression brass glands shall be provided for entry / exit of the cables into the junction box.

6.12.3 Illumination Levels

Lighting system shall be designed to achieve the average maintained levels of illumination as indicated below. The Contractor shall be required to measure the actual levels and carry out necessary modifications to accomplish specified levels. It is to be noted that the values measured after installation will exceed those specified due to inclusion of light loss factor in the calculation. Measurement shall be carried out after 100 burning hours.

- | | | | |
|----|--------------------------------|---|-------------------------------|
| a) | Pump House | : | 250 lux |
| b) | Office / PLC_SCADA room | : | 400 lux |
| c) | Switchboard Room | : | 250 lux and main indoor areas |
| d) | All other indoor areas | : | 150 lux |
| e) | Switchyard area | : | 50 lux |
| f) | Outdoor plant/ Street lighting | : | 10 – 20 lux |

The illumination system shall be so designed that the uniformity factor is of acceptable level and that the glare is within limits. The ratio of maximum to minimum illumination levels shall not exceed 20 in outdoor area.

The following values of 'light loss factor' shall be considered for design:

- | | | | |
|----|-----------------------------|---|-----|
| a) | Indoor air-conditioned area | : | 0.8 |
| b) | Other indoor areas | : | 0.7 |
| c) | Outdoor area | : | 0.6 |

The Contractor shall furnish detailed design calculations, uniformity factors, ratio of maximum to minimum illumination levels, ratio of average to minimum illumination levels, glare values, etc. for approval. Detailed characteristics of various types of fixtures including photometric curves and tables shall also be furnished for review.

6.12.4 Receptacles with Switches

Adequate number of receptacles of 6A, 16A and 32A rating with MCBs suitable for operation on 230 V AC, 1phase, 50 Hz supply shall be provided as detailed below:

- a) Decorative and industrial type shall be proposed in relevant areas.
- b) Receptacles proposed for outdoor installation shall be of weatherproof design of degree of protection IP65.
- c) Single phase receptacle shall be provided with a switch / MCB of the same current rating, housed in the same enclosure. Three phase receptacles shall be associated with a MCB of the same rating, housed in the same enclosure. The number, type, rating and location of receptacle shall be subject to approval of the Employer's Representative.

6.12.5 Switches

Decorative / industrial type switches of 6A / 16A rating shall be provided for all indoor areas. Switches shall be provided to control a group of lighting fixtures in various areas. Switches shall be housed in galvanized steel boxes.

6.12.6 Desert Coolers

6.12.6.1 General

The Desert Coolers shall be of steel body complete with Fan, Motor, Filter Pads, Water

Pumps etc. suitable for operation 230 or 240 Volts $\pm$ 10 % single phase 50 Hz Ac supply confirming to IS-3315/1994. The pump set shall be confirming to IS 11981/87 with latest amendment.

6.12.6.2 Specifications

Technical parameters of components of desert cooler are as follows:

S. No.	Particulars	Capacity	
		4000 cum per hour	5000 cum per hour
1.	Overall Dimensions of the cooler		
	Width (measured along discharge grill side)	700 mm	770 mm
	Height	910 mm	950 mm
	Length	600 mm	770 mm
2	Air Grill Dimensions		
	Inside Dimensions (in mm)	505x505	525x525

S. No.	Particulars	Capacity	
		4000 cum per hour	5000 cum per hour
	Outside Dimension (in mm)	645x645	695x610
	Gross area of the grill (in sqm)	0.20	0.30
	Net area of the grill (in sqm)	0.20	0.29
3	Filter Pads		
	Area in (in sqm)	0.9	1.0
	Material of the Filter pads	Wood Wool	Word Wool
4	Tank Dimensions		
	Size of tank (in mm)	700x700x170	770x770x170
	Capacity of Tank	80 liters	80 liters
5	Maximum power consumption of the air cooler with load at rated voltage at zero static pressure condition	280W	350W
6	Nominal capacity at zero pressure (cum per hour)	4000	5000
7	Fan		
	Size/Dia (in mm)	450/500	525/550
	Material of Fan Blade	MS Sheet/ Aluminum	
	Speed of Motor ± 10 %	Single speed motor 900 rpm, two speed motorhigh speed 1300 rpm and low speed 1250 rpm	
	Horsepower	1/8 or 1/7	1/6 or 1/5
	Power Factor	0.9	0.9
	Type of enclosures of fan motor	Totally enclosed type (TE)	
	Maximum full load current of fan motors (amps)	1.3	
8	Pump		

	Type	Centrifugal Vertical Type(ISI marked)
	Output (Head)	1 meter
	Output (delivery)	7 liters per meter
	Maximum power consumption	45 watts
	HP	1/70
	RPM± 10 %	Minimum 1200 RPM
	Type of enclosures of pump motor	Totally enclosed type
	Make of pump motor	ISI
	Material of Pump Shaft	Stainless steel

6.12.7 Water Coolers

- Make Blue Star, Voltas, Godrej, Feder's Lloyd or equivalent as approved by Employer's Representative

6.12.7.1 General

Water cooler shall conform to IS 1475/78 with latest amendment suitable for operation on 230 volts $\pm 10\%$, 50 cycle's single phase AC supply. It shall be supplied with hermetically sealed type suction cooled compressor with overload protection conforming to IS 10167. It shall have cooling capacity of 40 liters per hour with storage capacity as 80 liters. The other technical parameters are as under:

Specifications

Sr. No.	Particulars	Parameter
1	Overall Dimensions of	
	Unit	
	Width	590 mm
	Depth	735 mm
	Height	1555 mm
	Tank	
	Width	485 mm
	Depth	455 mm
	Height	485 mm
2	Details of Cabinet	
	Material of Construction	CRCA Sheet/Coated GI
	Thickness	1 mm
	Surface Treatment	Powder Coated
	Type of finish	Structural
	Dimensions of SS front panel below water outlets	410mm X 465 mm
3	Details of pedestal	
	Material of construction	Stainless steel
	SS conforming	AISI 304
	Thickness	2.65 mm
	Method of securing to the cabinet	SS bolts washer and nuts
5	Rated voltage of water cooler	230 $\pm 10\%$ volts
6	Details of compressor	
	Capacity of compressor	900 Kcal per hour

	Max output of compressor motors	0.25 KW
	Rated	
	Current	3.1 (nominal) Amps
	Speed	2850 RPM
	Voltage	230±10 % volts
	Maximum full current of compressor	3.4 Amps
	Warranty of compressor	One year
	Class of insulation	B
	Power consumption (max) during operation under capacityrating test condition	575 watts

6.12.8 Tests

Lighting panels, fixtures, receptacles, and other accessories shall be subjected to routine and acceptance tests as per the applicable standards.

6.13 CABLING SYSTEM

INSTALLATION General

The scope shall cover, in addition to supply, complete installation of plant items and accessories as indicated in various parts of the specification. Requirements / guidelines / information / parameters / instructions, etc. specified in this section shall apply to all the sections. Installation work pertaining to plant items and systems such as cabling, lighting, earthing and lightning protection systems, etc. shall comply with the applicable standards, safety codes, etc. Installation shall be carried out strictly in accordance with the approved drawings. Changes, modifications, if any, required to suit site conditions, shall be carried out only with the prior approval of the Employer's Representative. All such changes shall be incorporated in the "As built" drawings to be furnished by the Contractor.

All tools, brazing equipment, crane, scaffolding, rigging materials, ladders, consumables, hardware, etc. required for installation shall be provided by the Contractor. It shall be the responsibility of the Contractor to engage Specialist Engineers from his Sub-Contractors / Manufacturers to supervise installation work for plant items such as transformers, switchboard, motors, etc. were felt essential. Such services shall be arranged by the Contractor at no extra cost to the Employer. It shall be the responsibility of the Contractor to obtain approval / clearance, if any, from local statutory authorities, for conducting any work for completed installation. The Contractor shall ensure that all plant under erection as well as the work area and the project site are kept clean to the satisfaction of the Employer's Representative. In case the Employer's Representative is not satisfied about the cleanliness, he will have the right to carry out the cleaning operations. Expenditure incurred by him in this regard will be to the Contractor's account. Packing cases and packing material, except for spares shall be cleared from sites.

In order to avoid hazards to personnel moving around the equipment, which is kept charged after installation before commissioning, such equipment shall be cordoned off by suitable barriers to prevent accidental injury. Switchboard shall be installed on finished surfaces. Proper aligning, joining of various vertical shipping sections, bulbar connections, inter panel wiring, etc. will be the responsibility of the Contractor. The Contractor shall take utmost care in handling instruments, relays, and other delicate mechanisms. Wherever the instruments and

relays are supplied separately, they shall be installed only after the erection of switchboards is complete.

6.13.1 Cabling System

All apparatus, connections and cable work shall be designed and arranged to minimize risk of fire and any damage, which might be caused in the event of a fire. Cables shall be laid directly buried in earth, on cable trays in built-up trenches, in conduits / pipes along walls / structures / foundations / ceilings, etc. The Contractor's scope of work includes unloading, excavation, laying, backfilling, fixing, bending, and terminating the cables. The Contractor shall supply the necessary material and accessories required for installation and termination of the cables which shall include but not be limited to items such as glands, lugs, terminating accessories, hardware, consumables, saddles / spacers, GI conduits / pipes, cable identification tags, protective bricks, civil materials, etc.

6.13.2 Buried Cables

Cable installation in outdoor areas shall be carried out in cable trenches. Where cable trench is not possible, the cable shall be directly buried. Stabilized thermal backfilling shall be used for directly buried cables. Cabling from trenches up to junction box / equipment, etc. shall be carried out in GI conduit / pipes of class B. Provision of GI pipe sleeves in trench wall shall be the Contractor's responsibility. Where cables crossroads or water / sewage pipes, the Contractor shall provide rows of 150 mm diameter GI pipes in a concrete block for passage of cables. Contractor shall also lay spare pipes for future use. Alternatively, Contractor shall provide concrete cable duct for road crossing. LV cables shall be buried at a depth of minimum 750 mm while HV and MV cables shall be buried at a depth of minimum 1000 mm. For road crossings, the pipe for the cables shall be buried at not less than one meter depth. Directly buried cables shall be laid on a 75 mm thick riddled and compacted earth bed. The cables shall then be covered on top and at their side with riddled earth to a depth of about 150mm. This shall then be gently pulled down to a depth of about 100 mm above the top of uppermost cable to provide bedding for the protective concrete cable covers, which shall be placed centrally over the cables. The protective cable covers shall be of reinforced concrete. The RCC covers shall have one hole at each end to tie them to each other with GI wires to prevent displacement. The trench should be then backfilled with the excavated soil and well rammed in successive layers of not more than 300 mm thick, with the trenches being watered to improve consolidation, wherever necessary. To allow for subsidence, a crown of earth not less than 50 mm in the center and tapering towards the sides of the trench should be provided. All cables to be routed along any route shall be laid at one time to avoid repeated excavation, etc. Each cable shall be tagged with numbers. The tag shall be of aluminum with the number punched on it and securely attached to the cable / conduits by not less than two turns of 20 SWG GI wire. Cable tags shall be of rectangular shape for power cables and of circular shape for control cables. Cables tags shall be provided on all cables at each end, on both sides of wall / floor crossings, on each duct / conduit entry, at each bend/ corner and at every thirty (30) meters in cables trench / tray racks on straight run. Where groups of HV, MV, LV and control cables are to be laid along the same route, suitable metallic barriers to segregate them physically shall be employed. When power cables are laid in the proximity of communication cables, minimum horizontal and vertical separation of 300 mm shall be maintained. Power and communication cables shall, as far as possible, cross at right angles to each other.

6.13.3 Cables in Trays

Cables in trays shall be cleated individually or in a group using GI saddles. Interval for cleating shall not exceed 1500 mm.

In case of laying on cable trays / racks, power and control cables shall be laid in separate cable trays, the order of laying of various cables being as given below:

- a) HV cables on top tiers
- b) LV cables on subsequent tiers
- c) Control, instrumentation, and other service cables in bottom-most cable tier.

Ladder type GI cable trays and painted rack support shall be installed in cable trenches for power cables. Perforated trays shall be used for control and instrumentation cables. Embedded flats for fixing cable tray support shall be provided in cable trenches to support the cable trays during civil works. Where such flats cannot be used, the fixing of cable trays shall be done using anchor fasteners. All cable trays shall be earthed at a regular interval. The cable trays shall be complete with all necessary coupler plates, elbows, tees, bends, reducers, stiffeners and other accessories and hardware. Cable trays and accessories such as tees, elbows, reducer, etc. shall be fabricated out of minimum 2 mm thick sheet of hot dip galvanized sheet except for trays of width 300 mm and lower for which 16 G GS sheet is acceptable. Bends, tees, etc. shall be supplied, as required. Cable tray supports such as angles, channels, etc. shall be of galvanized steel. Galvanizing thickness shall be not less than 85 microns.

6.13.4 Cable Pulling

The cables shall be laid in built-up trenches, directly buried in ground, or on cable trays, vertical raceways, clamped on structures / walls / ceiling, pulled through pipes and conduits, etc. The scope of cable installation shall include excavation and backfilling (in case of buried cable trench), laying, pulling of cables, proper dressing of cables on cable trays, racks, vertical raceways and supply and installation of cable tags, saddles, spacers and nylon cord for tying as required. The cost of supplying covers for cable route / joint markers, supply of sand and cover plates are included in the scope of the Contractor. Standard cable grips and reels shall be utilized for cable pulling. If unduly difficult pulling occurs, the Contractor shall check the pull required and suspend pulling until further procedure has been approved by the Employer's Representative. The maximum pull tension shall not exceed the recommended value for the cable measured by the tension dynamometer. In general, any lubricant that does not injure the overall covering and does not set up undesirable conditions of electrostatic stress or electrostatic charge may be used to assist in the pulling of insulated cables in conduit / pipes and ducts. After pulling the cable, the Contractor shall record cable identification with date pulled neatly with waterproof ink in linen tags / aluminum tag and shall securely attach such identification tags. Identification tags shall be attached to each end of each cable with non-corrosive wire. The wire must be non-ferrous material on single conductor power cable. Tags would further be required at intervals on long runs of cables on cable trays and in pull boxes. Cable and joint markers and RCC warning covers shall be provided wherever required.

Each cable shall be pulled into the particular conduit / pipe and shall be taken from the particular reel designated for the run. In hand holes, pull boxes or junction boxes having any dimension over 1000 mm, all conductors shall be cabled and / or racked in an approved manner. Care shall be taken to avoid sharp bending or kinking cables, damaging insulation or stressing cable beyond manufacturer's recommendations in pulling. Cable shall be protected at all times from mechanical injury and from absorption of moisture at unprotected ends. The bending radii for various types of cables shall not be less than 15 times the overall diameter of the cable for armoured cables and 20 times the overall diameter of the cable for unarmoured cables. Cables on cable racks and in conduits / pipes shall be formed to avoid bearing against edges of trays, racks, conduit / pipes, or their supports upon entering or leaving racks or conduit / pipes.

Cables splices shall not be used except were permitted by the Employer's Representative. Splices shall be made by Contractor for each type of wire or cable in accordance with the

instructions issued by cable manufacturers and the Employer's Representative. Before splicing, insulated cables shall have conductor insulation stepped and bound or penciled for recommended distance back from splices to provide a long leakage path. After splicing, insulation equal to that on the spliced conductors shall be applied at each splice. At cable terminal points, where the conductor and cable insulation will be terminated, terminations shall be made in a neat, skillful and approved manner by specially trained staff. Terminations shall be made by the Contractor for each type of wire or cable in accordance with instructions issued by cable manufacturers and / or the Employer's Representative. Control cable termination shall be made in accordance with wiring diagrams, using proper color codes for the various control circuit.

When control cables are to be fanned out and corded together with a cord, the Contractor shall make connections to terminal blocks, and test the equipment for proper operation before cables are corded together. If there is any doubt about correctness of connection, the Contractor shall make a temporary connection with sufficient length of cable so that the cable can be switched to another terminal without splicing. After correct connections are established, cables shall be cut to their correct lengths, connected to terminals in the specified manner, and corded together where necessary to hold them in place in a skillful manner. Jointing of cables shall be in accordance with relevant Standards and manufacturer's instructions. Materials and tools required for cable jointing work shall be supplied by the Contractor. Cables shall be firmly clamped on either side of a 'straight through joint' at a distance of not more than 300 mm away from the joints. Identification tags shall be provided at each joint at all cable terminations.

Where cables pass through floor or wall openings or other partitions, suitable bushes / pipe sleeves of GI shall be provided by the Contractor. The Contractor shall seal the cables at the bushes / pipe sleeves using fire resistant material. Cable seals shall be examined to ascertain if they are intact and that cable ends are not damaged. If the seals are found to be broken, the cable ends shall not be jointed until after due examination and testing under supervision of the Employer's Representative. Before joining is commenced, insulation resistance of both sections of cables to be jointed shall be checked by megger. In case of motor cables, after installation and alignment of motors, the Contractor shall complete the conduit / pipe installation, including a section of flexible conduit / pipe between motor terminal box and trench / tray, if necessary. The Contractor shall install and connect the power, control, and heater supply cables as per equipment manufacturer's drawings / instructions. The Contractor shall be responsible for correct phasing of the motor power connection and shall interchange connections at the motor terminal box, if necessary, after each motor is test run. Connections to recording instruments float switches, level electrodes, limit switches, pressure switches, thermocouples, thermostats, and other miscellaneous equipment shall be done as per manufacturer's drawings and instructions. In each cable run, some extra length shall be kept at a suitable point to enable one or two straight-through joints to be made, should the cable develop fault at a later date.

6.13.5 Conduits / Pipes

Where cable trench is not available, cables shall be laid in GI conduits / pipes routed along walls / columns / beams / steel structures or buried in concrete slabs, etc. to suit site conditions. GI conduits shall be Class C type. Supply and installation of GI conduits / pipes, their accessories such as bends, tees, couplers, etc., saddles, spacers, junction / marshalling boxes and GI hardware required for installation shall be included in the Contractor's scope. Interval between supports shall not exceed 500mm. For multiple cables, maximum utilization factor (ratio of total wire area to internal conduit area) shall be 50% of the conduit area. Non-

metallic conduits / pipes shall be used for single core cables of a 3 phase circuits.

6.13.6 Junction Boxes / Marshalling Boxes

Junction boxes / marshalling boxes shall be hot dip galvanized, weatherproof with IP 55 degree of protection, and shall be provided with cable glands for incoming and outgoing cables. The boxes shall be fabricated from 1.6 mm thick sheet steel and galvanized. The boxes shall be suitable for mounting on walls / columns / steel structures, etc. and shall be supplied with mounting accessories. The front covers of the boxes shall be removable and provided with gaskets. All the terminals shall be complete with insulated barriers, terminal studs, washers, nuts, etc. The boxes shall be effectively earthed.

6.13.7 Fireproof Sealing (FPS) System

Fireproof sealing system shall be provided and shall consist of

- a) Firestops / fire-seals for sealing of cable / cable tray and conduit / pipe penetrations, both horizontal and vertical, through brick or RCC walls / floors, to prevent the spread of fire from one area to other areas by fire-resistant barriers.

The FPS system shall also include all the necessary accessories and equipment required for supporting, holding in position, fixing and installation of the firestop. The FPS system shall comply in all respects with the requirements of the codes and standards mentioned herein IEC-331 and IEC-332.

6.13.7.1 Fire Stop / Seal

The FPS system adopted for cables or cable trays penetrating through walls and floor openings, or cables passing through embedded conduits / pipes / pipe-sleeves, constitutes a 'fire stop / seal', which is meant to prevent spreading of fire between areas separated by fire-resistant barriers.

6.13.7.2 Performance

Requirements

Requirement of fire stops

- i. The material, design and construction of the fire stops shall be such as to provide a fire-rating of 120 minutes for a fire on any side and meet all requirements listed in this specification and the relevant codes and standards.
- ii. The materials used in the fire stops shall be non-hygroscopic, compatible with the type of cables.
- iii. The fire stops shall be suitable for retrofitting of cables through the penetration seal without disturbing the sealing of the cables already existing.

6.13.7.3 Application of Fireproof Sealing System

- a) Fire stops

Fire stops shall be provided for cable penetration openings listed below

- i. The passage of cables / cable trays pipe sleeves / embedded conduits through walls / floors.
- ii. Vertical raceways, if any, which carry cables between successive floors, through openings provided in the RCC floor slab, shall be sealed by fire stops at each floor level.
- iii. Cable entry through openings in floor slabs.

Contractor shall furnish the test certificates for the fire stops after award of Contract for Employer's Representative review. If the certificates are not satisfactory, all the tests shall be conducted free of cost. The offered system i.e. fire stops and fire breaks shall be identical (or better) with the system which is successfully type tested for the specified rating i.e. the composition density of the material, thickness of coating in case of fire breaks and any other properties of the material / system offered shall be identical or better than the tested system

and shall be subject to Employer's Representative approval.

6.13.7.4 Performance Tests:

- a) The fire stops shall be subjected to the following type tests:
 - i. Fire Rating Test
 - ii. Hose Stream Test
- b) Type tests shall be conducted on different fire stop test specimens described above as per IEEE-634. The sizes of the fire stop test specimens shall be similar to the largest of the sizes being used in the plant.
- c) Preconditioning of fire stop test specimens
Before conducting the Fire Rating and Hose Stream tests, each test specimen shall be preconditioned for thermal ageing, water immersion and vibration.
- d) Test on Fire Stops
During the Fire Rating test, the transmission of heat through the cable penetration fire stop shall not raise the temperature on its unexposed surface above the self-ignition temperature of the outer cable covering, the cable penetration fire stop material, or material in contact with the cable penetration fire stop, with a maximum temperature limit on the unexposed surface of 200°C.

6.14 EARTHING AND LIGHTNING PROTECTION SYSTEM

Earthing and lightning protection system shall comply with the following International Standards, including those referred to therein. ANSI / IEEE Std. 80 and 142, IEC 61024 and IS 2309, 3043.

The scope includes measurement of electrical soil resistivity (during dry season) at site, supply of earthing conductors, earth electrode pits, lightning protection system and their installation including associated civil works as per the specifications and approved drawings, to the satisfaction of the Employer's Representative. The scope of works shall also comprise designing the earthing and lightning protection systems as per the applicable standards and specific design basis listed below:

- a) Average value of soil resistivity as measured for different electrode spacing, at site. (From 2 to 100 Meter or more in steps of 5, 10 Meter. At least 20 nos. readings shall be taken over the plant area, each in two different directions)
- b) Permissible values of step and touch potentials based on weight of human being as 70 kg and Earth fault current of 40 kA for 1 seconds
- c) Gravel with surface resistivity of 3000 ohm-m
- d) Depth of burial of earth conductors of 600 mm below ground level
- e) Ground resistance with only electrodes of maximum 1 ohm.
- f) Ground resistance of earthing grid of maximum 1 ohm
- g) Corrosion allowance of at least 20 %
- h) Earthing conductor material shall be copper, and electrode shall be of minimum 20 mm diameter and 3 m long.

Earthing system design and calculations shall be subject to Employer's Representative approval. Earthing and lightning protection system shall be provided to ensure equipment safety, personnel safety and to facilitate designed operation of protective devices during earth fault conditions in the associated system. The Contractor shall install bare earth conductors as required for the system and individual equipment earthing. All the work such as cutting, bending, supporting, drilling, brazing / soldering, clamping, bolting and connections to structures, equipment frames, terminals or other devices shall be in the Contractor's scope. All hardware and consumables such as fixing cleats / clamps, anchor fasteners, lugs, bolts, nuts, washers, brazing electrodes, flux, bituminous compound, anti-corrosive paint, etc. as required for the complete work shall be included by the Contractor. Tap connections (earthing leads) of more than 500 mm long, from main earthing grid to equipment shall be embedded in

the floor by the Contractor together with associated civil work such as chipping / chasing, concreting, and surfacing, etc. The concrete cover over the conductor shall not be less than 50 mm. The scope of installation of earth conductors in outdoor areas, buried in ground shall include excavation in earth up to 600 mm depth and 400mm width, laying of conductor at 600 mm depth, brazing as required of main grid conductor joints as well as riser's up to 500 mm above ground at required locations and backfilling. Backfilling material to be placed over buried conductor shall be free from stones and other mixtures. Backfill shall be placed in layers of 150 mm, uniformly spread along the trench, and compacted. If the excavated soil is found unsuitable for backfilling, the Contractor shall arrange for suitable material from outside. Earthing conductors in outdoor areas shall be laid 1500mm away from buildings. The scope of installation of earth conductors in outdoor areas buried in ground, shall include excavation of earth up to 600 mm depth, brazing / welding of main grid conductor, joints as well as risers of length 500 mm above ground at required locations and then backfilling. Wherever earthing conductor crosses underground service duct and pipes, it shall be laid 300 mm below them. If the distance is less than 300 mm, the earthing conductor shall be bonded to such service ducts / pipes. The scope of installation of electrodes shall include installation of electrodes in constructed earth pits and connecting to main buried earth grids. The scope of work shall include excavation, construction of the earth pits including all materials required for treatment (salt, charcoal, chemicals, etc.), placing the electrode and connecting to main earth grid conductors. The work of embedment of earthing conductor in RCC floors / walls along with provision of earth plate inserts / pads / earth risers shall be done by the Contractor preferably before the floors / columns / walls are cast. The embedded conductors shall be connected to reinforcing rods wherever necessary. The scope of installation of earthing leads to the equipment and risers on steel structures / walls shall include laying the conductors, brazing / cleating at specified intervals, brazing to the main earth grids, risers, bolting at equipment terminals and coating brazed joints by bituminous paint. Earthing and lightning protection system conductors along their run on walls / columns, etc. shall be cleated at an interval of 750 mm. Main earthing conductor shall be buried below the trench at crossing points. Metallic frames of all electrical equipment shall be earthed by two separate and distinct leads and then connected with earthing system. Neutral of a transformer shall be earthed to two separate earth electrode pits by two separate earth leads. Crane rails shall be connected to the earthing system. An earthing mat shall be provided under the operating handle of the disconnector. Operating handle of the disconnector and the supporting structure shall be bonded together by a flexible connection and connected to earth grid. Metal pipes and cable conduits shall be effectively bonded and earthed by earthing clamps efficiently fastened to the conduit at both ends. Neutral connection shall never be used for equipment earthing. A separate earth electrode shall be provided for each lightning arrester and for each lightning conductor down comer. Cable sheaths and screen shall be bonded to the earthing system. Armour of multicore cables shall be bonded to earthing system at both ends, while that of single core cables shall be earthed at source end only. The size of conductor for bonding shall be appropriate with the system fault current. Conduits, fixtures, junction boxes, etc. shall be bonded to the earthing system by 16 SWG diameter copper wire looped from lighting panel earth bus onwards. Outdoor lighting poles, junction boxes, etc. shall be earthed by 12 SWG copper wires. Street light pole and junction box shall be earthed with 12 SWG copper wires tapped off from the 25x3 mm GI earthing conductor to be laid along the street lighting cable. All metallic parts such as transformer, fence, gate, etc. shall be properly earthed. Wherever earthing conductor passes through walls, galvanized steel pipe sleeves shall be provided for the passage of earthing conductor. The pipe ends shall be sealed by the Contractor, by suitable water-proof compound. Water stops shall be provided wherever earthing conductor enters the building from outside below ground level. All connections in the main earth conductors buried in earth / concrete shall be brazed type. Connections between main earthing conductor and earth leads shall also be of brazed type. Connection between earth leads and equipment shall be by two bolts. Installation of lightning conductors on the roof of buildings shall include laying, anchoring, fastening and cleating of horizontal

conductors, grouting of vertical rods wherever necessary, laying, fastening / cleating / brazing of the down comers on the walls / columns of the building and connection to the test links to be provided above ground level.

Lightning protection system down-conductors shall not be connected to the conductors of safety earthing system above ground level. The lightning protection system for the structures shall be installed by forming a grid of exposed continuous earth conductors and taking down-comers along the walls/supports of the structure and terminating the same at earth pits. A separate earth electrode shall be provided for each lightning arrester and for each lightning conductor downcomer. The lightning protection system earth pits shall be inter-connected to form the safety earthing grid provided for the building / structure. The safety earthing grid shall be connected to the mains grid of the switch yard. The lightning protection air termination rods and / or horizontal air termination conductors shall be fixed in a firm manner. The necessary accessories such as cleats, clamps, brazing materials, bolts, nuts, shall be supplied by Contractor. Air termination systems shall be connected to earthing system by down conductors. There shall not be any sharp bends, turns and kinks in the down conductors. All joints in the down conductors shall be of brazed type. All metallic structure within 1 meter of down conductors shall be bonded to lightning protection system. Every down conductor shall be provided with a 'test link' mounted on wall / column at about 1000 mm above ground level housed in a 16 SWG GS enclosure. The test joint shall be directly connected to the earth electrode.

The lightning protection system shall not be in direct contact with underground metallic service ducts, cables, cable conduits and metal enclosures of electrical equipment. However, all metal projections, railings, vents, tanks, etc. above the roof shall be bonded together to form a part of roof grid.

Lightning protection system down conductors shall not be connected to other earthing conductors above ground level. In addition, no intermediate earthing connection shall be made to lightning arresters and transformer, whose earthing leads shall be directly connected to electrode pit.

Earth electrodes and pit

Treated earth pits shall comprise of treatment material such as salt and charcoal or any other conductivity enhancing compound. Treatment material placed around the electrode shall be finely graded, free from stones and other harmful mixtures. Backfill shall be placed in 150 mm thick uniformly spread and compacted layers. If excavated soil is found unsuitable for backfilling, the Contractor shall arrange for a suitable soil from outside. Earth electrodes shall be fabricated from minimum 20 mm diameter, 3m long, copper rod or 40 mm diameter, 3m long GI pipe. The minimum spacing between adjacent electrodes shall be 6 m. Design and constructional details of electrode pit shall be subject to the Employer's Representative approval. Electrodes shall, as far as practicable, be embedded below permanent moisture level. Test pits with concrete covers shall be provided for periodic testing of earth resistance. Installation of electrodes in test pits shall be suitable for watering. The necessary materials required for installation of test pits shall be supplied and installed by Contractor. The installation work shall also include civil works such as excavation / drilling and connection to main earth grid. Earth electrode pit marker shall be provided. Treated earth pits shall be treated with suitable treatment material mentioned above, if average electrical resistivity of soil is more than 20-ohm meter. Conductor size for connections to various equipment shall be as per the table as follows:

Equipment		Conductor Size
Motors	Up to 11 kW 11 kW up to 22 kW 22 kW up to 37.5 kW 37.5 kW to 90 kW 90 kW to 200 kW Above 200 kW	8 SWG GI wire 4 SWG GI wire 25 x 3 mm GI flat 25 x 6 mm GI flat 40 x 6 mm GI flat 50 x 10 mm GI flat
PCC		50 x 6 mm GI flat
PDB		50 x 6 mm GI flat
DG and other panel		50 x 6 mm GI flat
Local control station, street light pole and its junction box		8 SWG GI wire
All switchyard equipment		50 x 6 mm GI flat
Main earth grid		50 x 6 mm GI flat
Lighting Panel		25 x 3 mm GI flat
Indoor fixtures		14 SWG GI wire

All paint, scale etc. shall be removed before earthing connections are made. Anchor bolts or fixing bolts shall not be used for earthing connections.

**Government of Rajasthan
Water Resources Department**

TENDER DOCUMENT

**VOLUME–III
FINANCIAL BID**

For

***Construction of Kaliteer Lift Scheme, Dholpur on
Engineering, Procurement and Construction
Basis (single Responsibility Turn-Key project)
and its operation & maintenance for 8 years***

January 2023

Additional Chief Engineer,

Water Resources Zone, JLN Marg, JAIPUR

Fax No. - 0141-2702353

E-mail - acejpr.wr@gmail.com

(“Copy of appendix XI of PW”F & AR, Govt. of Rajasthan effective from 01.07.09 and subsequent addendum up to date. In case of any typographical error or omission or alteration the original version of the same shall be valid.”)

ARTICLE II GENERAL CONDITIONS OF CONTRACT

Clause 1 :Security Deposit.-

The security deposit @ 3% of the gross amount of the running bill shall be deducted from each running bill and shall be refunded as per rules on completion of the contract as per terms and conditions. The earnest money deposited shall however be adjusted while deducting security deposit from the first running bill of the contractor. There will be no maximum limit of security deposit.

A contractor may, however, elect to furnish bank guarantee or any acceptable form of security for an amount equal to the full amount of security deposit @ 3% of the work order before or at the time of executing the agreement. In that case, earnest money may be refunded only after furnishing of the bank guarantee as above. During the execution of the work or after completion of the work also a contractor may replace the security deposit by furnishing bank guarantee for an equal amount. However, during execution of the work if cost of work exceeds as shown at the time of furnishing bank guarantee, balance security deposit shall be deducted from the Running Account Bills.

All compensation of other sums of money payable by the contractor to Government under the terms of his contract may be deducted from or paid by the sale of a sufficient part of his ²[XXXX] Security Deposit, or from interest arising therefrom, or from any sums, which may be due or may become due to the Contractor by the Government on any account whatsoever, and in the event of his Security deposit being reduced by reason of any such deduction or sale as aforesaid, the Contractor shall within ten days thereafter, make good in cash or Bank Guarantee of Nationalized/Scheduled bank, as aforesaid, any sum or sums which may have been deducted from or raised by sale of his ²[XXXX] Security Deposit or any part thereof..

In case of Bank Guarantee of any Nationalized/Scheduled Bank is furnished by the Contractor to the Government, as part of the Security Deposit ³[XXXX] and the bank goes into liquidation or, for any reason, is unable to make payment against the said Bank guarantee, the loss caused thereby shall fall on the Contractor and the Contractor shall forthwith, on demand, furnish additional security to the Government to make good the deficit.

The liability or obligation of the bank under the Guarantee Bond shall not be affected or suspended by any dispute between the Engineer-in-charge and the Contractor, and the payment, under the Guarantee Bond by the bank to the Government shall not wait till disputes are decided. The bank shall pay the amount under the Guarantee, without any demur, merely on a demand from the Government stating that the amount claimed is required to meet the recoveries due or likely to be due from the Contractor. The demand, so made, shall be conclusive as regards to amount due and payable by the bank, under the guarantee limited to the amount specified in the Guarantee Bond. The guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.

The Bank Guarantee shall remain valid up to the specified date unless extended on demand by the Engineer-in-charge, which shall include the period of completion of the contract and the defect removal period as per terms of the Agreement. bank's liability shall stand automatically discharged unless a claim in writing is lodged with the bank within the period stated in the Bank Guarantee including the extended period. After satisfactory completion of the contract and clearance of all dues by the Contractor, the Chief Engineer or duly authority Engineer will discharge the bank Guarantee after expiry of the original or the extended period, as the case may be. In case the date of expiry of the Bank Guarantee is a holiday, it will be deemed to expire on the close of the next working day.

Government is not concerned with any interest accruing to the Contractor on any form of Security (primary of collateral) lodged by him with the bank or any sums payable to sureties obtained by the Bank as counter guarantee to secure its own position. These will be the matters between the Bank and the Contractor.

Clause 2 Compensation for delay

The time allowed for carrying out the work, as entered in the tender, shall be strictly observed by the contractor and shall be reckoned from the 10th day after date of written order to commence the work given to the contractor. If the contractor does not commence the work within the period specified in the work order, he shall stand liable for the forfeiture of the amount of earnest money and security deposit. Besides appropriate action may be taken by the Engineer in charge /competent authority to debar him from taking part in future tenders for a specified period or black list him. The work shall throughout the stipulated period of completion of the contract, be proceeded with all due diligence, time being essence of the contract on, the part of the contractor. To ensure good progress during the execution of work the contractor shall be bound in all cases in which the time allowed for any work exceeds one month (save for special jobs) to complete 1/8 of the whole of the work before ¼ of the whole time allowed under the contract has elapsed 3/8 of the work before ½ of such time has elapsed and ¾ th of the work before ¾ of such time has elapsed. If the contractor fails to complete the work in accordance with this time schedule in terms of cost

in money, and the delay in execution of work is attributable to the contractor, the contractor shall be liable to pay compensation to the Govt. at every time span as below:-

A- Time span of full stipulated period.	1/4th (days)	1/2th (days)	3/4th (days)	Full (days)
B- Work to be completed in terms of money.	1/8th (Rs.lacs)	3/8th (Rs. lacs)	3/4th (Rs.lacs)	Full (Rs.lacs)
C- Compensation payable by the contractor for delay attributable to contractor at the stage.	2.5% of scheduled work remained unexecuted on the last day of (1/4) time span.	5% of scheduled work remained unexecuted on the last day of (1/2) time span.	7.5% of scheduled work remained unexecuted on the last day of (3/4) time span.	10% of scheduled work remained unexecuted on the last day of contracted full period.

Note: - In case delayed period over a particular span is split up and is jointly attributable to government and contractor the competent authority may reduce the compensation in proportion of delay attributable to Government over entire delayed period over that span after clubbing up the split delays attributable to government and this reduced compensation would be applicable over the entire delayed period without paying any escalation. Following illustration is given.

1. First time span is of 6 months delay is of 30 days which is split over as under:

5 days (attributable to government) + 5days (attributable to contractor) +5days (attributable to government) +5days (attributable contractor) +5days (attributable to government) +5 days (attributable to contractor)
Total delays are thus clubbed to 15 days attributable to Govt. and 15 days attributable to contractor.

The normal compensation of 30 days as per clause 2 of agreement is 2.5% which can be reduced as $2.5 \times 15/30 = 1.25\%$ over 30 days without any escalation by competent authority.

The contractor shall, further, be bound to carryout the work in accordance with the date and quantity entered in progress statement attached to the tender.

In case the delay in execution of work is attributable to the contractor, the span wise compensation as laid down in this clause shall be mandatory However in case the slow progress in one time span is covered up within original stipulated period then the amount of such compensation levied earlier shall be refunded. The price escalation if any, admissible under clause 45 of conditions of contract would be admissible only on such rates and cost of work as would be admissible if work would have been carried out in that particular time span. The Engineer in charge shall review the progress achieved in every time span and grant stage-wise extension in case of slow progress with compensation, if the delay is attributable to contractor, otherwise without compensation.

However, if for any special job, a time schedule has been submitted by the contractor before execution of agreement and it is entered in agreement as well as same has been accepted by the Engineer in-charge, the contractor shall complete the work within the said time schedule. In the event of the contractor failing to comply with this condition he shall be liable to pay compensation as prescribed in forgoing paragraph of this clause provided that the entire amount of compensation to be levied under the provisions of this clause shall not exceed 10% of the value of the contract While granting extension in time attributable to the Government, reasons shall be recorded for each delay.

Clause 2A: Incentive for early completion:

In the event that the project (cost more than 50 crore) completion date occurs prior to the scheduled completion date (after taking into account any time extension approved by the competent authority for delay not attributable to the contractor), the contractor shall be entitled to receive a payment of incentive equivalent to 0.03% (zero point zero three percent) of the contract price for each day by which the project completion date precedes the scheduled completion date, but subject to a maximum of 3% (three percent of the contract price). Provided however, that the payment of incentive, if any, shall be made only after the issue of the completion certificate.

Note: Contract price for calculation of above incentive means original cost of work, plus cost of additional and extra items, if any, but excluding price variation/escalations granted, if any.

Clause 3 Risk & Cost Clause:

The Engineer-in-charge or the competent authority defined under rules may without prejudice to his right against the contractor, in respect of any delay or inferior workmanship or otherwise or to any claims for damages in respect of any breaches of the contract and without prejudice to any right or remedies under any of the provisions of this contract or otherwise and whether the date for completion has or has not

elapsed by notice in writing absolutely determine the contract in any of the following cases:-

- (i) If the contractor have been given by the Engineer in charge a notice in writing to rectify reconstruct or replace any defective work or that the work is being performed in any inefficient or otherwise improper or un work man like manner shall omit to comply with the requirement of such notice for a period of seven days thereafter, or if the contractor shall delay or suspend the execution of the work so that either in the judgment of the Engineer in charge (which shall be final and binding), he will be unable to secure completion of the work by the date for completion or he has already failed to complete the work by that date.
- (ii) If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor, shall be appointed or if circumstances shall arise, which entitle the court or creditor to appoint a receiver or a manager or which entitle the court to make a winding up order.
- (iii) If the contractor commits breach of any of the terms and conditions of this contract
- (iv) If the contractor commits any acts mentioned in Clause in 19 hereof.

When the contractor has made himself liable for action under any of the cases aforesaid, the Engineer in charge on behalf of the Governor of Rajasthan shall have powers:

- (a) To determine or rescind the contract as aforesaid (of which determination or rescission notice in writing to the contractor under the hand of the Engineer in charge shall be conclusive evidence upon such determination or rescission the earnest money full security deposit of the contract shall be liable to be forfeited and shall be absolutely at the disposal of Government.
- (b) To employ labour paid by the department and to supply material to carry out the work or any part the work debiting the contractor with the cost of the labour and price of the materials (of the amount which cost and price certified by the Engineer in charge shall be final and conclusive against the contractor, and crediting him with the value of the work done in all respect in same manner and at the same rates, as if it had been carried out by the contractor under the terms of this contract The certificate of the divisional officer as to the value of the work done shall be final and conclusive evidence against the contractor provided always that action under the sub clause shall only be taken after giving notice in writing to the contractor Provided also that if the expensed incurred by the department are less than amount payable to the contractor at his agreement rates, the difference shall not be paid to the contractor.
- (c) After giving notice to the contractor to measure up the work of the contractor and to take such part thereof, as shall be unexecuted out of his hands and to give it to another contractor to complete in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor if the whole work had been executed by him [of the amount of which excess the certificate in writing of the Engineer in charge shall be final and conclusive, shall be borne and paid by the original contractor and may be deducted from any money due to him by the government under this contact or any other account whatsoever or from his earnest money security deposit enlistment security or the proceeds of sales thereof or a sufficient part thereof as the case may be in the event of any one or more of the above courses being adopted by the Engineer in charge the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials of entered in to any engagement or made any advances on account or with a view to the execution of the work or the performance of the contract And, in case action is taken under any of provisions aforesaid the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer in charge has certified, in writing, the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

Clause:4 Contractor remains liable to pay compensation if action not taken under clause 3:

[I] In any case in which any of the powers conferred by clause 3 hereof shall have become exercisable and the same shall have not been exercised, the non-exercise thereof, shall not constitute waiver of any of the conditions hereof and such power shall notwithstanding be exercisable in the event of any future case of default by the contractor for which by any clause or clauses hereof, he is declared liable to pay compensation amounting to the whole of his security deposit / earnest money / enlistment security and the liability of the contractor for past and future compensation shall remain unaffected.

Powers to take possession of or require removal sale of contractor's Plant:

[ii] In the event of the Engineer in Charge putting in force powers vested in him under the preceding clause 3he may if he so desires take possession of all or any tools plants materials and stores in or upon the works or the site, thereof or belonging to the contractor or procured by him and intended to be used for the execution of the work or any part thereof, paying or allowing for the same in account at the contact rates or in case of these not being applicable at current market rates to be certified by Chief Engineer or duly

authorized Engineer [whose certificate thereof shall be final and conclusive] otherwise the Engineer in charge may by notice in writing to the contractor or his clerk of the works foreman or other authorized agent require him to remove such tools plants materials or stores from the premises [within a time to be specified in such notice]and in the event of the contractor failing to comply with any requisition the Chief Engineer or other dully authorized Engineer may remove them at the contractors expenses sell them by auction of private sale on account of the contractor and at his risk in all respects and the certificate of the Chief Engineer or other duly authorized Engineers as to the expenses of any such removal and the amount of the proceeds and expense of any such sale shall be final and conclusive against the contractor.

Clause 5 Extension of time

If the contractor shall desired an extension of time for completion of the work on the ground of his having being unavoidably hindered in its execution or on any other grounds he shall apply in writing to the Engineer in charge within 30 days of the date of the hindrance on account of which he desired such extension as aforesaid and the Authority Competent to the grant extension under the rules /delegations of powers or other duly authorized Engineer shall if in his opinion [which shall be final] reasonable ground shown therefore authorized such extension of time if any as may in his opinion be necessary or proper if the period of completion of contract expires before the expiry of the period of one month provided in this clause the application for extension shall be made before the expiry of the period stipulated for completion of the contact The competent authority shall grant such extension at each such occasion within a period of 30 days of receipt of application from the contractor and shall not wait for finality of work. Such extension shall be granted in accordance with provision under clause [2] of this agreement.

Clauses. 5A: Monthly return for Extra Claim:

Contractor has to submit a return every month for any work claimed as extra The contractor shall deliver the return in the office of the Executive Engineer and obtain, Receipt Number of the Receipt Register of the day on or before 10 day of every month during the continuance of the work covered by this contact, a return showing details of any work claimed as extra by the contractor which value shall be based upon the rates and prices mentioned in the contract or in the Schedule of Rates in force in the district for the time being The contractor shall be deemed to have waived all claims not included in such return and will have no right to enforce any such claim not included, whatsoever be the circumstances.

Clause 6 Final certificate:

On completion of work the contractor shall send a registered notice to the Engineer in charge giving the date of completion and sending a copy of it to the officer excepting the contract on behalf of the Governor and shall request the Engineer in charge to give him a certificate of completion but no such certificate shall be given nor shall the work be considered to be complete until the contractor shall have removed from the site on which the work shall be executed all scaffolding surplus materials and rubbish and cleared off the dirt from all wood work doors walls floors or other parts of any building in upon or about which the work is to be executed or of which he may have possession for the execution thereof, he had filled up the pits. If the contractor shall fail to comply with the requirements of this clause as to removal of scaffolding surplus materials and rubbish and cleaning off dirt and filling of pits on or before the date fixed for completion of the work the Engineer in charge may at the expenses of the contractor remove such scaffolding surplus materials and the rubbish dispose of the same as he thinks fit and clean off such dirt and fill the pits as aforesaid and contractor shall forthwith pay the amount of all expenses so incurred and shall have no claim in respect of any such scaffolding or surplus arterial as aforesaid except for any sum actually realized by the sale thereof On completion the work shall be measured by the Engineer in charge himself or through his subordinates, whose measurements shall be binding and conclusive against the contractor Provided that if subsequent to taking of measurements by the subordinate as aforesaid the Engineer in charge had reason to believe that the measurement taken by his subordinate are not correct the Engineer in charge shall have the power the cancelled the measurement already taken by his subordinate and acknowledged by the contractor and to take measurement again after giving reasonable notice to the contractor as such re measurements shall be binding on the contractor within thirty days of the receipt of the notice Engineer in charge shall inspect the work and if there is no visible defect on the face of work shall give the contractor, a certificate of completion. If the Engineer in charge finds that the work has been fully completed it shall be mentioned in the certificate so granted if on the other hand it is found that there are certain visible defect to be removed the certificate to be granted by Engineer in charge shall specifically mention the details of visible defects along with the estimate of the cost for removing these defects The final certificate of work shall be given after visible defects pointed out as above have been removed (delete whichever is not applicable). (Ten days will apply to works at the headquarters of Engineer-in-charge and thirty days for works at another place).

Clause 7 Payment of intermediate certificate to be re-granted as advance

No payment shall be made for works estimated to cost less than Rupees twenty five thousand till after the

whole of the work shall have been completed and a certificate of completion given But in the case of works estimated to cost more than Rupees twenty five thousand the contractor shall on submitting the bill therefore be entitled to receive a monthly payment proportionate to the part thereof then approved and passed by the Engineer in charge whose certificate of such approval and passing of sum so payable shall be final and conclusive, Running Account Bill shall be paid within 15 days from presentation But all such intermediated payments shall be regarded as payment by way of advance against the final payment only and not as payments for work actually done and completed and shall not preclude the requiring of bad unsound and imperfect or unskillful work to be removed and taken away and re constructed or re-erected or considered as an admission of the due performance of the contract or any part thereof in any respect or the accruing of any claim nor shall it conclude determine or effect in any way the powers of the Engineer in charge under these conditions or any of them as to the final settlement and adjustment of the accounts or otherwise or in any other way vary or affect the contract The final bill shall be made / submitted by the contractor within a one month of the date fixed for completion of the work otherwise the Engineer in charge's certificate of the measurement and of the total amount payable for the work accordingly shall be final and binding on all parties

Clause 7A: Time limit for payment of Final Bills:

The final bill shall be paid within 3 months on presentation by the contractor after issuance final completion certificate in accordance with clause 6 of the conditions of contract. If there shall be any dispute about any item[s] of the work, Then the undisputed item (s) only shall be paid within the said period of 3 months. If a final bill [which contains no disputed item or disputed amount of any item is not paid within the period of 3months from presentation of final bill or 6 months from the date of receipt of registered notice regarding completion of work in accordance with clause 6of the conditions of the contract the defects if any shall be brought to the notice of the higher authority The period of 3months is shall commence from the date of rectification of the defects. The higher authority shall ensure that in no case final bill should be left unpaid after 9 months from the receipt of registered notice regarding completion of work the contractor shall submit a memorandum of the disputed items along with justification in support within 30 days from the disallowance thereof and if he fails to do so his claims shall be deemed to have been fully waived and absolutely extinguished.

Clause:8 - Bills to be submitted monthly

A bill shall be submitted by the contractor each month on or before the date fixed by the Engineer in charge for all work executed in the previous month and the Engineer in charge shall take or cause to be taken the requisite measurement for the purpose of having the same verified and the claim as far as admissible authorized or paid if possible before the expiry of ten days from the presentation of the bill. If the contractor does not submit the bill within the time fixed as aforesaid the Engineer in charged may depute a subordinate to measure up the said work in the presence of the contractor whose signature in the measurement book will be sufficient warrant and the Engineer in charge may prepare a bill from such measurement book, which shall be binding on the contractor in all respect.

Clause 8A Contractor to be given time to file objection to the Measurements, recorded by the Department:

Before taking any measurement of any work as have been referred to the preceding clause 6,7&8 the Engineer in charge or a subordinate deputed by him shall give reasonable notice to the contractor. If the contractor fails to be present at the time of taking measurements after such notice or fails to sign or to record the difference within a week from the date of measurement in the manner required by the Engineer in charge then in any such event, the measurement taken by the Engineer in charge or by the subordinate deputed by him, as the case may be shall be final and binding on the contractor and the contractor shall have no right to dispute the same.

Clause 8B - Recovery of cost of preparation the bill:

In case of contractor of Class "A" and "AA" do not submit the bill with in time fixed, the Engineer in charge may prepare the bill as per provision of clause 8 of the condition of contract but deduction @ 0.5% of amount of such a bill shall be made & credited to the general revenue on account of preparation of bill.

Clause 9 - Bills to be on printed from:

The contractor shall submit all bills on the printed forms to be had on application at the office of the Engineer in charge and the charges in the bills shall always be entered at the rates specified in the tender or in the case of any extra work ordered in pursuance of these conditions and not mentioned or provided for in the tender at the rates hereinafter provided for such work.

Clause 9A Payments of Contractor's Bills to Banks:

Payments due to the contractor may if so desired by him be made to his Bank instead of direct to him provided that the contractor has furnished to the Engineer in charge [I] an authorization in the form of a

legally valid document such as a power of attorney conferring authority on the Bank to receive payments and [ii] his own acceptance of the correctness of the account made out as being due to him by Government or his signature on the bill or other claim preferred against Government before settlement by the Engineer in charge of the account of claim, by payments to the bank while the receipt given by such bank shall constitute a full and sufficient discharge for the payment the contractor should whenever possible present his bill duly receipted and discharged through his Banker Nothing herein contained shall operate to create in favor of the Bank any rights vis a vis the Governor.

Clause 10 Stores supplied by Government

If the specification or estimate of the work provides for the use of any special description of material, to be supplied from Engineer in charge's stores, or if it is required that contractor shall use certain stores to be provided by the Engineer in charge specified in the schedule or memorandum hereto annexed, The contractor shall be bound to procure and shall be supplied such material and stores as are, from time to time, required to be used by him for the purpose of the contract only, and the value of the full quantity of the material & stores, so supplied, at the rates specified in the said schedule or memorandum, may be set off or which may be deducted from any sum, then due or there after become due, to the contractor under the contract or otherwise or against or from the performance guarantee and or security deposit or the proceeds of sale, if the same is held in government securities, the same or a sufficient portion thereof being in this case, sold for this purpose. All materials supplied to the contractor, either from departmental stores or with the assistance of Government, shall remain the absolute property of Government. The contractor shall be the trustee of the stores / materials, so supplied / procured, and these shall not, on any account, be removed from the site of work and shall be, all times, open to inspection by the Engineer in charge. Any such material, unused & in perfectly good condition at the time of completion or determination or rescinding of the contract, shall be returned to the divisional officers stores, if by a notice in writing under his hand, he shall so require, and if on service of such notice, the contractor fails to return the materials, so required, he shall be liable to pay the price of such material in accordance with the provision of clause 10 B in bid. But the contractor shall not be entitled to return any such materials, unless with such consent, and shall have no claim for compensation on account of any such materials. So supplied to him as aforesaid being unused by him, or for any wastage in or damage to any such materials. For the stores returned by the contractor, he shall be paid for, at the price originally charged excluding storage charges, in case of material supplied from departmental stores and actual cost including freight, cartage taxes etc. paid by the contractor, in case of supplies received with the assistance of Government, which, however, should in no case exceed market rate prevailing at the time the materials are taken back. The decision of the Engineer in charge, as to the price of the stores returned, keeping in view its conditions etc, shall be final and conclusive. In the event of breach of the aforesaid condition, the contractor shall, in addition to the throwing himself open to account for contravention of the terms of the license or permit and /or for criminal breach of trust, pay to the Government, all advantage or profits resulting, or which in the usual course, would result to him by reason of such breach. Provided that the contractor shall, in no case be entitled to any compensation or damage on account of any delay in supply or non-supply thereof, all or any such materials and stores.

Clause 10A - Rejection of materials procured by the Contractor

The Engineer in charge shall have full powers to require the removal from the premises of all materials which in his opinion are not in accordance with the specifications and in case of default the Engineer in charge shall be at liberty to employ other person [s] to remove the same without being answerable or accountable for any loss of damage that may happen or arise to such materials to be substituted thereof and in case of default Engineer in charge may cause the same to be supplied and all costs which may attend such removal and substitution are to be borne by the contractor.

Clause 10B- Penal rate in case of excess consumption:

The contractor shall also be charged for the materials consumed in excess of the requirements calculated on the basis of standard consumption approved by the department at double of the issue rate including storage and supervision charges or market rate whichever is higher A Material Supply and Consumption Statement in prescribed Form RPWA 35A shall be submitted with every running Account Bill, distinguishing material supplied by the Government and material procured by the contractor himself The recovery for such material shall be made from Running Account Bill next after the consumption and shall not be deferred Certificate of such nature shall be given in each Running Account Bill.

Clause 10C - Hire of Plant and Machinery:

Special plant and Machinery required for execution of the work may be issued to the contractor, if available on the rates of hire charges and other terms and conditions as per departmental rules as per schedule annexed to these conditions Rates of such plant & Machinery shall be got revised periodically so

as to bring them at par with market rate.

Clause 11- Works to be executed in accordance with specifications drawing Order etc.

The contractor shall execute the whole and every part of the work in the most substantial and satisfactory manner and both as regards materials and otherwise in every respect in strict accordance with the Specification. The contractor shall also conform exactly fully and faithfully to the design drawings and instructions in writing relating to the work signed by the Engineer in charge and lodged in his office and to which the contractor shall be entitled to have access at such office or on the site of the work for the purpose of inspection during office hours and the contractor shall, if he so require, be entitled, at his own expense to make or cause to be made copies of specifications and of all such designs, drawings and instructions as aforesaid. A certificate of executing works as per approved design and specification etc. shall be given on each Running Account Bill.

The specification of work, material, methodology of execution, drawings and designs shall be signed by the Contractor and Executive Engineer while executing agreement and shall form part of agreement.

Clause 12:-

The Engineer in charge shall have power to make any alternations omissions or additions to or substitutions for the original specifications, drawings, designs and instructions that may appear to him to be necessary during the progress of the work and the contractor shall carry out the work in accordance with any instructions which may be given to him in writing signed by the Engineer in charge and such alterations omission additions or substitutions shall not invalidate the contract and any altered additional or substituted shall not invalidate the contract and any altered additional or substituted work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the contractor on the same conditions in all respects on which he agreed to do the main work. The time for the completion of the work shall be extended in the proportion that the altered additional or substituted work bears to the original contract work and the certificate of the Engineer in charge shall be conclusive as to such proportion. The rates for such additional altered or substituted work under this clause shall be worked out in accordance with the following provision in their respective order

- [I] If the rates for the additional altered or substituted work are specified in the contract for the work, the contractor is bound to carry out the additional, altered or substituted work at the same rates as are specified in the contract for the work
- [ii] If the rates for the additional altered or substituted work are not specifically provided in the contract for the work the such rates will be derived from the rates for a similar class of work as are specified in the contract for the work
- [iii] If the rates for the altered, additional or substituted work cannot be determined in the manner specified in the sub clause [I] to [ii] above, then the rates for such composite work item shall be worked out on the basis of the concerned schedule of rates of the District/area specified above minus/plus the percentage which the total tendered amount bears to the estimated cost of the entire work put to tender provided always that if the rate for a particular part of parts of the item is not in the schedule of rates, the rate for such part or parts will be determined by the Engineer in charge on the basis of the prevailing market rates when the work was done .
- [iv] If the rates for the altered, additional or substituted work item cannot be determined in the manner specified in sub clause [i] to [iii] above then the contractor shall within 7 days of the date of receipt of order to carry out the work, inform the Engineer in charge of the rate which it is his intention to charge for such class of work supported by analysis of the rate or rates claimed and the Engineer in charge shall determine the rate or rates on the basis of prevailing market rates, and pay the contractor accordingly. However, the Engineer in charge, by notice in writing, will be at liberty to cancel his order to carry out such class of work and arrange to carry it out in such manner as he may consider advisable. But under no circumstances, the contractor shall suspend the work on the plea of non-settlement of rates on items falling under the clause.
- [v] Except in case of items relating to foundation, provisions contained in sub clauses (i) to (iv) above shall not apply to contract or substituted items as individually exceed the percentage set out in the tender documents under clause 12.A.

For the purpose of operation of clause 12 (v) the following works shall be treated as work relating to foundations:-

- [a] For buildings, compound wall, plinth level or 1.2 meters (4feet) above ground level whichever is lower excluding items above flooring and D.P.C. but including base concrete below the floors.
- [b] For abutments, piers, retaining wall of culverts and bridges, walls of the water reservoir and the bed of floor level.

- [c] For retaining walls, where floor levels is not determinate 1.2 meters above the average ground level or bed level.
- [d] For roads, all items of excavation and filling including treatment of sub base and soling work.
- [e] For water supply lines, sewer lines underground' storms drains and similar work, all items of work below ground level except items of pipe work for proper masonry work.
- [f] For open storm water drains, all items of work except lining of drains.
- [g] Any other items of similar nature which Engineer in charge may decide relating to foundation.

The rates of any such work, except the items relating to foundations, which is in excess of the deviation limit shall be determined in accordance with the provision contained in clause 12 A.

Clause 12A

The quantum of additional work for each item shall not exceed 50% of the original quantity given in the agreement and the total value of additional work shall not exceed 20% of the total contract value unless otherwise mutually agreed by the Engineer in charge and the contractor This limit shall not be applicable on items relating to foundation work which shall be executed as per original rates or provision of clause 12[I] to [iv].

In case of contract substituted items or additional items, which results in exceeding the deviation limit laid down in this clause except items relating to foundation work which the contractor is required to do under clause 12 above the contractor shall within 7 days from the receipt of order claim revision of the rate supported by proper analysis in respect of such items for quantities in excess of the deviation limit notwithstanding the fact that the rates for such items exist in the tender for the main work or can be derived in accordance with the provision of sub clauses [ii] of clause 12 and the Engineer in charge may revise their rates having regard to the prevailing market rates and the contractor shall be paid in accordance with the rates so fixed The Engineer in charge shall however be at liberty to cancel his order to carry out such increased quantities of work by giving notice in writing to the contractor and arrange to carry it out in manner as he may consider advisable But under no circumstance, the contractor shall suspend the work on the plea of non-settlement of rates of items failing under this clause.

All the provisions of the preceding paragraph shall equally apply to decrease in rates of items for quantities in excess of the deviation limit notwithstanding the fact that the rates for such item exist in the tender for the main work or can be derived in accordance with the provisions of sub clause [ii] of the preceding clause 12 and the Engineer in charge may revise such rates having regard to the prevailing market rates unless otherwise mutually agreed by the Engineer in charge and the contractor

Clause 13: No compensation for alternations in or restriction of work to be Carried out:

- 5 If, at any time after the commencement of the work, the Government shall, for any reason whatsoever not require the whole work, thereof, as specified in the tender, to be carried out the Engineer in charge shall give notice in writing of the fact to the contractor who shall have no claim to any payments or compensation whatsoever on account of any profit or advantage, which he might have derived from the execution of the work in full which he did not derive in consequences of the full amount of the work not having been carried out Neither shall he have any claim for compensation by reason of alterations having been made in the original specifications, drawing and design and instructions which shall involve any curtailment of the work as originally contemplated provided that the contractor shall be paid the changes for the cartage only of materials actually brought to the site of the work by him for benefited use and rendered surplus as a result of the abandonment or curtailment of the work or any portion thereof and taken them back by the contractor provided however that the Engineer in charge shall have in all such cases the option of taking over all or any such materials at their purchase price or at local market rates whichever may be less in the case of such stores, having been issued from Government stores charges recovered including storage charges shall be refunded after taking into consideration any deduction for claim on account of any deterioration or damage while in the custody of the contractor and in this respect the decision of the Engineer in charge shall be final.

Clause 14: Action and compensation payable in case of bad work:

If it shall appear to the Chief Engineer or any authorized authority or the Engineer in charge or his subordinates in charge of the work or to the committee of retired officer/officers appointed by the State Government for the purpose that any work has been executed with unsound, imperfect or unskillful workmanship or with material of any inferior description or that any materials or articles provided by him for the execution of the work are unsound or of a quality inferior to that contracted or otherwise not in accordance with contract the contractor shall on demand in writing from the Engineer-in-charge specifying the work/ materials or articles complained of, notwithstanding that the same may have been inadvertently passed certified and paid for will rectify or remove and reconstruct the work so specified in whole or in part as the case may be, remove the materials or articles, so specified and provide other proper and suitable

materials or articles at his own cost and in the event of his failing to do so, within a period to be specified by the Engineer in charge in his demand as aforesaid than the contractor shall be liable to pay compensation at the rate of one percent on the tendered amount of work for every week not exceeding ten percent while his failure to do so shall continue and in the case of any such failure the Engineer in charge may rectify or remove and re execute the work or remove and replace with others the materials or articles complained of as the case may be at the risk and expense, in all respects of the contractor

Clause 15 Work to be open to inspection: Contractor or his responsible Agent to be present:

All work under or in course of execution or executed in pursuance of the contract shall at all times be open to inspection and supervision of the Engineer in charge and his superior officer e.g. Superintending Engineer Additional Chief Engineer Chief Technical Engineer, Chief Engineer and his subordinates and any other authorized agency of the Government and the contractor shall at all times during the usual working hours and at all other times at which reasonable notice of the intention of the Engineer in charge or his subordinate and any other authorized agency of Government or committee of retired officer/ officers appointed by the state Government for the purpose to visit the work shall have been given to the contractor either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing, present for the purpose Orders given to the contractors agent shall be considered to have the same force as if they had been given to the contractor himself.

Clause 16: Notice to be given before any work is covered up:

The contractor shall give not less than 7days notice, in writing, to the Engineer-in- charge or his subordinate in charge of the work, before covering up or otherwise placing beyond the reach of measurement. any work in order that the same may be measured and correct dimensions thereof be taken before the same is so covered up or placed beyond the reach of measurement and shall not cover up or place beyond the reach of measurement any work without the consent in writing of the Engineer in charge of the work and if any work, shall be covered up or placed beyond the reach of measurement without such notice having been given or consent obtained the same shall be uncovered at the contractor's expenses or in default, thereof, no payment or allowance shall be made for **such work, or for the materials, with which the same was executed.**

Clause 17 Contractor liable for done and for imperfections:

If the Contractor or his work people or servants shall break deface injure or destroy any part of a building in which they may be working or any building road fence enclosure or cultivated ground contiguous to the premises on which the work or any part of it is being executed or if any damage shall happen to the work while in progress from any cause whatsoever or any imperfections become apparent in it within a period specified in clause 37 after a Certificate final or otherwise of its completion shall have been given by the Engineer in charge may cause the same to be made good by other workmen and deduct the expensed [of which the certificate of the Engineer in charge shall be final] from any sums that may be then or at any time thereafter may become due to the contractor or from his security deposit or the proceeds of sale thereof or a sufficient portion thereof .

Clause 18 Contractor to supply plant, Ladders, Scaffolding etc.

The contractor shall arrange and supply at his own cost all material (except such special materials, if any, as may in accordance with the contract, be supplied from the Engineer in charge s store] Plants tools appliances implements ladders cordage tackle scaffolding and temporary works requisite or proper for the proper execution of the work whether original altered or substituted and whether included in the specification or other documents forming part of the contract or referred to in these conditions or not or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer in charge as to any matter as to which under these conditions he is entitled to be satisfied or which he is entitled to require together with carriage thereof to and from the work The contractor shall also arrange and supply without charges the requisite number of persons with the means and materials necessary for the purpose of setting out work and counting weighing and assigning in the measurement or examination at any time and from time to time of the work or materials Failing his so doing the same may be provided by the Engineer in charge at the expense of the Contractor and the expenses may be deducted from any money due to the contractor under the contract or from his performance guarantee and/or security deposit or the proceeds of sale thereof or a sufficient portion thereof The contractor shall also provide all necessary fencing and lights required to protect the public from accident and shall be bound to bear the expenses of defense of every suit action or other proceeding at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay to pay damages and costs which may be awarded in any such suit action proceeding to any such person or which may with the consent of the contractor, be paid to compromise any claim by any such person

Clause19: Work not to be sublet contract may be rescinded and Security Deposit and Performance forfeited for subletting bribing or if Contractor becomes insolvent

The contract shall not be assigned or sublet without the written approval of the Chief Engineer, and if the contractor shall assign or sublet his contract or attempt so to do or become insolvent or commence any insolvency proceedings or make any composition with his creditors or attempt so to do or any bribe gratuity gift loan requisite reward or advantage, pecuniary or otherwise, shall either, directly or indirectly, be given promised or offered by the contractor or any of his servants or agents to any public officer or person in the employ of Government, in any way relating to his office or employment or if any such officer or person shall become, in any way, directly or indirectly, interested in the contract the Chief Engineer may, thereupon by notice, in writing, rescind the contract and the Performance Guarantee and Security Deposit of the contractor shall thereupon, stand forfeited and be absolutely at the disposal of Government and the same consequence shall ensue as if the contract has been rescinded under clause 3 here of and in addition the contractor shall not be entitled to recover or paid for any work therefor, actually performed under the contract.

Clause 20: Sums payable by way of compensation to be considered as reasonable compensation without reference to actual loss:

All sums payable by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied to the use of Government without reference to the actual loss or damage sustained and whether or not any damage shall have been sustained.

Clause 21: Changes in Constitution of firm:

Where the contractor is a partnership firm, the previous approval in writing, of the Engineer in charge shall be obtained before any change is made in the constitution of the firm Where the contractor is an individual or a Hindu Undivided family business concern such approval as aforesaid shall likewise be obtained before the contractor enters into any partnership agreement where under the partnership firm would have the right to carry out the work there by undertaken by the contractor. If previous approval as aforesaid is not obtained the contract shall be deemed to have been assigned in contravention of clause 19 thereof, and the same action may be taken and the same consequence shall ensue as provided in the said clause 19

Clause 22 Works to be under Direction of Engineer in charge.

All the works to be executed under the contract shall be executed under the direction and subject to the approval in all respect of the Engineer in charge of the government of Rajasthan for the time being who shall be entitled to direct, at what point or points, and in what manner, they are to be commenced and from time to time carried on.

Clause 23 Standing Committee for Settlement of dispute:

If any question difference or objection whatsoever shall arise in any way, in connection with or arising out of this instrument or the meaning of operation of any part thereof or the rights duties or liabilities of either party then, save in so far as the decision of any such matter as herein before provided for and been so decided such matter constructing a total claim of Rs 50,000/- or above, whether its decision has been otherwise provided for and whether it has been finally decided accordingly, or whether the contract should be terminated or has been rightly terminated and as regards the right or obligations of the parties as the result of such termination, shall be referred for decision to the empowered Standing Committee, which would consist of the following:

- [i] Administrative Secretary concerned,
- [ii] Finance Secretary or his nominee not below the rank of Deputy Secretary and/or Chief Accounts officer.
- [iii] Law Secretary or his nominee, not below the rank of Joint Legal Remembrancer.
- [iv] Chief Engineer cum Add. Secretary of the concerned department.
- [v] Chief Engineer /Addl. Chief Engineer concerned [Member Secretary]

The Engineer in charge on receipt of application along with nonrefundable prescribed fee [the fee would be two percent of the amount in dispute, not exceeding Rs One Lac] from the contractor shall refer the disputes to the committee within a period of **three month** from the date of receipt of application Procedure and application for referring cases for settlement by the Standing Committee shall be as given in Form RPWA 90.

(विवाद जिसको निस्तारण हेतु स्टेपिंग कमेटी के समक्ष रखा जाना है, New work process (online) के अन्तर्गत अधिशाषी अभियंता के द्वारा कार्य की प्रगति एवं बिल के सत्यापन की दिनांक से 90 दिवस की समय सीमा में इंजिनियर इंचार्ज के समक्ष प्रस्तुत किया जा सकता है।)

Clause 23A- Contractor to indemnify for infringement of patent or Design

Contractor shall fully indemnify the Governor of Rajasthan against any action claim or proceeding relating

to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the contract, in the event of any claims made under or action brought against Government in respect of any such matters as aforesaid the contractor shall be immediately notified thereof, and the Contractor shall be at liberty at his own expense to settle any dispute or to conduct any litigation that may arise there from provided in that the contractor shall not be liable to indemnify the Governor of Rajasthan if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the Engineer in charge in this behalf

Clause 24 imported store articles to be obtained from Government:

The Contractor shall obtain from the stores of the Engineer in charge all imported store articles which may be required for the work or any part thereof or in making up articles required thereof or in connection therewith unless he has obtained permission in writing from the Engineer in charge to obtain such stores and articles from elsewhere The value of such stores and articles as may be supplied to the contractor by Engineer in charge will be debited to the contractor in his account at the rates shown in schedule attached to the contract and if they are not entered in the schedule, they will be debited at cost price which for the purposes of this contract shall include the cost of carriage and all other expenses whatsoever which shall have been incurred in obtaining delivery of the same at the stores aforesaid plus storage charges.

Clause 25 Lump Sums in estimate:

When the estimate, on which a tender is made, includes lump sums in respect of the parts of work, the contractor shall be entitled to payment in respect of the item of work involved or the part of the work in question at the same rates as are payable under the contract for such items or if the part of the work in question is not in the opinion of the Engineer in charge capable of measurement, the Engineer in charge may at his discretion pay the lump sum amount entered in the estimate and the certificate in writing of the Engineer in charge shall be final and conclusive with regard to any sum or sums payable to him under the provision of this clause.

Clause 26 Action where no specification:

In case of any class of work for which there is no such specification as is mentioned in Rule 1, such work shall be carried out in accordance with the detailed specification of the department and also in accordance with the instructions and requirement of the Engineer in charge.

Clause 27 Definition of work:

The expression "Works" or work" where used in these conditions, shall, unless there become thing either in subject or context repugnant to such construction be construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary of permanent and whether original, altered, substituted or additional.

Clause 27A Definition of Engineer in charge

The term "Engineer in charge" means the Divisional officer who shall supervise and be in charge of the work and who shall sign the contract on behalf of the Governor.

Clause 28:

It cannot be guaranteed that the work will be started immediately after the tender have been received No claims for increase of rate will be entertained if the orders for starting work are delayed.

Clause 29: Payments at reduced rates on account of items of work not accepted and no completed to be the discretion of the Engineer in charge

The rates for several items of works, estimates to cost more than Rs 1000/- agreed within, will be valid only when the item concerned is accepted, as having been completed fully in accordance with the sanctioned specification. In cases, where the items of work are not accepted, as so completed, the Engineer in charge may make payment on account of such items, at such reduced rates as he considers reasonable in the preparation of final or on account bills and his decision in the matter shall be final and binding

Clause 29A Payments at part rates:

The rates for several items of work may be paid at part rates provisionally in running bills in proportion to the quantum of items executed at the discretion of Engineer in charge in case of item rates if the rate quoted for certain items are very high in comparison to the average/overall tendered premium then the payment at running stages shall not be made more than the average sanctioned premium, The deterred payment will however be released after successful completion of the work.

Clause 30 Contractor's percentage whether applied to net or gross amount of bills: -

The percentage referred to in the Tender for works will be deducted /added from/to the gross amount of the bill before deducting the value of any stock issued

Clause 31 Contractor to adhere to labour Laws/regulation:-

The contractor shall adhere to the requirements of the Workmen's Compensation Act and Labour Legislation in force from time to time and be responsible for and shall pay any compensation to his

workmen which would be payable for injuries under the workmen compensation act, hereinafter called the said act, if such compensation paid by the state as principal employer under sub section [1] of section 12 of the said act, on behalf of the contractor; if shall be recoverable by the state from the contractor under such section (2) of the said section, such compensation shall be recovered in the manner laid down in clause 1 of the conditions of contract.

“Note – All contracts with Govt. shall require registration of workers under the building and other construction workers (Regulation of employment and condition of services) Act, 1996 and extension of benefit to such workers under the act. Definitions of cess at source will be made as per provisions of the said act, in force from time to time.”

Clause 32: Withdrawal of work from the contractor.

If the Engineer-in-charge shall at any time and for any reasons, whatever including inability to maintain prorate progress, think any portion of the work should not be executed or should be withdrawn from the contractor he may by notice in writing to that effect require the contractor not to execute the portion of the work specified, in the notice or may withdraw from the contractor the portion of work, so specified and the contractor shall not be entitled to any compensation by reason of such portion of work having been withdrawn from him. The engineer-in-charge may supplement the work by engaging another agency to execute such portion of the work at the cost of the original contractor without prejudice to his rights under clause 2. He shall also be competent to levy compensation for delay in progress. The recovery of excess cost shall be made from next available running bill or any other claim and shall not be deferred.

Clause 33:

The contractor includes clearance leveling and dressing of site within distance of 15 meters of the building on all sides except where the building adjoins another building.

Clause 34: Protect works:

The contractor shall arrange to protect at his own cost in adequate manner all cut stone work and other work requiring protection and to maintain such protection as long as work is in progress. He shall remove and replace this protection as required by the Engineer in charge from time to time. Any damage to the work so protected no matter how it may be caused shall be made good by the contractor free of cost.

All templates, forms, moulds, Centering, false work and models which in the opinion of the Engineer in charge are necessary for the proper and workman like execution of the work shall be provided by the contractor free of cost.

Clause 35: Contractor liable for settlement of claims caused by his delays

If the progress of the work has fallen so much in arrears as to prevent other contractors on the work, from carrying out their part of the work within the stipulated time, he will be liable for the settlement of any claim put in by any of these contractors for the expenses of keeping their labour unemployed to the extent considered reasonable by the Engineer in charge.

Clause 36A: The liability, if any, on account of quarry fees, royalties, octroi and any other taxes and duties in respect of materials actually consumed on public work, shall be borne by the contractor.

Clause 36B: The cost of all water connections necessary for the execution of work and the cost of water consumed, and hire charges of meters and the cost of electricity consumed in connection with the execution of work, shall be paid by the contractor, except where otherwise specifically indicated

Clause 36C: Payment of GST and any other Taxes.

Royalty or other tax on materials, issued in the process of fulfilling contract payable to the Government under rules in force will be paid by the contractor himself.

Clause 36D: In respect of goods and materials procured by the contractor for use in works under the contract GST will be paid by the contractor himself but in respect of all such goods manufactured and supplied by the contractor and works executed under the contract the responsibility of payment of GST would be that of the Engineer in charge

Clause 36E:

If any rates of Tax are increased or decreased, a new tax is introduced in India only, an existing Tax is abolished, or any change in interpretation or application of any Tax resulting from a change or Introduction in India only due to any National or State Statute, Ordinance, Decree or other law or any regulation or bye-law of any local or other duly constituted authority in India only, in the course of performance of contract, which was or will be assessed on the Contractor, in connection with the performance of the Contract, an equitable adjustment of the Contract price shall be made to fully take into account any such change by addition to the Contract Price or deduction there from, as the case may be. However, these adjustments would be restricted to direct transactions between the Owner and Contractor only those items which are included in bid. Further, no adjustment of the Contract Price shall be made on account of variation in

deemed export benefits, if any. Any increase or decrease which is included in price variation formula incorporated in the contract shall not be accounted for this purpose. Such increase including GST shall not be made in the extended period of contract for which the contractor alone is responsible for delay as determined by authority for extension of time."

Clause 37: Refund of Performance Security Deposit

Performance Security deposit will be refunded after the expiry of the period as prescribed below

- [a] in case of contracts relating to hiring of trucks and other T&P transportation including the loading unloading of materials, the amount of security deposit is refundable along with the final bill.
- [b] Supplies of material:- As per provision of GF & AR
- [c] Ordinary repairs:- 3 months after completion of the work provided of final bill has been paid
- [d] Original works/ special repair / renewal works: Security deposit will be refunded six months after completion or expiry of one full rainy season, or after expiry of defect liability period, as defined in special conditions of the agreement, whichever is later provided the final bill has been paid.
- [e] In case of PWD original works/special repairs works costing more than Rs 10 lac partial amount of security deposit will be refunded during the defect liability period @10% of SD amount after lapse of one year of completion and thereafter 10% of original amount of SD at the end of each subsequent year. The remaining amount of SD be refunded after the expiry of defect liability period.

Clause 38: Fair Wages Clause:

- [a] The contractor shall pay not less than fair wages/minimum wages to laborious engaged by him on the work as revised from time to time by Government but the government shall not be liable to pay anything extra for it except as stipulated price escalation clause [Clause 45] of the agreement.

Explanation: - Fair Wages means minimum wages for time or piece work fixed or revised by the state Government under the Minimum Wages Act 1948.

- [b] The contractor shall notwithstanding the provision of any contract to the contrary cause to be paid fair wages to labour indirectly engaged on the work including any labour engaged by his subcontractors in connection with the said work as if the laborers have been immediately or directly employed by him
- [c] in respect of all laborers immediately or directly employed on the work for the purpose of the contractors part of this agreement the [contractor shall comply with or cause to be complied with the Public Works Department contractor's Labour Regulation made or that may be made by the Government, from time to time in regard to payment of wages, wages period, deductions from wages, recovery of wages not paid, and un authorized deductions maintenance of wages register wage card publication of scale of wages and other terms of employment inspection and submission of periodical returns and other matters of like nature .
- [d] The Engineer in charge shall have the right to deduct from the money due to the contractor any sum required or estimated to be required for making good the loss suffered by a workers or workers, by reasons of nonfulfillment of the conditions of the contract, for the benefit of the worker, or workers nonpayment of wages or of deductions made therefrom which are not justified by the terms of the contract, or as a result of non-observance of the aforesaid regulations.
- [e] Vis-a-vis the Government of Rajasthan the contractor shall be primarily liable for all payments to be made and for the observance of the regulations aforesaid, without prejudice to his right to claim indemnity from his sub-contractors.
- [f] The regulation aforesaid shall be deemed to be part of this contract and any breach thereof shall be deemed to be breach of the contact

Clause 39 Contractor to engage technical staff:

The contractor shall engage the technical staff as follows on the contract work

- [a] For works costing Rs100 lacs above One Graduate Engineer
- [b] For works costing between Rs 50 lacs to 100 lacs One qualified diploma holder having experience of not less than 3 years.
- [c] For work costing between Rs. 15 lacs and 50 lacs - One qualified diploma holder.

The technical staff should be available at site whenever required by Engineer in charge to take instructions

Clause 39 A:

The contractor shall comply with the provision of the Apprenticeship Act 1961 and the Rules and orders issued thereunder from time to time. If he fails to do so his failure will be a breach of contract The contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provision of the said Act

Clause 40 safely code:

The contractor shall follow the safety code of the Department

Clause 41 Near Relative barred from tendering:

The contractor shall not be permitted to tender for works in Circle in which his near relative is posted as Divisional Accountant or as an officer in any capacity between the grades of the Superintending Engineer and Assistant Engineer [both inclusive] He shall also intimate the names of persons, who are working with him in any capacity or are subsequently employed by him and who are near relatives to any Gazette officer in the Organization/Department Any breach of this condition by the contractor worked. If such facts in noticed[a] before sanction of tender his offer shall be declared invalid and earnest money shall be forfeited [b] after sanction of the tender then the tender sanctioning authority may at his discretion forfeit his earnest money, performance guarantee security deposit and enlistment deposit and the work/ remaining work may allot to any registered contractor on the same rate as per rules

Note: by the term near relative is meant Wife, Husband, Parents and grandparents' children and grandchildren brothers and sisters uncles and cousin and their corresponding in laws

Clause 42 Retired Gazetted Officers barred for 2 years:

No Engineer of Gazetted rank or other Gazetted officer employed in Engineering or Administrative duties in an Engineering Department of the Government of Rajasthan is allowed to work as a contractor for a period of 2 years of his retirement from Government service without the previous permission of Government of Rajasthan The contract is liable to be cancelled, if either the contractor or any of his employee is found at any time to be such a person who had not obtained the permission of Government as aforesaid before submission of the tender or engagement in the contractor's service as the case may be

Clause 43 Quality Control:

The Government shall have right to exercise proper Quality control measures the contractor shall provide all assistance to conduct such tests

Clause 43A

The work [whether fully constructed or not] and all materials, machines tools and plant scaffolding temporary building and other things connected therewith, shall be at the risk of the contractor until the work has been delivered to the Engineer in charge and a certificate from him, to the effect, obtained

Clause 44 Death of Contractor.

Without prejudice to any of the rights or remedies under the contract if the contractor dies the legal heirs of the contractor or the Chief Engineer or duly authorized Engineer shall have the option of terminating the contract without any compensation

Clause 45: Price variation clause:

If during the progress of the contract of value exceeding Rs. 50.00 lac (accepted tendered amount minus cost of material supplied by the department) and where stipulated completion period is more than 3 month (both the conditions should be fulfilled) the price, of any material / bitumen / diesel and petrol incorporated in the works (not being material to be supplied by the department) and / or wages of labour increases or decreases, as compared to the price and / or wages prevailing at **the last date of submission of bids**, the amounts payable to contractors for the work shall be adjusted for increase or decrease in the rates of materials (excepting those materials supplied by the department)/labour / bitumen diesel and petrol/cement/steel.

नोट: मूल्य विचलन की गणना हेतु इस क्लॉज 45 में नीचे दिये गये सूत्र (A) से (F) तक तथा क्लॉज 45A में जो सूत्र दिये गये हैं उनमें भी क्लॉज 45 एवं 45A में किये गये उक्त संशोधन अनुसार **"the last date of submission of bids"** को आधार तिथि मानते हुए तदनुरूप ही संशोधन समझा जाकर मूल्य विचलन की गणना की जावे। यह आदेश जारी होने की दिनांक (अर्थात् 05.07.2018) से जो बोली आमंत्रित करने वाले नोटिस (NIB) प्रकाशित किए जायेंगे उन सभी उपापनों पर यह संशोधित प्रावधान लागू होंगे। इस आदेश दिनांक से पूर्व प्रारंभ हो चुकी बोली/उपापनों प्रक्रियाओं एवं अनुबंधों में पूर्व के ही प्रावधान लागू होंगे। (उपर्युक्त दिया गया नोट दिनांक 05.07.2018 को जारी आदेश PWF&AR -71/2018 का ही भाग है। कृपया उक्त आदेश का वित्त विभाग की वेबसाईट पर अवलोकन करें।)

Increase or decrease in the cost of labour / material / bitumen / diesel and petrol shall be calculated quarterly in accordance with the following formula

(A) Labour:

$$V_L = 0.75 \times (P_L/100) \times R \times (I_{L1} - I_{L0})/I_{L0}$$

V_L = Increase or decrease in the cost of work during the quarter under consideration due to change in rates for labour.

R = The value of the work done in rupees during the quarter under consideration excluding the cost of materials supplied by the department and excluding other items as mentioned in this clause.

I_{L0} = The average consumer price index for industrial workers (whole –sale prices) for the quarter in which tenders were opened/ negotiated (as published in Reserve Bank of India Journal/ Labour Bureau Shimla, for the area)

I_{L1} = The average consumer price index for industrial workers (whole –sale prices) for the quarter of calendar year

under consideration (as published in Reserve Bank of India Journal/ Labour Bureau Shimla, for the area.)

P_L = Percentage of labour components.'

Note:- in case of revision of minimum wages by the Government or other competent authority, nothing extra would be payable except the price & escalation permissible under this clause.

(B) Material (excluding material supplied by the department):

$$V_M = 0.75 \times (P_M/100) \times R \times (I_{M1} - I_{M0})/I_{M0}$$

V_M = Increase or decrease in the cost during the quarter under consideration due to change in the rates of material.

R = The value of the work done in rupees during the quarter under consideration excluding the cost of materials supplied by the department and excluding other items as mentioned in this clause.

I_{M0} = The average wholesale price index (all commodities) for the quarter in which tenders were opened / negotiated (as published in Reserve Bank of India Journal / Economic Adviser to Government of India, Ministry of Industries, for the area.)

I_{M1} = The average wholesale price index (all commodities) for the quarter under consideration (as published in Reserve Bank of India Journal / Economic Adviser to Government of India, Ministry of Industries, for the area.)

P_m = Percentage of materials component (excluding materials supplied by the department.)

(C) Bitumen.

$$V_b = 0.85 \times (P_b/100) \times R \times \{(B_1 - B_0)/B_0\}$$

V_b = Increase or decrease in the cost of the work during the quarter under consideration due to change in rates for Bitumen.

R = The value of the work done in rupees during the quarter under consideration excluding the cost of materials supplied by the department and excluding other items as mentioned in this clause.

B_0 = The wholesale price for bitumen on the day of opening of tenders/negotiation by Economic Adviser to Government of India, Ministry of Industry.

B_1 = The average wholesale price index for bitumen for the quarter under consideration as published weekly Economic Adviser to Government of India, Ministry of Industry.

P_b = Percentage of bitumen components excluding bitumen supplied by the department (specified in the sanctioned estimate of the work).

(D) Petroleum:

$$V_F = 0.75 \times (P_F/100) \times R \times (F_1 - F_0)/F_0$$

V_F Increase or decrease in the cost of the work during the quarter under consideration due to changes in the rate for fuel and lubricants.

R = The value of the work done in rupees during the quarter under consideration excluding the cost of materials supplied by the department and excluding other items as mentioned in this clause.

F = The average whole –sale price index of high speed diesel (HSD) as published by the Economic adviser to Govt. of India, ministry of Industry on the day of opening of tender/ negotiation.

F = The average wholesale price index of H.S.D. for the quarter under consideration as published weekly by the economic adviser to the Government of India, ministry of Industry for the quarter under consideration.

P = Percentage of fuel and lubricants component excluding fuel and lubricants supplied by the department (specified in the sanctioned estimate for the work)

R = Total work done during the quarter as prescribed under this clause.

Note: - for application of this clause price of HSD is chosen to indicate fuel and lubricant component.

(E) Cement:

$$V_c = 0.75 \times (P_c/100) \times R \times (P_{C1} - P_{C0})/L_{C0}$$

V_c Increase or decrease in the cost of the work during the quarter under consideration due to changes in the rate for CEMENT.

R = The value of the work done in rupees during the quarter under consideration excluding the cost of materials supplied by the department and excluding other items as mentioned in this clause.

L_{C0} = The average whole –sale price index for the quarter under which tenders were opened / negotiated (as published by the Economic adviser to Govt. of India, ministry of Industries)

L_{C1} = The average wholesale price index for the quarter under consideration (as published by the Economic adviser to Govt. of India, ministry of Industries)

P_C = Percentage of cement components.

(F) STEEL:

$$V_s = 0.75 \times (P_s/100) \times R \times (P_{S1} - P_{S0})/L_{S0}$$

V_s Increase or decrease in the cost of the work during the quarter under consideration due to changes in the rate for STEEL.

R = The value of the work done in rupees during the quarter under consideration excluding the cost of steel

supplied by the department and excluding other items as mentioned in this clause.

L_{SO} = The average whole –sale price index for the quarter under which tenders were opened / negotiated (as published by the Economic adviser to Govt. of India, ministry of Industries)

L_{S1} = The average wholesale price index for the quarter under consideration (as published by the Economic adviser to Govt. of India, ministry of Industries)

P_s = Percentage of steel components.

Clause :45A:Price Variation in- installation of elevators, supply/installation of centrally Air Conditioning and Central Evaporating cooling works:

In all cases of contracts for installation of elevators, supply/ installation of central Air Conditioning and Central Evaporating Cooling works, the price quoted shall be based on the Indian electrical and Electronics Manufacturers Association (IEEMA) price variation clause based on the cost of raw materials/ components and labour cost as **on the last date of submission of bids**, and the same is deemed to be related to wholesale price index number of metal products and all India Average consumer price Index number of industrial workers as specified below. In case of any variation in these index numbers, the prices shall be subject to adjustment up or down in accordance with following formula.

नोट: मूल्य विचलन की गणना हेतु इस क्लॉज 45 में नीचे दिये गये सूत्र (A) से (F) तक तथा क्लॉज 45A में जो सूत्र दिये गये हैं उनमें भी क्लॉज 45 एवं 45A में किये गये उक्त संशोधन अनुसार **"the last date of submission of bids"** को आधार तिथि मानते हुए तदनुरूप ही संशोधन समझा जाकर मूल्य विचलन की गणना की जावे।

यह आदेश जारी होने की दिनांक (अर्थात् 05.07.2018) से जो बोली आमंत्रित करने वाले नोटिस (NIB) प्रकाशित किए जायेंगे उन सभी उपापनों पर यह संशोधित प्रावधान लागू होंगे।

इस आदेश दिनांक से पूर्व प्रारंभ हो चुकी बोली/उपापनों प्रक्रियाओं एवं अनुबंधों में पूर्व के ही प्रावधान लागू होंगे।

(उपर्युक्त दिया गया नोट दिनांक 05.07.2018 को जारी आदेश PWF&AR -71/2018 का ही भाग है। कृपया उक्त आदेश का वित्त विभाग की वेबसाईट पर अवलोकन करें।)

$$P = P_0/100 [15+55 (MP/MPO) + 15 \times W_o + 15 \times W_O (1)/ W_o]$$

Where

P= price payable as adjusted in accordance with the above price variation formula.

P0= price quoted/ confirmed.

MP= Wholesale price index Number for metal products as published by the office of the Economic Advice Ministry of Industry, Government of India, in their weekly bulletin, Revised Index number of wholesale prices (base:1981-82=100) for the week ending first Saturday of the relevant calendar month. The relevant month shall be that in which price was offered or negotiated whichever is later.

W.= All India Average consumer price Index number for Industrial workers (Base:1982=100) as published by labour bureaus Ministry of labour Government of India, for relevant calendar month. The relevant month shall be that in which price was offered or negotiated whichever is later.

The above index number MP. & we are those published by IEEMA as prevailing on the first working day of the calendar month FOUR months prior to the date tendering.

MP= Wholesale price Index Number of metal products as published by the office of Economic adviser, ministry of Industry, Government of India, in their weekly bulletin revised index number of wholesale price (Base: 1981-82= 100). The applicable wholesale price index number or metal products as prevailing on 1st Saturday of the month covering the date FOUR months prior to the date of delivery and would be as published by IEEMA.

W.(D) = All India average consumer price index number for industrial workers prevailing for the month covering the date FOUR month prior to the date of delivery of manufactured material and would be as published by IEEMA.

W(I) = All India average consumer price index number for industrial workers (base:1982=100) as published by labour bureau ministry of labour, Government of India. The applicable all India consumer Price Index number of Industrial workers prevailing for the FOUR Months prior to the date of completion of installation/ progress parts of Installation and would be as published by IEEMA. The date of delivery shall be the date on which the manufactured materials are actually supplied at site. The date of completion of installation (or progress part of installation shall be the date on which the work is notified as being completed and is available for inspection/ duly tested. In the absence of such notification, the date of completion is not intimated such completion shall be considered by the Engineer-in-charge which shall be final.

Note- 1 The wholesale price index number for metal products is published weekly by the office of the economic adviser, but if there are any changes, the same are incorporated in the issue appearing in the following week. For the purpose of this price variation clause, the final index figures shall apply.

Note-2 the sole purpose of the above stipulation is to arrive at the entire contract under the various situations. The above stipulation does not indicate any intentions to sell materials under this contract as movables.

Note-3 the indices MP & wo are regularly published by IEEMA in monthly basis price circulars based on information bulletins from the authorities mentioned. These will be used for determining price variation and only IEEMA circulars will be shown as evidence, if required.

General Condition as for admissibility of Escalation

1. The exact percentage of labour/ material [excluding materials to be supplied by the department] / bitumen/diesel and petrol component and labour component for the work shall be approved by the authority while sanctioning the detailed estimates
2. The breakup of components of labour/materials [excluding materials to be supplied by the department] /bitumen/diesel and petrol as indicated in Clause 45 have been pre-determined as below

[a] Labour	20.00%.
[b] Material	43.00%.
[c] Bitumen	00.10%
[d] Diesel and petrol	18.50%
[e] Cement: -	03.00%
[f] Steel	15.40%
Total	100%
3. While allowing price escalation the following shall be deducted from the value(R):
 - (a) Cost of material supplied by the department
 - (b) Cost of services rendered as per clause 34
 - (c) Secured Advance/any advance added earlier but deducted now after work is Measured
 - (d) Cost of extra item the rates for which have been worked out based on market rates/mutually agreed rates
4. The first statement of escalation shall be prepared at the end of three months in which the work was awarded and the work done from the date of start to the end of this period shall be taken into account for subsequent statement, cost of work done during every quarter shall be taken into account At the completion of work the work done during the last quarter or fraction, thereof shall be taken into account
5. For the purpose of reckoning the work done during any period the bills prepared during the period shall be considered the dates of recording measurement in the measurement book by the Assistant Engineer shall be guiding factor to decide the bills relevant to any period. The date of completion as finally recorded by competent authority in the Measurement Book, shall be the criterion
6. The index relevant to any quarter, for which such compensation is paid, shall be the arithmetical average of the indices relevant of the calendar month.
7. Price adjustment clause shall be applicable only for the work that is carried out within the stipulated time or extension thereof as are not attributable to the contractor
8. If during the progress in respect of contract works stipulated to cost Rs 50.00 lacs or less the value of work actually done excluding cost of material supplied by the Department exceeds Rs 50.00 lac and completion period is more than 3 months then escalation would be payable only in respect of value of work in excess over Rs 50.00 lacs from the date of satisfying both the conditions.
9. Where originally stipulated period is 3 months or less but actual period of execution exceeds beyond 3 months on account of reasons not attributable to contractor escalation amount would be payable only in respect of extended period if amount of work is more than Rs 50.00 lacs.
10. In case the contractor does not make prorata progress in the first-or-another time span and the short fall in progress is covered up by him during subsequent time span within original stipulated period than the price escalation of such work expected to be done in the previous time span shall be notionally given based upon the price index of that quarter in which such work was required to be done.
11. No claims for price adjustment other than those provided herein shall be entertained
12. If the period of completion including extended period attributable to Government exceeds 3 months but cost does not exceed more than 50.00lacs no escalation is admissible.
13. Similarly, if cost of works increases more than Rs 50.00 but completion period including extended period attributable to Government is less than 3 months no escalation is admissible
14. No Provisional escalation is payable on the basis of indices of the previous quarter in absence of nonpublication of indices for concerned quarter by the RBI.
15. Escalation is always payable quarterly and no provisional escalation is payable monthly or fortnightly.
16. In case at the time of executing agreement both the conditions [completion period 12 months and amount of works Rs 50.00 lacs] for admissibility of prices escalation are not fulfilled and subsequently due to additional work and extension of time attributable to Government, both the conditions become fulfilled in that case the escalation shall be payable from the date of satisfying both the conditions and only for work done beyond Rs. 50.00 lacs and in period of work beyond 3 months
17. The contractor shall for the purpose of this conditions keep such books of account and other documents as are necessary to show the amount of any increase climbed or reduction available and shall allow inspection of the same by a duly authorized representative of Government and further shall at the request of the Engineer in charge furnishes verified in such a manner as the Engineer in charge may require any documents so kept and such other information as the Engineer in charge may require.

- 18 Price variation clause shall be applicable in case of lump sum contracts estimated to more than Rs. 100 crores with stipulated completion period of more than 18 months.\
- 19 The component of operation and maintenance (O&M) cost included in the contract price shall not be subject to price variations. The price may be adjusted by the use of prescribed formula (or formulae) which breaks down the total price into components.
- 20 The amount of price variation in case of lump sum contracts will be made by adding or deducting, as case may be, from the payment made at the stage of work specified in the contract document.

Clause 46: Force Majeure:

Neither party shall be liable to each other for any loss or damages occasioned by or arising out of acts of God such as unprecedented floods volcanic eruptions earthquake or other invasion of nature and other acts.

Clause 47: General Discrepancies and Errors:

In case of percentage rate tenders, if there is any typographical or clerical error in the rates shown by the Department in the G -Schedule the rates as given in the Basic Schedule of Rates of the department for the area shall be taken as correct

Clause 48: Post payment Audit & Technical Examination:

The Government shall have right to cause an audit and technical examination of the works and the final bills of the contractor including all supporting vouchers abstract etc to be made within 2 year after payment of the final bills and if as a result of such audit and technical examination any sum is found to have been over paid in respect of any work done by the contractor under the contract or any work claimed by him to have been done by him under the contract and found not to have been executed or executed below specification the contractor shall be liable to refund the amount of over payment and it shall be lawful for department to recover the same from him in the manner prescribed in clause 50 or in any other manner legally permissible, and if it is found that the contractor was paid less than what was due to him under the contract in respect of any work executed by him under it the amount of such under payment shall be duly paid by the Government to the contractor.

Clause 48A: Pre-Check or post check of bills.

The Government shall have right to provide a system of pre check of contractors bills by a specified Organization, and payment by an Engineer or an Account Officer/Sr Account Officer /Chief Account Officer/Financial Advisor, as the Government may in its absolute discretion prescribe Any overpayments / excess payment detected as a result of such pre check or post check of contractor's bills can be recovered from the contractors bills in the manner herein before provided and the contractor will refund such over/excess payments

Clause 48B: Check Measurements:

The department reserves to itself the right to prescribed a scale of check measurement of work in general or specific scale for specific works, or by other special orders (about which the decision of the department shall be final) checking of measurement by superior officer shall supersede measurements by the subordinate officer and the former will become the basis of the payment Any over/excess payment detected as a result of such check measurement of otherwise at any stage up to the date of completion and the defect removal period specified elsewhere in this contract shall be recoverable from the contractor as any other dues payable to the Government.

Clause 49: Dismantled Materials

The contractor, in course of the work, should understand that all materials e.g. stone bricks steel other materials obtainable in the work by dismantling etc will be considered as the property of the Government and will be disposed off to the best advantage of the Government as per directions of the Engineer-in-charge

Clause 50: Recovery from contractors

Whenever any claim against the contractor for the payment of a sum of money arises out of or under the contract the Department shall be entitled to recover such sum by appropriating, in part or whole of the performance Guarantee and /or Security Deposit security Deposit at the time of enlistment of the contractor in the event of the security being insufficient or if no security has been taken then the balance or the total sum recoverable as the case may be shall be deducted from any sum then due or which at any time thereafter may become due to the contractor under this or any other contract with the Governor of Rajasthan Should this sum be not sufficient to cover the full amount recoverable, the contractor shall pay to the Department on demand the balance remaining dues

The department shall further have the right to affect such recoveries under public Demands Recovery Act.

Clause 51: Jurisdiction of Court:

In the event of any dispute arising between the parties here to, in respect of any of the matters comprised

in this agreement the same shall be settled by a competent Court having jurisdiction over the place where agreement is executed and by no other court after completion of proceedings under clause 23 of this contract.

**Schedule of Materials to be supplied by the Department, if available
(Referred to in Clause 10)**

S.No.	Particulars	Quantity	Rates		Place of Delivery
			Unit	Rupees	

Schedule of Machinery/T & P to be supplied by the Department

The following Machinery/T & P shall be supplied by the Department, if available, to the Contractor, on hire as per "Rules of the Department for supply for machinery and T & P to the Contractors on hire" (Referred to in Clause 10 C)

S.No.	Item	Rate	Place of Delivery and Return

Progress statement referred to in clause 2 of conditions of contract.

Name of Work	Date from which the work should be commenced.	Date by which the work should be completed.	Monthly rate of progress.
1	2	3	4

The contractor has been informed that his tender has been accepted.

Signature of Engineer-in-charge
Dated:-

Signature of Contractor
Dated:-

NOTES:- FOR FILLING IN THE PROGRESS STATEMENT FROM

- Columns 2,3 and 4 must be initialed and dated by the contractor.
- Column 4 must be initialed and dated by the chief Engineer or other duly authorized Engineer also.
- The date in column 2 should correspond to the date on which the order to commence work TS given to contractor read with Clause 2 of the conditions of Contract."
- The date in column 3 must correspond to the period stated in sub clause [e] of the Memorandum below Tender for works
- Column 4 This will ordinarily be worked out proportionately thus if Rs 24000/- is the cost of the whole or portion of work tendered for and six months period of completion then the monthly rate of progress should be Rs 4000/- if necessary, quantities may also be specified in this column at the discretion of the chief Engineer
- The certificate as to intimation of acceptance of tender printed at the foot of the form, must be signed and dated both by the chief Engineer or other duly authorized Engineer and the Contractor

**ANNEXURE TO APPENDIX XI
RAJASTHAN PUBLIC WORKS DEPARTMENT CONTRACTORS
LABOUR REGULATIONS**

1. **Short title:** These regulations may be called "The Rajasthan Public Works Department Contractor's- Labour Regulations."

2. **Definition:** These regulations unless otherwise expressed or indicated, the following words and expressions shall have the meaning hereby assigned to them respectively, that is to say :-
 - (i) **"Labour"** means a minimum worker employed by a Rajasthan P.W. Department contractor directly or indirectly through a sub-contractor or other person or by an agent on his behalf.
 - (ii) **"Fair Wage"** means minimum wages for time or piece work fixed or revised by the State Government under the Minimum Wages Act, 1948,
 - (iii) **"Contractor"** shall include every person whether sub-contractor or headman or Agent employing labour on the work taken on contract.
 - (iv) **"Wages"** shall have the same meaning as defined in the Payment of Wages Act and includes time and piece rate wages.

3. **Display of Notice regarding wages etc. :** The contractor shall
 - (a) before he commences his work on contract, display and correctly maintain and continue to display and inconspicuous places on the work notices in English and the correctly maintain in Hindi by the majority of the workers giving the rate of wages which have been certified by the Executive Engineer-, the Superintending Engineer, the Chief Engineer or Labour Commissioner, as fair wages and the hours of works for which such wages are earned, and
 - (b) send a copy of such notices to the Certifying Officers.

4. **Payment of Wages:**
 - (i) Wages due to every worker shall be paid to him direct.
 - (ii) All wages shall be paid in current coin or currency or in both.

5. **Fixation of wage periods:**
 - (i) The contractor shall fix the wage periods in respect of which the wages shall be payable.
 - (ii) No wage period shall exceed one month.
 - (iii) Wages of every workman employed on the contract shall be paid before the expiry of ten days after the last day of the wage period in respect of which the wages are payable.
 - (iv) When the employment of any worker is terminated by or on behalf of the contractor, the wages earned by him shall be paid before the expiry of the day succeeding the one on which his employment is terminated.
 - (v) All payments of the wages shall be made on a working day except when the work is completed before the expiry of the wage period, in which case, final payments shall be made within 48 hours of the last working day.

Note: The term "working day" means a day on which the labour is employed in progress.

6. Wage Book and Wage Slips etc.

- (i) The Contractor shall maintain a Wage Book of each worker in such form as may be convenient but the same shall include the following particulars :-
 - (a) Rate of daily or monthly wages.
 - (b) Nature of work on which employed.
 - (c) Total number of days worked during each wage period.
 - (d) Total amount payable for the work during each wage period.
 - (e) All deductions made' *from the* wages with an indication in each case of the ground for which the deduction is made.
 - (f) Wages actually paid for each wage period.
- (ii) The contractor shall also maintain a wage slip for each worker employed on the work.
- (iii) The Executive Engineer may grant an exemption from the maintenance of the wage books and wages slips to a contractor who, in his opinion, may not directly or indirectly employ more than 50 persons on the work.

7. Fines and deductions which may be made from wages :-

- (i) The wages of a worker shall be paid to him without any deductions of any kind except those authorized, namely the following:-
 - (a) Fines.
 - (b) Deductions for absence from duty i.e. from the place or places where, by the terms of his employment, he is required to work. The amount of deduction shall be in proportion to the period for which he was absent.
 - (c) Deductions for damages to or loss of goods expressly entrusted to the employed person for custody or for loss or any other deductions of money, which he is required to account where such damages or losses are directly attributable to his neglect or default.
 - (i-a) The Rajasthan Government may, from time to time, allow deductions other than those specified in clause I above.
- (ii) No fines shall be imposed on a worker and no deductions for damage or loss shall be made until worker has been given an opportunity of showing cause against each fine or deductions.
- (iii) The total amount of fines which may be imposed in anyone wage period on a worker, shall not exceed an amount equal to three paisa in rupee of the wage payable to him in respect of that wage period.
- (iv) No fine imposed on any worker shall be recovered from him by installments or after the expiry of 60 days from the date on which it was imposed.

- 8. Register of fines etc. :** The contractor shall maintain a register of fines and of all deductions for damage or loss. Such register shall mention the reasons for which fine was imposed or deduction for damage or loss was made.

The Contractor shall maintain both in English and local Indian Language, a list approved by the Labour

Commissioner clearly stating the acts and omission for which penalty of fine may be imposed on a workman and display it in a good condition in a conspicuous place of the work.

9. **Preservation of Register:** The wage register, the wage card and the register fines deductions required to be maintained under these regulations, shall be preserved for 6 months after the date of the 1st entry made in them.
10. **Powers of Labour Welfare Officer to make investigation of enquiry:** The Labour Welfare Officer or any other person, authorized by the State Government on their behalf, shall have power to make enquiries with a view to ascertaining and enforcing due and proper observance of the fair wage clauses and provisions of the regulations. He shall investigate into any complaint regarding default made by the Contractor or Sub-Contractor in regard to such provisions.
11. **Report of Labour Welfare Officer:** The Labour Welfare Officer or other person, authorized as aforesaid, shall submit a report of the result of his investigation or enquiry to the Executive Engineer concerned indicating the extent, if any, to which the default has been committed with a note that necessary deductions from the contractors bill be made and the wage and other dues be paid to the labour concerned In case an appeal is made by contractor under clause 12 of these regulations, actual payment to Labours will be made by the Executive Engineer after the Labour Commissioner had given decision on Such appeal.
12. **Appeal against the decision of Labour Welfare Officers:** Any person aggrieved by the decision and recommendation of the Labour Welfare Officer or other persons, so authorized, may appeal against such decision to the Labour Commissioner within 30 days from the date of decision forwarding simultaneously a copy of his appeal to Executive Engineer concerned but subject to such appeal the decision of the Officer shall be final and binding upon the contractor.
- 12-A No party shall be allowed to be represented by a lawyer during any investigation, enquiry, appeal or any other proceedings.
13. **Inspection of Wage Books and Slips:** The Contractor shall allow inspection of the wage books and wage slips and register of fines and deductions to any of his workers or to his agent at a convenient time and place after due notice is received or to the Labour Welfare Officer or any other person authorized by the State Government on his behalf.
14. **Submission of Returns:** The Contractor shall submit periodical returns, as may be specified from time to time.
1. **Amendments:** The State Government may, from time to time, add to or amend these regulations and on any questions as to the application, interpretational effect of these regulations, the decision of the Labour Commissioner to the Government of Rajasthan or any other person authorized by the State Government in that behalf, shall be-final.

**SCHEDULE OF FAIR WAGE TO BE GIVEN BY EXECUTIVE ENGINEER
LIST OF ACTS AND COMMISSION FOR WHICH FINE CAN BE IMPOSED**

1. Willful insubordination or disobedience whether alone or in combination with another.
2. The fraud or dishonesty in connection with the contractors business or property of the Rajasthan P.W.D.
3. Taking or giving bribes or any illegal gratification.
4. Habitual late attendance.
5. Drunkenness; fighting, riot or disorderly or indecent behavior.
6. Habitual negligence.
7. Smoking near or around the area where combustible or other materials are stocked.
8. Habitual indiscipline.
9. Causing damage work in progress or to property of the Rajasthan P.W.D. or the contractor.
10. Sleeping on duty.
11. Malingering or sowing down work.
12. Giving of false information regarding name, age, father's name.
13. Habitual loss of wage cards supplied by the employers.
14. Unauthorized use of employer's property or manufacturing or making of unauthorized articles at the work places.
15. Bad workmanship in construction and maintenance by skilled workers which is not approved by the department and for which contractors are compelled to undertake rectification.
16. Making false complaints and/or misleading statement.
17. Engaging, in trade within the premises of the establishment.
18. Any delinquency of business affairs of the employers.
19. Collection or canvassing for the collection of any money within the premises of an establishment unless authorized by the employer.
20. Holding meeting inside the premises without previous sanction of the employer.
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Appendix A : General Conditions of Admissibility of Escalation.....

1. General Provisions

Sub-Title	Sub Clause/ Article	Provision
1. General Provisions		
Definitions	1.1	In the Conditions of Contract (these General Conditions) which include Special Conditions, the following works and expressions shall have the meaning stated as under. Words indicating persons or parties include firms, companies, and other legal entities except where context requires otherwise.
The Contract	1.1.1	
	1.1.1.1	“Act” shall mean the Law relating to procurement “The Rajasthan Transparency in Public Procurement Act, 2012 and its latest amendments” Activity Schedule means the various stages of execution of the Works in case of Lump Sum Contract which are linked to payment Schedule. "Approved" shall mean approval in writing including subsequent written confirmation of previous verbal approval. Bill of Quantities (BOQ) shall mean the bill of quantities included in the contract (s) or/ and in case of EPC contract, as approved by the Owner/ employer during execution for the Works.
	1.1.1.2	Contract means the document forming the Bid and acceptance thereof and the formal agreement executed between the competent authority on behalf of the Governor of Rajasthan and the Contractor, together with the documents referred to therein including these conditions, the Specifications, designs, Drawings and instructions issued from time to time on Contract and shall be complementary to one another.
	1.1.1.3	Contract Agreement means the Contract Agreement referred to in Sub-Clause 1.8.1 [Signing of the Contract].
	1.1.1.4	Contract Data means the pages completed by the Procuring Entity entitled Contract Data which constitute the Special Conditions of the Contract.
	1.1.1.5	"Day" shall mean calendar day. "Week" shall mean seven consecutive days. “Defects Liability Period” shall have the meaning as 96 months after issue of completion certificate of works by Engineer-in-Charge. Drawings means the Drawings of the Works, as included in the Contract and any additional and modified drawings issued by (or on behalf of) the Procuring Entity in accordance with the Contract. “Drawings” shall include maps, plans sketches and tracing of prints thereto referred to and incorporated in Contract and modification (after detailed design and investigation during execution) of such drawings approved in writing by the Owner/Engineer-in-charge and such other drawings as may from time to time be approved in writing by the Owner/Engineer-in-charge in connection with the execution of the contract.
	1.1.1.6	Letter of Acceptance means the letter of formal acceptance, signed by the Procuring Entity, including any annexed memoranda comprising agreements between and signed by both Parties. If there is no such Letter of Acceptance, the expression “Letter of Acceptance” means the Contract Agreement and the date of issuing the Letter of Acceptance means the date of signing the Contract Agreement.
	1.1.1.7	Letter of Technical/ Financial Bid means the document entitled Letter

		Technical Bid or Letter of Financial Bid, which was completed by the Bidder and includes the signed offer to the Procuring Entity for the Works.
	1.1.1.8	Risk and Cost means when the Contractor fails to complete the Contract despite due notices, the procuring entity may terminate the Contract with full 10% compensation and/ or measure the acceptable work done and get the balance work of the BOQ/ Activity Schedule carried out at the risk and cost of the Contractor and the difference of cost at which the balance work is carried out through the Department/ Organization or another agency is debited to the Contractor. "Project" shall mean the Construction of Kaliteer Lift Scheme, Dholpur on Engineering, Procurement and Construction Basis (single Responsibility Turn-Key project) and its operation & maintenance for 8 years all more fully described in the scope of work Special Conditions and the Technical Specifications, which the Contractor has to execute pursuant to the provisions of the Contract. "Project Area" shall mean the area to be indicated/approved by the Owner and shown in the drawing included in Technical Bid or during project period "Project Officer" shall mean the Government of Rajasthan, through Superintending Engineer, Water Resources Rajasthan in charge of the project and shall include its successors and assigns. "Section of Works" shall mean a part of the Works specifically identified as such in the Special Conditions. "Owner Design Consultant (ODC)" shall mean any one the institution among CWC or any IIT or MNIT Jaipur as approved by the owner. "Bidder's Design Consultant (ODC)" shall mean consultant by bidder for the planning, investigation design and approval of project (from employer) and its components, as approved by the owner.
	1.1.1.9	Schedules/ schedules of quantities means the document(s) entitled Schedules, completed by the Contractor and submitted with the letter of Bid, as included in the Contract. Such documents may include the Bill of Quantities, data, lists and Schedules of rates and /or prices.
	1.1.1.10	Specifications means the BIS, IRC, and other Codal provision ,Specification of the Works, practice followed by relevant Department, best practices of the Government of India/ State Government departments and specifications included in the Contract and any modification or addition in specifications made and approved by the Engineer-in-Charge/ employer during contract period.
	1.1.1.11	Technical/ Financial Bid means the Letter of Technical or Financial Bid and all other documents which the Bidder submitted with the Letter of Technical or Financial Bid, as included in the Contract.
Parties involved in Contract	1.1.2	
	1.1.2.1	Party: means the Procuring Entity or the Contractor, or both as the context requires.
	1.1.2.2	Contractor shall mean the individual, firm or company, whether incorporate or not undertaking the Works and shall include the legal or authorized representative of such individual or the persons composing such firm or company or the successors of such firm or company and the permitted assignees of such individual, firm or company.
	1.1.2.3	Contractor's Personnel means the Contractor and Contractor's Representative and all personnel whom the Contractor utilizes on Site, who may include the staff, labour and other employees of the Contractor and of each Subcontractor; and any other personnel assisting the Contractor in the execution of the Works. All communications addressed to the Contractor can be handed over at site to the Contractor's Representative.

	1.1.2.4	Contractor's Representative means the person named by the Contractor in the Contract or appointed from time to time by the Contractor under Sub-Clause 4.5 [Contractor's Representative], who acts on behalf of the Contractor.
	1.1.2.5	Engineer-in-Charge or Engineer means the authorized engineer of the Procuring Entity who shall be in-charge of the Works and who shall sign the Contract on behalf of the Governor of Rajasthan/ Procuring Entity and who shall be responsible for supervising the Contract, administering the Contract, certifying payments due to the Contractor, issuing and issuing instructions in pursuance of the Contract. Engineer-in-charge Representative All technical and accounts Persons Posted in Division office of engineer in charge, division/ sub-Division office who are directly or indirectly involved in construction , supervision, billing, audit of the work.
	1.1.2.6	The Procuring Entity or PE means the Party who employs the Contractor to carry out the Works. Procurement entity means Owner/employer.
	1.1.2.7	Procuring Entity's Personnel means the Engineer-in-Charge, the assistants referred to in Sub-Clause 3.2 [Delegation by the Engineer-in-Charge] and all other staff, labour and other employees of the Engineer-in-Charge and of the Procuring Entity; and any other personnel notified to the Contractor, by the Procuring Entity or the Engineer-in-Charge, as Procuring Entity's Personnel.
	1.1.2.8	Subcontractor means any person / firm named in the Bid /Contract and approved by the Engineer-in-Charge as a Subcontractor, or any person appointed and approved as a Subcontractor subsequently, for a part of the Works; and the legal successors in title to each of these persons/ firms.
Dates, tests and periods of completion	1.1.3	
	1.1.3.1	Base Date means the date 28 Days prior to the last date specified for submission of the Bid.
	1.1.3.2	Commencement/ start Date means the date specified under Sub-Clause 8.3.1 [Commencement of Works].
	1.1.3.3	A Defect is any part of the Works not completed in accordance with the approved specifications, designs and/ or drawings of the Contract.
	1.1.3.4	The Defect Liability Certificate is the certificate issued by Engineer-in-Charge after Defect Liability Period has ended and upon correction of Defects pointed out by the Engineer-in-Charge.
	1.1.3.5	The Defect Liability Period will be decided by the Department/ Organization depending on nature of the Works, from the date of completion of the Works and shall be mentioned in the Contract Data.
	1.1.3.6	Defects Notification Period means the period for notifying Defects in the Works or a Section (as the case may be) under Sub-Clause 13.2 [Completion of Outstanding Work and Remedying Defects], which extends over twelve Months except if otherwise stated in the Contract Data (with any extension under Sub-Clause 13.4 [Extension of Defects Notification Period], calculated from the date on which the Works or Section is completed as certified under Sub-Clause 12.1 [Taking Over of the Works and Sections].
	1.1.3.7	Performance Certificate means a certificate issued under Sub-Clause 13.10 [Performance Certificate].
	1.1.3.8	Taking-Over Certificate means a certificate issued under Sub-Clause 12.1[Taking Over of the Works and Sections].
	1.1.3.9	Tests on Completion means the tests which are specified in the Contract or agreed by both Parties or instructed as a Variation, and which are carried out under Clause 11 [Tests on Completion] before the Works or a Section (as the case may be) are taken over by the Procuring Entity.
	1.1.3.10	Tests after Completion means the tests (if any) which are specified in the Contract and which are carried out in accordance with the Specification after the Works or a Section (as the case may be) is taken

		over by the Procuring Entity.
	1.1.3.11	The Intended Completion Date is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Engineer-in Charge by issuing an extension of time.
	1.1.3.12	Time for Completion means the time for completing the Works or a section (as the case may be) under Sub-Clause 8.4 [Time for Completion], as stated in the Contract Data (with any extension under Sub-Clause 8.6 [Extension of Time for Completion], calculated from Commencement Date.
	1.1.3.13	Day means calendar Day; Year means a period of 365 Days.
Money and Payments	1.1.4	
	1.1.4.1	Accepted Contract Amount means the amount accepted in the Letter of Acceptance for execution and completion of the Works and remedying of any defects and maintaining the Works, if stated in the Contract.
	1.1.4.2	Cost means all expenditure reasonably incurred (or to be incurred) by the Contractor, whether on or off the Site, including overheads upto completion of project in all respect. "Contract Price" shall mean the price of the work package of the successful Bidder as accepted by the Owner. Contract price is deemed to include all overheads of man machine, material, services, taxes, duties, expanses on all unforeseen heads which may likely to occur due to working/non working of man and machine in closure / hindrance period of works, damages to contractor due to any reasons, insurances premiums etc till completion of project in all respect. "Contractor" shall mean the qualified bidder whom awarded the work for execute and include its legal representative's successors and permitted assigns. "Contractor's work program" shall mean the program showing the order of sequence in which the Contractor intends to carry out the works within the time for completion stipulated in the contract for completion of the works.
	1.1.4.3	Final Payment Certificate means the Payment Certificate issued to contractor after completion of all contractual obligations under the contract.
	1.1.4.4	Final Statement means the statement defined in Sub-Clause 15.10 [Final Statement of Payments].
	1.1.4.5	Interim Payment Certificate means a Payment Certificate issued under Sub-Clause 15.5 [Issue of Interim Payment Certificate], other than the Final Payment Certificate.
	1.1.4.6	Market Rate of an item shall be the current rate as decided by the Engineer-in Charge on the basis of the Cost of Materials and Labour at the Site where the work is to be executed for a variation item.
	1.1.4.7	Payment Certificate means a Payment Certificate issued under Clause 15 [Contract Price, Payment and Lien].
	1.1.4.8	Provisional sums/ Lump sums mean a sum (if any) which is specified in the Contract as a provisional sum, for the execution of any part of the Works or for supply of Plant, Materials or services under Sub-Clause 9.6 [Provisional Sums]. These are also moneys provided in the estimate of the project to pay for unforeseen / un-quantified items. It may also include lump sum provided in the estimate/ BOQ for unforeseen items to be paid after approval of analysis of rates of such items and charges payable to Government agencies or the contractor for approvals, service connections, extensions of services from the supply lines etc., as the case may be.
	1.1.4.9	Performance Security means an amount as percentage of the Accepted Contract Price deposited in the form of Bank Guaranteed or any other prescribed form deposited by the Contractor as a security for due performance of the Contract.

	1.1.4.10	"Foreign Currency" shall mean a Currency other than Indian Rupee. "Onshore Component" shall mean the component of Contract price expressed in India Rupees and to be paid in Indian Rupees by the Owner for work done pursuant to the contract.
Works and Materials	1.1.5	
	1.1.5.1	Materials are all supplies, including consumables, used by the Contractor for consumption in the Works.
	1.1.5.2	Permanent Works means the Permanent Works to be executed by the Contractor under the Contract. These works shall have a defined designed life and durability.
	1.1.5.3	Plant means the apparatus, machinery and other equipment intended to form or forming part of the Permanent Works,
	1.1.5.4	Scope of work shall cover execution of all aspects of the Works as per the Contract.
	1.1.5.5	Section means a part of the Works specified in the Contract Data as a Section (if any).
	1.1.5.6	Temporary Works are Works designed, approved constructed, installed, and removed by the Contractor which are needed for construction or installation of the Works.
	1.1.5.7	Work or Works shall, unless there is something either in the subject or context repugnant to such construction, be construed and taken to mean the Works by virtue of the Contract contracted to be executed whether temporary or permanent and whether original, altered, substituted or additional works.
Others	1.1.6	
	1.1.6.1	Act means the Rajasthan Transparency in Public Procurement Act, 2012.
	1.1.6.2	Contractor's documents are the bids (technical and financial) submitted, software's, bills, reports, drawings, designs, letters/communications, test results, etc., submitted by the Contractor to the Procurement Entity in connection with the Contract.
	1.1.6.3	Department means water resources Department or any Department of Government of Rajasthan which invite Bids on behalf of Governor of Rajasthan as specified in Contract Data as the case may be.
	1.1.6.4	Field laboratory means the Contractor's equipped laboratory provided with equipment, experienced personnel, consumables, books of specifications and codes for use on quality testing/ inspections on the works. In case of Works valuing more than Rupees 10 Crores the Field Laboratory equipment must be as per NABL norms.
	1.1.6.5	Deleted
	1.1.6.6	Government/ Governor of Rajasthan means the State Government of Rajasthan/ Governor of Rajasthan
	1.1.6.7	Laws means all the national or the state legislations, statutes, ordinances and other laws, and regulations and by-laws of India and Rajasthan and any legally constituted public authority. Orders and circular issued by water Resources Department, Finance Department etc.
	1.1.6.8	Procuring Entity's Equipments means the apparatus, machinery and vehicles (if any) made available by the Procuring Entity on hire for the use of the Contractor in the execution of the Works, as stated in the Specifications and Bidding Document.
	1.1.6.9	Rules means the Rajasthan Transparency in Public Procurement Rules, 2013
	1.1.6.10	Site shall mean land and/or other places on, into or through which work is to be executed under the Contract or any adjacent land, path or street through which work is to be executed under the Contract or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the Contract.
	1.1.6.11	Site office means a suitable covered all weather usable space built by the Contractor at Site of Works at his cost for use by him and the Procuring

		Entity.
	1.1.6.12	Unforeseeable means not reasonably foreseeable by the Base Date.
	1.1.6.13	Variations means any change to the Works, which is instructed or approved as a variation under Clause 9 [Deviations, Variations and Adjustments].
Interpretations	1.2	In the Contract, except where the context requires otherwise - words indicating one gender include all genders; - words indicating the singular also include the plural and words indicating the plural also include the singular; - provisions including the word “agree”, “agreed” or agreement” require the agreement to be recorded in writing; “written” or “in writing” means hand-written, typewritten, printed or electronically made, and resulting in a permanent record; - the word “tender” is synonymous with “bid” and tenderer” with “bidder” and the words “tender document” with “bidding document”. The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.
Communications	1.3	Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices, requests and discharges, by one party to the other, these communications shall be: - In writing and delivered by hand against receipt, sent by mail or courier, or transmitted using any of the agreed systems of electronic transmission as stated in the Contract Data; and - Delivered, sent or transmitted to the address for the recipient’s Communications as stated in the Contract Data. However: - if the recipient gives notice of another address, communications shall thereafter be delivered accordingly; and - if the recipient has not stated otherwise when requesting an approval or consent, it may be sent to the address from which the request was issued. Approvals, certificates, consents and determinations shall not be unreasonably withheld or delayed. When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Engineer-in-Charge, a copy shall be sent to the Engineer-in-Charge or the other Party, as the case may be.
Law and language	1.4	The Contract shall be governed by the laws of Central Government, the State Government of Rajasthan and other States as applicable. The ruling language of the Contract shall be English or that stated in the Special Conditions of Contract.
Works to be carried out	1.5	The Works to be carried out under the Contract shall, except as otherwise provided in these conditions, include all labour, materials, equipment, tools, plants, testing and quality assurance, and transport which may be required in preparation of and doing in the full and entire execution and completion of the Works. The descriptions given in the Schedule of Quantities (Activity Schedule in case of Lump Sum Contract) shall unless otherwise stated, be held to include wastage on Materials, carriage and cartage, carrying and return of empties, hoisting, setting, fitting and fixing in position and all other Labour necessary in and for the full and entire execution and completion of the Works as aforesaid in accordance with good practice and recognized principles to deliver a work of specified quality and durability conforming to designs, drawings etc. The Works include clearance, leveling and dressing of Site within a distance of 15 meters of the work site on all sides except where the building adjoins another building.
Sufficiency of Tender/ Bid	1.6	The Contractor shall be deemed to have satisfied himself before bidding as to the correctness and sufficiency of his Bid for the Works and of the rates and prices quoted in the Schedule of Quantities, which rates and

		prices shall, except as otherwise provided, cover all his obligations under the Contract and all matters and things necessary for the proper completion and maintenance of the Works. He shall also be responsible for satisfying himself on the completeness of the documents /data provided by the Procuring Entity. He shall not raise any objections or deficiencies or inaccuracies in such documents.
Discrepancies and adjustment of errors	1.7.1	The several documents forming the Contract are to be taken as mutually explanatory of one another, detailed Drawings being followed in preference to small scale Drawing and figured dimensions in preference to scale and special conditions in preference to General Conditions.
	1.7.2	In the case of discrepancy between the Bill of Quantities, the Specifications and/or the Drawings, the following shall be referred for clarification: • Description of Bill of Quantities • Particular detailed Specification and Special Condition, if any • Drawings / Designs • IRC / MORT & H , ASTHO Specification, if required • Indian Standard Specifications or B.I.S. Engineer in charge shall study the relevant clause and matter of conflict after consultation with employer, he will issue clarification contractor has any objection on his decision, he may submit his objection within 15 days of issuance latter by engineer. After lapse of 15 days, decision of engineer in charge shall be binding on contractor if he does not register any objection.
	1.7.3	If there are varying or conflicting provisions made in any one document forming part of the Contract, the Procuring Entity shall be the deciding authority with regard to the intention(Project objective) of the document and his decision shall be final and binding on the Contractor.
	1.7.4	Any error in description, quantity or rate in Bill of Quantities or any omission therefore shall not vitiate the Contract or release the Contractor from the execution of the whole or part of the Works comprised therein according to Drawings and Specifications or from any of his obligations under the Contract. Any error/ omission observed at any stage of the work, shall rectified by the contractor without any cost.
Signing of the Contract	1.8.1	The successful Bidder, after submitting the performance guarantee i.e. within 15 Days of receipt of Notification of Award or as specified in the Contract Data, shall attend the office of the Procurement Entity / Engineer- in-charge for authentication, signing and completion of the Contract document and execute the agreement consisting of: The notice inviting Bid, all the documents including Drawings, if any, forming the Bidding Document as issued at the time of invitation of bids and acceptance thereof together with any correspondence leading thereto, Standard Forms consisting of various standard Sub-Clauses with corrections up to the date stipulated in Contract Data along with annexure thereto and drawings etc. The Costs of stamp duties and similar charges (if any) imposed by Law in connection with entry into the Contract Agreement shall be borne by the Contractor.
Signed copy of Contract Documentable given to Contractor	1.8.2	The Contractor shall be furnished, free of Cost one signed copy of the Contract Documents together with all Drawings except standard Specifications (BIS or IRC or others), Schedule of Rates and such other printed and published documents, which shall be procured by the Contractor at his cost. These documents shall be deemed to be part of the Contract. These shall be kept in the Site office. None of these documents shall be used for any purpose other than that of this Contract.
Personnel	1.9.1	The Contractor shall employ the key personnel named in the Schedule of Key Personnel as referred to in the qualification criteria to carry out the functions stated in the Schedule or other personnel approved by the Engineer-in-Charge. The Engineer-in-Charge will approve any proposed replacement of key personnel only if their qualifications, abilities, and relevant experiences are substantially equal to or better than those of the

		personnel listed in the Schedule.
	1.9.2	If the Engineer-in-Charge asks the Contractor to remove a person who is a member of the Contractor's staff or his work force stating reasons, the Contractor shall ensure that the person leaves the Site within seven Days and has no further connection with the work in the Contract.
Procuring Entity's Risks	1.10	The Procuring Entity is responsible for the excepted risks which are : (a) in so far as they directly affect the execution of the Works in India, the risks of war, hostilities, invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power, civil war, riot commotion or disorder (unless restricted to the Contractor's employees), and contamination from any nuclear fuel or nuclear waste or radioactive toxic explosive, or (b) a cause due solely to the design of the Works, other than the Contractor's design part.
Contractor's Risks	1.11	All risks of loss of profit , overheads or damage to physical property and of personal injury and death, delay in the work due to any reason which arise during and in consequence of the performance of the Contract other than the Procuring Entity's risks are the responsibility of the Contractor and are to be covered in contract amount while bidding.
Procuring Entity's use of Contractor's documents	1.12	As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents and other design documents made by (or on behalf of) the Contractor. The Contractor shall be deemed (by signing the Contract) to give to the Procuring Entity a non-terminable transferable non- exclusive royalty-free license to copy, use and communicate the Contractor's Documents, including making and using modifications of them. This license shall: i. applies throughout the actual or intended working life (whichever is longer) of the relevant parts of the Works, ii. entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works, and in the case of Contractor's Documents which are in the form of computer programs and other software, permit their use on any computer on the Site and other places as envisaged by the Contract, including replacements of any computers supplied by the Contractor. iii. The Contractor's Documents and other design documents made by (or on behalf of) the Contractor shall not, without the Contractor's consent, be used, copied or communicated to a third Party by (or on behalf of) the Procuring Entity for purposes other than those permitted under this Sub-Clause.
Contractor's use of Procuring Entity's Documents	1.13	As between the Parties, the Procuring Entity shall retain the copyright and other intellectual property rights in the Specification, the Drawings and other documents made by (or on behalf of) the Procuring Entity. The Contractor may, at his Cost, copy, use, and obtain communication of these documents for the purposes of the Contract. They shall not, without the Procuring Entity's consent, be copied, used or communicated to a third Party by the Contractor, except as necessary for the purposes of the Contract.
Care and Supply of documents	1.14	The approved Specification, Designs and Drawings shall be in the custody and care of the Procuring Entity or his representative. Unless otherwise stated in the Contract, one copy of the Contract and of each subsequent Drawing shall be supplied to the Contractor, who may make further copies at his Cost. Each of the Contractor's Documents shall be in the custody and care of the Contractor, unless and until taken over by the Procuring Entity. Unless otherwise stated in the Contract, the Contractor shall supply to the Engineer-in-Charge four copies of each of the Contractor's Documents. The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Specification, the Contractor's Documents (if

		any), the Drawings and Variations and other communications given under the Contract. The Procuring Entity's Personnel shall have the right of access to all these documents at all reasonable times. If a Party becomes aware of an error or Defect in a document which was prepared for use in executing the Works, the Party shall promptly give notice to the other Party of such error or Defect.
Delays in issuing drawings or instructions.	1.15	The Contractor shall give notice to the Engineer-in-Charge whenever the Works are likely to be delayed or disrupted if any necessary Drawing or instruction is not issued to the Contractor within a particular time, which shall be reasonable. The notice shall include details of the necessary Drawing or instruction, details of why and by when it should have been issued, and the nature and amount of the delay or disruption likely to be suffered if it is late. However, if and to the extent that the Engineer-in-Charge's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time,
Confidential Details	1.16	The Contractor's and the Procuring Entity's Personnel shall not disclose all such confidential and other information as may be reasonably required in order to verify compliance with the Contract and allow its proper implementation. Each of them shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out their respective obligations under the Contract or to comply with applicable Laws. Each of them shall not publish or disclose any particulars of the Works prepared by the other Party without the previous agreement of the other Party. However, the Contractor shall be permitted to disclose any publicly available information, or information otherwise required to establish his qualifications to compete for other projects.
2. The Procuring Entity		
Right of Access to the Site	2.1	The Procuring Entity shall give the Contractor right of access to, and possession of the entire Site within the time specified in the Special Conditions of Contract (SCC). If under the Contract the Procuring Entity is required to give to the Contractor possession of any foundation, structure, plant or means of access, the Procuring Entity shall do so in the time and manner stated in the Specifications/ Special Conditions of Contract. However, the Procuring Entity may withhold any such right or possession until the Performance Security has been received. After receiving this notice, the Engineer-in-charge shall promptly proceed to agree or determine these matters. However, if and to the extent that the Procuring Entity's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time.
		The right and possession may not be exclusive to the Contractor.

Assistance by Procuring Entity	2.2	The Procuring Entity shall provide, at the request of the Contractor, such reasonable assistance as to allow the Contractor to obtain expeditiously any permits, licenses or approvals which the Contractor is required to obtain : i. for the delivery of Goods, including clearance through customs, and ii. for the export of Contractor's Equipment when it is removed from the Site.
Procuring Entity's Personnel	2.3	The Procuring Entity shall be responsible for ensuring that the Procuring Entity's Personnel and the Procuring Entity's other Contractors on the Site, co-operate with the Contractor's efforts under Sub-Clause 4.7 [Co-operation], and take actions similar to those which the Contractor is required to take under Sub-Clause 4.8 [Safety Procedures] and under Sub-Clause 4.17 [Protection of the Environment]
Procuring Entity's Claims	2.4	If the Procuring Entity considers himself to be entitled to any payment under any Sub-Clause of these Conditions or otherwise in connection with the Contract, and/or to any extension of the Defects Liability Period, the Procuring Entity or the Engineer-in-charge shall give notice and particulars to the Contractor. However, notice is not required for payments due under Sub-Clause 4.18 [Electricity, Water and Gas], or for other services requested by the Contractor. The notice shall be given as soon as practicable and no longer than 28 Days after the Procuring Entity became aware, or should have become aware, of the event or circumstances giving rise to the claim. A notice relating to any extension of the Defects Notification Period shall be given 28 days before the expiry of such period. The particulars shall specify the Sub-Clause or other basis of the claim and shall include substantiation of the amount and/or extension Defects Notification Period to which the Procuring Entity considers himself to be entitled in connection with the Contract. The Engineer-in-charge shall then proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the amount (if any) which the Procuring Entity is entitled to be paid by the Contractor, and/or the extension (if any) of the Defects Notification Period in accordance with Sub-Clause 13.4 [Extension of Defects Notification Period]. This amount may be included as a deduction in the Contract Price and Payment Certificates. The Procuring Entity shall be entitled to set off against or make any deduction from an amount certified in a Payment Certificate, or to otherwise claim against the Contractor, in accordance with this Sub-Clause.
3. Engineer-in-Charge		
Duties and Responsibilities	3.1.1	The Procuring Entity shall designate/ appoint an Engineer-in-charge for the Works, as specified in the Contract Data, who shall carry out the duties assigned to him in the Contract and ensure execution of works as per approved drawings, designs, specifications etc. In case of EPC contracts, engineer in charge shall ensure that all design and drawings are in conformation to specifications. The Engineer-in-charges staff shall include suitably qualified Engineers, accounts professionals and other professionals who are competent to carry out these duties. The Engineer-in-charge shall have no authority to amend the Contract. The Engineer-in-charge may exercise the authority attributable to the Engineer-in-charge as specified in or necessarily to be implied from the Contract. If the Engineer-in-charge is required to obtain the approval of the competent authority before exercising a specific power, he shall obtain that approval. Execution of all the works as per terms and conditions of contract is duty of EiC.
	3.1.2	The Procuring Entity shall promptly inform the Contractor of any change

		to the authority attributed to the Engineer-in-charge. However, whenever the Engineer-in-charge exercises a specified authority for which the Procuring Entity's approval is required, then (for the purposes of the Contract) the Procuring Entity shall be deemed to have given approval. Except as otherwise stated in these Conditions: i. whenever carrying out duties or exercising authority, specified in or implied by the Contract, the Engineer-in-charge shall be deemed to act for the Procuring Entity; ii. the Engineer-in-charge has no authority to relieve either Party of any duties, obligations or responsibilities under the Contract; and iii. any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by the Engineer-in-charge (including absence of disapproval) shall not relieve the Contractor from any responsibility he has under the Contract, including responsibility for errors, omissions, discrepancies, quality of works and non-compliances to specifications/ instructions of the Engineer-in-charge /Procuring Entity. iv. Any act by the Engineer-in-charge in response to a Contractor's request except otherwise expressly specified shall be notified in writing to the Contractor within 28 Days of receipt. The Engineer-in-charge shall obtain the specific approval of the competent authority before taking action under the following Sub-Clauses of these Conditions and other Sub-Clauses, if specified in the Contract Data: i. Sub-Clause 4.12 [Unforeseeable Physical Conditions] agreeing or determining an extension of time and/or additional Cost. ii. Sub-Clause 9.1 [Right to Vary]: Instructing a Variation, except; (a) in an emergency situation as determined by the Engineer-in-charge, or (b) if such a Variation would increase the Accepted Contract Amount by less than the percentage specified in the Contract Data. iii. Approving a proposal for Variation submitted by the Contractor in accordance with Sub-Clause 9.1 [Right to Vary] or Sub-Clause 9.3 [Value Engineering]. Notwithstanding the obligation, as set out above, to obtain approval, if, in the opinion of the Engineer-in-charge, an emergency occurs affecting the safety of life or of the Works / workmen or of adjoining property, he may, without relieving the Contractor of any of his duties and responsibility under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer-in-charge, be necessary to abate or reduce the risk. The Contractor shall forthwith comply, despite the absence of approval of the competent authority, with any such instruction of the Engineer-in-charge. The Engineer-in-charge shall determine (after due approval from the competent authority) an addition to the Contract Price, in respect of such instruction, in accordance with Clause 9 [Deviations, Variations and Adjustments] and shall notify the Contractor accordingly, with a
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		copy to the Procuring Entity.
Delegation by Engineer-in-Charge	3.2	The Engineer-in-charge may from time to time assign duties and delegate authority to assistants and may also revoke such assignment or delegation. These assistants may include a resident Engineer, (AE /JE) and/or independent inspectors appointed to inspect and/or test items of works and/or Materials. The assignment, delegation or revocation shall be in writing and shall not take effect until copies have been received by both Parties. However, unless otherwise agreed by both Parties, the Engineer- in-charge shall not delegate the authority to determine any matter in accordance with Sub-Clause 3.5 [Determinations] Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorized to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by an assistant, in accordance with the delegation, shall have the same effect as though the act had been an act of the Engineer-in-charge. However: Any failure to disapprove any work, Plant or Materials shall not constitute approval, and shall therefore not prejudice the right of the Engineer-in-charge to reject the work, Plant or Materials; ii. if the Contractor questions any determination or instruction of an assistant, the Contractor may refer the matter to the Engineer-in-charge, who shall promptly confirm, reverse or vary the determination or instruction.
Instruction of the Engineer-in-Charge	3.3	The Engineer-in-charge may issue to the Contractor (at any time) instructions and additional or modified Drawings which may be necessary for the execution of the Works and the remedying of any Defects, all in accordance with the Contract. The Contractor shall only take instructions from the Engineer-in-charge, or from an assistant to whom the appropriate authority has been delegated under Sub-Clause 3.2. If an instruction constitutes a Variation, Clause 9 [Deviations, Variations and Adjustments] shall apply. The Contractor shall comply with the instructions given by the Engineer-in-charge or delegated assistant, on any matter related to the Contract. Whenever practicable, their instructions shall be given in writing. If the Engineer-in-charge or a delegated assistant: - gives an oral instruction, - receives a written confirmation of the instruction, from (or on behalf of) the Contractor, within two working Days after giving the instruction, and - Does not reply by issuing a written rejection and/or instruction within two working Days after receiving the confirmation, then the confirmation shall constitute the written instruction of the Engineer-in-charge or delegated assistant (as the case may be).
Replacement of Engineer-in-Charge	3.4	If the Procuring Entity intends to replace the Engineer-in-charge, the Procuring Entity shall inform the Contractor by a notice before the intended date of replacement, the name and contact details of the intended replacement of the Engineer-in-charge.
Determinations	3.5	Whenever these Conditions provide that the Engineer-in-charge shall proceed in accordance with this Sub-Clause 3.5 to agree or determine any matter like variations, extensions of time, responsibilities / valuation for loss and or damage to works etc., the Engineer-in-charge shall peruse the Contract, Specifications, Codes and consult the Contractor in an endeavor to reach an agreement. If an agreement is not reached, the Engineer-in-charge shall make a fair determination in

		accordance with the Contract, taking due regard of all relevant circumstances. The Engineer-in-charge shall give notice to the Contractor of each agreement or determination, with supporting particulars, within 28 Days from the likely date of implementation of such agreement or determination and obtain receipt of the corresponding claim or request except when otherwise specified. The Contractor shall give effect to each determination unless and until revised under Clause 21 [Claims, Disputes and Arbitration].
Minutes of Meeting	3.6	The Engineer-in-charge may require the Contractor to attend a progress review / or quality assurance/ design review meeting during execution of the Works. The Engineer- in-charge shall record the minutes of the meeting and provide a copy within 7 days to the Contractor for compliance. These minutes will be a part of evidence in case of request for extension of time or variation or punitive action against the Contractor as per terms of the Contract. In case the issue of minutes is delayed, the Contractor may issue the record note of discussions and decisions taken in the meeting for record and confirmation by the Engineer-in Charge. These shall be treated as confirmed if not denied within 5 working days by the Engineer-in-Charge.
4. The Contractor		
General Obligations	4.1.1	The Contractor shall design, prepare drawings (to the extent specified in the Contract), execute as per specifications and complete the Works in accordance with the Contract and with the Engineer-in-Charge's instructions, and shall remedy any Defects in the Works. The Contractor shall provide the Plant and Contractor's Documents specified in the Contract, and all Contractor's Personnel, Goods, consumables and other things and services, whether of a temporary or permanent nature, required in and for this design, execution, completion and remedying of Defects.
	4.1.2	The Contractor shall be responsible for the adequacy, stability and safety of all Site operations and of all methods of construction. Except to the extent specified in the Contract, the Contractor shall be responsible for all Contractor's Documents, Temporary Works, and such design of each item of works, Plant and Materials as is required for the item to be in accordance with the specifications for items of Contract, and shall not otherwise be responsible for the design or Specification of the Permanent Works.
	4.1.3	The Contractor shall deploy experienced and competent personnel to execute the works. The quality of workmanship has to be as specified. Personnel not found capable of good workmanship shall be removed and replaced with better workman.
	4.1.4	The Contractor shall, whenever required by the Engineer-in-charge, submit details of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works. He shall also be responsible for the safety of works and personnel at the site and shall submit a safety execution plan (as per relevant code for safety at construction site) for the approval by the Engineer-in-charge. No significant alteration to these arrangements and methods shall be made without this having previously been approved by the Engineer-in-charge. He shall also comply to the requirements of the mitigations of the Environmental impacts of the execution of works.
	4.1.5	If the Contract specifies that the Contractor shall design any part of the Permanent Works, then unless otherwise stated in the Special Conditions of Contract: - The Contractor shall submit to the Engineer-in-charge the Contractor's Documents for this part in accordance with the procedures specified in the Contract. - these Contractor's Documents shall be in accordance with the

		Specification and Drawings, shall be written in the language for communications defined in the Sub-Clause 1.4 [Law and Language] and shall include additional information required by the Engineer-in-charge to add to the Drawings for coordination of each Party's designs; iii. the Contractor shall be responsible for this part and it shall, when the Works are completed, be fit for such purposes for which the part is intended as are specified in the Contract; and iv. prior to the commencement of the Tests on Completion, the Contractor shall submit to the Engineer-in-charge the "as-built" drawings, designs and documents and, if applicable, operation and maintenance manuals in accordance with the Specification and in sufficient detail for the Procuring Entity to operate, maintain, dismantle, reassemble, adjust and repair all parts of the Works. Such part shall not be considered to be completed for the purposes of taking-over under Clause 12 [Taking Over of the Works and Sections] until these documents and manuals have been submitted to the Engineer-in-charge.
	4.1.6	The Contractor shall allow the Engineer-in-charge and any person authorized by the Engineer-in-charge access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where Materials or plant are being installed / assembled for the Works. The contractor may satisfy himself regarding site, acquisition of land, approach roads etc.
	4.1.7	The liability, if any, on account of quarry fees, royalties, octroi, service tax, and any other taxes and duties in respect of materials actually consumed on public work shall be borne by the Contractor.
	4.1.8	The cost of all water / power connections necessary for the execution of the Works and the cost of water consumed and hire charges of meters and the cost of electricity consumed in connection with the execution of the Works shall be paid by the Contractor except where otherwise specifically indicated. He shall also be responsible for environment mitigated disposal of waste water released during execution.
Compliance with the Code of Integrity	4.2.1	The Contractor is bound by the provisions of the Code of Integrity stipulated in the Act, the Rules and specified in ITB Sub-Clause 1.3 [Code of Integrity] and refrain himself from corrupt, fraudulent, coercive and collusive practices which are defined as below: a) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party; b) "fraudulent practice" means any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation; c) "Coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party; d) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party.
	4.2.2	The Procuring Entity shall take legal action against the Contractor, if it breaches any provisions of the Code of Integrity, under Section 11(3), 46 and chapter IV of the Act.

	4.2.3	The Contractor shall permit the Procuring Entity to inspect the Contractor's accounts and records relating to the performance of the Contract and to have them audited by auditors appointed by the Procuring Entity, if so, required by the Procuring Entity.
Additional Performance Security	4.3.1	i. If the Bid, which results in the lowest evaluated bid price, is seriously imbalanced or front loaded in the opinion of the Procuring Entity, the Procuring Entity 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 Procuring Entity may require that the amount of the performance security be increased at the expense of the Bidder to a level sufficient to protect the Procuring Entity against financial loss in the event of default by the successful Bidder under the Contract. ii. Without limitation to the provisions of the rest of this Sub-Clause, whenever the Engineer-in-charge determines an addition to the Contract Price as a result of a change in Cost, or as a result of a Variation of the Contract Price, the Contractor shall at the Engineer-in-charge's request promptly increase the Performance security to a level of 3percent (or as per further order / notification of government in future)of the increased Contract Price. iii. In addition to Performance Security as specified in rule 75, an Additional Performance Security shall also be taken from the successful bidder in case of unbalanced bid. The Additional Performance Security shall be equal to fifty percent of Unbalanced Bid Amount. The Additional Performance Security shall be deposited in lump sum by successful bidder before execution of Agreement. The Additional Performance Security shall be deposited through e-Grass, Demand Draft, Banker's Cheque, Government Securities or Bank Guarantee(Inserted by Finance Department Order Dated October 22,2021) A. Explanation : For the purpose of this rule,- i. Unbalanced Bid means any bid below more than fifteen percent of Estimated Bid Value. ii. Estimated Bid Value means value of subject matter of procurement mention in bidding documents by Procuring Entity. iii. Unbalanced Bid Amount means positive difference of eighty five percent of Estimated Bid Value minus Bid Amount Quoted by the bidder. B. The Additional Performance Security shall be refunded to the contractor after satisfactory completion of entire work. The Additional Performance Security shall be forfeited by the Procuring Entity when work is not completed within stipulated period by the contractor. Provision for Unbalanced Bid and Additional Performance Security shall be mentioned in the Bidding Documents by the Procuring Entity.
	4.3.2	The proceeds of the Performance Security may be forfeited in full or part

		and shall be payable as compensation to the Procuring Entity on happening of any of the events mentioned below: i. when the Contractor does not execute the agreement within the specified time; after issue of letter of acceptance/placement of work order; or ii. when the Contractor fails to commence the work within the time specified; or iii. when the Contractor fails to complete the work satisfactorily within the time specified; or iv. when any terms and conditions of the contract is breached; or v. Failure by the Contractor to pay the Procuring Entity any amount due, either as agreed by the Contractor or determined under any of the Sub-Clauses of these Conditions or any established dues under any other contract; or vi. if the Contractor breaches any provision of the Code of Integrity prescribed for Bidders specified in the Act, the Rules, ITB Sub-Clause 1.3 and Sub-Clause 4.2.1 of these Conditions. Notice of reasonable time will be given in case of forfeiture of Performance Security. The decision of the Procuring Entity in this regard shall be final.
	4.3.3	The Contractor shall ensure that the Performance Security remains valid up to a period 60 days beyond fulfillment of all the obligations of the Contractor under the Contract, including defect liability and maintenance, if any. If the terms of the Performance Security specify its expiry date, and the Contractor has not become entitled to receive the Performance Certificate by the date 28 Days prior to the expiry date as provided in the Contract, the Contractor shall get extended the validity of the Performance Security. Failure by the Contractor to extend the validity of the Performance security as described herein above, in which event the Engineer-in-charge may claim the full amount of the performance security.
	4.3.4	In the event of the Contract being determined or rescinded under any of the provisions of Sub-Clause 16.1, the Performance Security shall stand forfeited in full and shall be absolutely at the disposal of the Procuring Entity.
Commencement of Work at the earliest. Record the Commencement or start date.	4.4	The Contractor shall commence the Works after signing of the Contract within the period as specified in the Special Conditions of the Contract. In case the Contractor does not commence the works within the above period, the Engineer-in-charge shall issue a notice after the expiry of the said period. The actual date of commencement shall be duly recorded by the Engineer-in-Charge.
Contractor's Representative	4.5	Contractor shall appoint the Contractor's Representative and shall give him all authority necessary to act on the Contractor's behalf under the Contract. Unless the Contractor's Representative is named in the Contract, the Contractor shall, prior to the Commencement Date, submit to the Engineer-in-charge for consent the name and particulars of the person the Contractor propose to appoint as Contractor's Representative. If consent is withheld or subsequently revoked in terms of this Sub-Clause, or if the appointed person fails to act as Contractor's Representative, or conducts improperly at the Site, the Contractor shall submit the name and particulars of another suitable person for such appointment. The former representative shall be removed within seven Days of such notice containing reasons by the Engineer-in-charge.

		The Contractor shall not, except if the representative has lost the confidence of the Contractor or is not complying to the instructions of the Engineer-in-charge or his assistants, remove without the prior consent of the Engineer-in-charge, revoke the appointment of the Contractor's Representative or appoint a replacement. The whole time of the Contractor's Representative shall be given to directing the Contractor's performance of the Contract. If the Contractor's Representative is to be temporarily absent from the Site during the execution of the Works, a suitable replacement person shall be appointed, subject to the Engineer-in-charge's prior consent, and the Engineer-in-charge shall be notified accordingly. The Contractor's Representative shall, on behalf of the Contractor, receive instructions under Sub-Clause 3.3 [Instructions of the Engineer-in-charge] and comply to them. The Contractor's Representative may delegate any powers, functions and authority to any competent person and may at any time revoke the delegation. Any delegation or revocation shall not take effect until the Engineer-in-charge has received prior notice signed by the Contractor's Representative, naming the person and specifying the powers, functions and authority being delegated or revoked. The Contractor's Representative shall be fluent in the language for communications defined in Sub-Clause 1.4. If the Contractor's Representative's delegates are not fluent in the said language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer-in-charge.
Sub-Contractor	4.6	As per Sub-clause 5 of General Provision
Co-Operation	4.7	The Contractor shall, as specified in the Contract or as instructed by the Engineer-in-charge, allow appropriate opportunities for carrying out work to: i. the Procuring Entity's Personnel, ii. any other Contractors employed by the Procuring Entity, and iii. the personnel of any legally constituted public authorities, who may be employed in the execution on or near the Site of any work not included in the Contract. In case of a notified disaster the Contractor shall extend all kind of support to the Disaster management Authority as per Government terms and conditions. Any such instruction shall constitute a Variation if and to the extent that it causes the Contractor to suffer delays and/or to incur Unforeseeable Cost. Services for these personnel and other Contractors may include the use of Contractor's Equipment, Temporary Works or access arrangements which are the responsibility of the Contractor. If, under the Contract, the Procuring Entity is required to give to the Contractor, possession of any foundation, structure, plant or means of accessing accordance with Contractor's Documents, the Contractor shall submit such documents to the Engineer-in-charge in the time and manner stated in the Specifications.
Safety Procedures at the site of works	4.8	The Contractor shall: i. Prior to the commencement of the Works, prepare and submit for approval by the Engineer-in-charge an auditable safety plan at Site in accordance with relevant Safety Code. The Contractor shall comply with all applicable safety regulations; ii. take care for the safety of all persons entitled to be on the Site; iii. use reasonable efforts to keep the Site and Works clear of unnecessary obstruction so as to avoid danger to these persons; iv. provide fencing, lighting, guarding and watching of the works

		until completion and taking over under Sub-Clause 12.1 [Taking over of Works]; and v. Provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land. In addition to the provisions of this Contract, the Contractor shall follow the safety code of the Department.
Quality Assurance	4.9.1	The Procuring Entity shall have the right to exercise proper Quality Control measures to ensure that the works have been executed as per specifications and have the designed durability. It will be in three tiers: i. The first tier being the Contractor's engineers ensuring full compliance to specifications and conforming the same through testing (as per frequencies specified in the BIS, IRC or other relevant codes) on input materials, processes and the output in the field laboratory established by the Contractor at his cost . ii. The second tier shall be the Engineer-in-charge's team conducting such tests to the extent of the specified code frequency at the Contractor's field laboratory or Department/ Organization's laboratory and comparing the results with those carried out by the Contractor's Engineers; and iii. The third tier shall be the QC unit or „Third Party Quality Inspections“ by the approved Inspection Bodies by employer, or by the Technical Examiner of the Department. iii. The third tier shall conduct such tests to the extent of 5 to 10% or as decided by employer of the specified frequencies duly witnessed by the Contractor's & Procuring Entity's engineers. iv. The Contractor shall provide all assistance to conduct such tests.
	4.9.2	The Contractor shall institute an approved quality assurance plan stating the methodology / responsibility for sampling, testing/ confirmatory testing, testing frequencies, statistical quality controls, observation / report formats, acceptance criteria, issue and resolution of Non-Conformance Reports etc. to demonstrate compliance with the requirements of the specifications. The system shall be in accordance with the details stated in the Contract. The Engineer-in-charge shall be entitled to audit any aspect of the system. Details of all procedures and compliance documents shall be submitted to the Engineer-in-charge for information before each design and execution stage is commenced. When any document of a technical nature is issued to the Engineer-in-charge, evidence of the prior acceptance by the Contractor himself shall be apparent on the document itself. Compliance with the quality assurance system shall not relieve the Contractor of any of his duties, obligations or responsibilities under the Contract.
Site Data	4.10.1	The Procuring Entity shall have made available to the Contractor for his information, prior to the Base Date, all relevant data in the Procuring Entity's possession on sub-surface and hydrological conditions at the Site, including environmental aspects. The Procuring Entity shall similarly make available to the Contractor all such data which come into the Procuring Entity's possession after the Base Date. The Contractor shall be responsible for verifying and interpreting all such data. The Procuring Entity shall not be held responsible about the correctness of all such data and the Contractor shall confirm/ verify all such data at his own cost.

	4.10.2	To the extent which was practicable (taking account of Cost and time), the Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Bid for Works. To the same extent, the Contractor shall be deemed to have inspected and examined the Site, its surroundings, the above data and other available information, and to have been satisfied before submitting the Bid as to all relevant matters, including (without limitation): - the form and nature of the Site, including subsurface conditions, - the hydrological and climatic conditions, - the extent and nature of the work and goods necessary for the execution and completion of the Works and the remedying of any Defects, - the Laws, procedures and labour practices of India, particularly Rajasthan, and - the Contractor's requirements for access, accommodation, facilities, personnel, power, transport, water and other services.
	4.11	Deleted
Unforeseeable Physical Conditions	4.12	In this Sub-Clause, "physical conditions" means natural physical conditions and man-made and other physical obstructions and pollutants, which the Contractor encounters at the Site when executing the Works, including sub-surface and hydrological conditions but excluding climatic conditions. If the Contractor encounters adverse physical conditions which the Procuring Entity considers to have been Unforeseeable, the Contractor shall give notice to the Engineer-in-charge as soon as practicable. This notice shall describe the physical conditions, so that they can be inspected by the Engineer-in-charge, and shall set out the reasons why the Contractor considers them to be Unforeseeable. The Contractor shall continue executing the Works, using such proper and reasonable measures as are appropriate for the physical conditions, and shall comply with any instructions which the Engineer-in-charge may give. If an instruction constitutes a Variation, Clause 9 [Deviations, Variations and Adjustments] shall apply. Upon receiving such notice and inspecting and/or investigating these physical conditions, the Engineer-in-charge shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine whether and (if so) to what extent these physical conditions were Unforeseeable, and the matters described in sub-paragraphs (i) and (ii) above related to this extent by the Contractor, but the Engineer-in-charge shall not be bound by the Contractor's interpretation of any such evidence. However, before additional Cost is finally agreed or determined under sub-paragraph (ii), the Engineer-in-charge may also review whether other physical conditions in similar parts of the Works (if any) were more favorable than could reasonably have been foreseen when the Contractor submitted the Bid. If and to the extent that these more favorable conditions were encountered, the Engineer-in-charge may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the reductions in Cost which were due to these conditions, which may be included (as deductions) in the Contract Price and Payment Certificates.

		However, the net effect of all adjustments under sub-paragraph (ii) and all these reductions, for all the physical conditions encountered in similar parts of the Works, shall not result in a net reduction in the Contract Price.
Right of Way and Facilities	4.13.1	Unless otherwise specified in the Contract the Procuring Entity shall provide access to and possession of the Site including special and/or temporary rights-of-way which are necessary for the Works. The Contractor shall obtain, at his risk and Cost, any additional rights of way or facilities outside the Site which he may require for the purposes of the Works.
	4.13.2	The Contractor shall allow the Engineer-in-charge and any person authorized by the Engineer-in-charge access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials are being collected or stored or plant are being installed/ assembled for the Works. The contractor may satisfy himself regarding site, acquisition of land, approach roads etc.
Avoidance of Interference with public conveniences	4.14	The Contractor shall not interfere unnecessarily or improperly with: - the convenience of the public, or - the access to and use and occupation of all roads and footpaths, irrespective of whether they are public or in the possession of the Procuring Entity or of others The Contractor shall indemnify and hold the Procuring Entity harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from any such unnecessary or improper interference.
Access Routes to Site	4.15	The Contractor shall be deemed to have been satisfied as to the suitability and availability of access routes to the Site at Base Date. The Contractor shall use reasonable efforts to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These efforts shall include the proper use of appropriate vehicles and routes. Except as otherwise stated in these Conditions: - The Contractor shall (as between the Parties) be responsible for any maintenance which may be required for his use of access routes; - The Contractor shall provide all necessary signs or directions along access routes, and shall obtain any permission which may be required from the relevant authorities for his use of routes, signs and directions; - The Procuring Entity shall not be responsible for any claims which may arise from the use or otherwise of any access route; - The Procuring Entity does not guarantee the suitability or availability of particular access routes; and v. Costs due to non-suitability or non-availability, for the use required by the Contractor, of access routes shall be borne by the Contractor.
Contractor's Equipment	4.16	The Contractor shall be responsible for all Contractor's Equipment. When brought on to the Site, Contractor's Equipment shall be deemed to be exclusively intended for the execution of the Works. The Contractor shall not remove from the Site any major items of Contractor's Equipment without the consent of the Engineer-in-Charge. However, consent shall not be required for vehicles transporting Goods or Contractor's Personnel off Site. Construction Plant & Equipment and Materials, brought to the site by the Contractor for use on the works, shall be removed outside the project area, after those are no longer required for the Works. The contractor will notify the Owner before removing the same. It will be the sole responsibility of contractor for mobilization/ demobilization of required plant and machinery at the site as per requirement and removal during idling period. Contractor shall not be entitled for any kind of claims for idling of tool and machinery due to slow progress/ no progress days attributed to either of the party/ force majeure or any reason.

		Contractor shall fully insure his tool and plants against all kinds of probable risks likely to occur during contract period. Any kind of idling, loss of capacity, damage to his resources during contract period will be liability of contractor.
Protection of the Environment	4.17	The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other results of his operations. The Contractor shall ensure that emissions, surface discharges and effluent from the Contractor's activities shall not exceed the values stated in the Specifications or prescribed by applicable Laws. The Contractor shall, throughout the execution and completion of the Works and the remedying of any Defects therein: - have full regard for the safety of all persons entitled to be upon the Site and keep the Site (so far as the same is under his control) and the Works (so far as the same are not completed or occupied by the Procuring Entity) in an orderly state appropriate to the avoidance of danger to such persons; and - provide and maintain at his own Cost all lights, guards, fencing, warning signs and watchmen and other things necessary or required by the Engineer-in-charge or by any duly constituted authority, for the protection of the Works or for the safety and convenience of the public or others.
Electricity, Water and Gas	4.18	The Contractor shall, except as stated below, be responsible for the provision of all power, water and other services he may require for his construction activities and to the extent defined in the Specifications, for the tests. The Contractor shall be entitled to use for the purposes of the Works such supplies of electricity, suitable water, gas and other services as may be available on the Site with due permission of the service provider, on payment of billing value. The Contractor shall, at his risk and cost, provide any apparatus necessary for his use of these services and for measuring / paying for the quantities consumed. The quantities consumed and the amounts due for such services shall be agreed or determined by the Engineer- in- Charge in accordance with Sub-Clause 2.5 [Procuring Entity's Claims] and Sub-Clause 3.5 [Determinations]. The Contractor shall pay these amounts to the Procuring Entity /service provider.
	4.19	Deleted
Progress Reports	4.20	The contractor shall submit to the Engineer- in - charge five copies of a Monthly Progress Report by the 3rd day of the following month, along with the interim payment certificates, and the updated construction program on MS Project or similar software for the next month in such form and details as the Engineer-in-charge shall reasonably prescribe, for the proper monthly follow up. Each report shall include: - Status of main items of works executed against targets indicating shortfall if any, and reasons thereof. Manpower - Labour – Expatriates Construction Equipment - charts, drawings, outputs and detailed descriptions of progress, including each stage of design (if any) on MS project or similar software, Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection and testing; and including these stages for work by each nominated Subcontractor (as defined in Sub-Clause 5.2 [Nomination of Sub-Contractors]; - photographs (in adequate numbers) showing the status of progress of works on the Site; - The details described in Sub-Clause 6.12 [Records of Contractor's Personnel & Equipment];

		v. Copies of quality assurance documents, test results, test certificates of manufactured Materials and action taken on Third Party Quality Inspections by the Contractor; vi. List of notices vii. Safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and viii. Comparisons of actual and planned progress, hindrances, with details of any events or circumstances which may jeopardize the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.
Security of the Site and Works	4.21	Unless otherwise stated in the Conditions: i. the Contractor shall be responsible for keeping unauthorized persons off the Site, ii. authorized persons shall be limited to the Contractor's Personnel and the Procuring Entity's Personnel; and to any other personnel notified to the Contractor by the Procuring Entity or the Engineer-in-charge, as authorized personnel of the Procuring Entity's other Contractors on the Site. iii. The contractor shall arrange to protect, at his own cost, in an adequate manner, all cut stone work and other work, requiring protection and to maintain such protection as long as work is in progress. He shall remove and replace this protection, as required by the Engineer-in-charge, from time to time. Any damage to the work, so protected, no matter how it may be caused, shall be made good by the Contractor free of cost. All templates, forms. Moulds, centering, false works and models which in the opinion of the Engineer-in-charge are necessary for the proper and workman like execution of the work, shall be provided by the Contractor free of cost. iv. The Contractor shall arrange to keep the site and works secure from manmade disasters, explosions by design or by accident or both at his own cost
Contractor's Operations on Site	4.22	The Contractor shall confine his operations to the Site, and to any additional areas which may be obtained by the Contractor and agreed to by the Engineer-in-charge as additional working areas. The Contractor shall take all necessary precautions to keep Contractor's Equipment and Contractor's Personnel within the Site and these additional areas, and to keep them off adjacent land. During the execution of the Works, the Contractor shall keep the Site free from all unnecessary obstruction, and shall store or dispose of any Contractor's Equipment or surplus Materials. The Contractor shall clear away and remove from the Site any wreckage, rubbish and Temporary Works which are no longer required. When the annual repairs and maintenance of Works are carried out, the splashes and droppings from white washing, color washing, painting etc. on walls, floor, windows etc. shall be removed and the surface cleaned simultaneously with the completion of these items of work in the individual rooms, quarters or premises etc. where the work is done without waiting for the actual completion of all the other items of work in the Contract. In case the Contractor fails to comply with the requirements of this Sub-Clause, the Engineer-in-Charge shall have the right to get this work done at the Cost of the Contractor either Departmentally or through any other agency. Before taking such action, the Engineer-in-Charge shall give ten Days' notice in writing to the Contractor. Upon the issue of a Taking-Over Certificate, the Contractor shall clear away and remove, from that part of the Site and Works to which the Taking-Over Certificate refers, all Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works. The Contractor shall leave that part of the Site and the Works in a clean and safe condition. However, the Contractor may retain on Site, during the Defects Notification Period, such goods, equipment as are required by the Contractor to fulfill obligations under the Contract.

Fossils/ antiques and articles of value	4.23	All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the Engineer-in-charge / Procuring Entity. The Contractor shall take reasonable precautions to prevent Contractor's Personnel or other persons from removing or damaging any of these findings.
Completion Plans to be Submitted by the Contractor	4.24	The Contractor shall submit completion drawings, designs and test data in 6 copies (4 hard and two soft) within thirty Days of the virtual completion of the Works. In case, the Contractor fails to submit the completion drawings, designs as aforesaid, the Engineer-in-charge shall be authorized to get these as built drawings, designs and test data prepared at the cost of the Contractor.
Contractor to Supply Tools & Plants etc.	4.25	The Contractor shall provide at his own Cost all materials plant, tools, appliances, implements, ladders, cordage, tackle, scaffolding and Temporary Works required for the proper execution of the Works, whether original, altered or substituted and whether included or not in the Specification or other documents forming part of the Contractor referred to in these conditions, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer-in-Charge as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefore to and from the Works. The Contractor shall also supply without charge the requisite number of persons with the means and materials, necessary for the purpose of setting out Works, and counting, weighing and assisting the measurement for examination at any time and from time to time of the work or Materials. Failing his so doing the same may be provided by the Engineer-in-Charge at the cost of the Contractor and recover it from him under this Contract or otherwise and/ or from his Performance Security or the proceeds of sale thereof, or of a sufficient portion thereof.
5. Sub-Contractor and Nomination of Sub-Contractor		
Sub-Contractor	5.1	The Contractor shall not Sub-let or subcontract the whole/ or even part of the Works without the consent of the Engineer-in-charge. If the Contractor does so, the Contract shall be liable to be terminated under Sub-Clause 16.1[Termination by Procuring Entity]. Details of the capability of such proposed Subcontractors shall be approved by the Engineer-in-charge. Engineer in charge shall obtain approval of sub-contractor from procurement entity. The Contractor shall be responsible for the misconduct, acts or defaults of any Subcontractor, his agents or employees, as if they were the acts or defaults of the Contractor. Unless otherwise stated: - the Contractor shall not be required to obtain consent to suppliers solely of materials, or to a subcontract for which the nominated Subcontractor is named in the Contract. - the prior consent/ approval of the Engineer-in-charge/ employer on capability documents of the sub-contract shall be obtained for proposed Sub-Contractor; - the Contractor shall give the Engineer-in-charge not less than 28 Days" notice of the intended date of the commencement of each Sub-Contractor's work, and of the commencement of such work on the Site. The Contractor shall ensure that the requirements imposed on the Contractor regarding Confidentiality as defined in the GCC Sub-Clause 1.16 [Confidential Details] shall apply equally to each nominated Subcontractor / Subcontractor.

		For all kind of activities performed by sub-contractor will be jointly and severally liability of both contractor and sub-contractor.
Nomination of Sub-Contractor	5.2	In the Contract “nominated Sub-Contractor” means a Subcontractor: - Who is stated in the Contract as being a nominated Sub contractor, or - Whom the Engineer-in-charge, instructs the Contractor to employ as a Subcontractor subject to Sub-Clause 5.3 [Objection to Nomination].
Objections to nominations	5.3	The Contractor shall not be under any obligation to employ a nominated Sub-contractor against whom the Contractor raises reasonable objection by notice to the Engineer-in-charge as soon as practicable, with supporting particulars.
Payment to Nominated Subcontractor	5.4	The Contractor shall pay to the Nominated Sub-Contractors the amounts shown on the Nominated Sub-contractor’s invoices approved by the Contractor which the Engineer-in-charge certifies to be due in accordance with the sub-contract. These amounts plus other charges paid to the Nominated Sub-Contractor shall be included in the Contract Price in accordance with Sub-Clause 9.6 [Provisional Sums].
Evidence of payments	5.5	Before issuing a Payment, Certificate which includes an amount payable to a nominated Subcontractor, the Engineer-in-Charge may request the Contractor to supply reasonable evidence that the nominated Subcontractor has received all amounts due in accordance with previous Payment Certificates, less applicable deductions for retention or otherwise. Unless the Contractor: - submits this reasonable evidence to the Engineer-in-Charge, or - satisfies the Engineer-in-Charge in writing that the Contractor is reasonably entitled to withhold or refuse to pay these amounts, and (ii) submits to the Engineer-in-Charge reasonable evidence that the nominated Subcontractor has been notified of the Contractor’s entitlement, then the Procuring Entity may (at his sole discretion) pay, direct to the nominated Subcontractor, part or all of such amounts previously certified (less applicable deductions) as are due to the nominated Subcontractor and for which the Contractor has failed to submit the evidence described in sub-paragraphs (a) or (b) above. The Contractor shall then repay, to the Procuring Entity, or the Procuring Entity shall deduct the amount from the dues of the Contractor, the amount which the nominated Subcontractor was directly paid by the Procuring Entity.
6. Engagement of Staff and Labour by the Contractor		
Staff and Labour	6.1	- Except as otherwise stated in the Specifications, the Contractor shall make arrangements for the engagement of all staff and labour, local or otherwise, and for their payment, water, power, healthcare backup, transport and, when appropriate, housing. - The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labour with appropriate qualifications and experience from sources within India. - No Engineer of gazetted rank or other gazetted officer employed in Engineering or administrative duties in an Engineering Department of the Government of Rajasthan shall work as a Contractor or employee of a Contractor for a period of two years after his retirement from Government service without the previous permission of State Government in writing. The Contract is liable to be cancelled if either the Contractor or any of his employees is found at any time to be such a person who had not obtained said permission prior to engagement in the Contractor's service, as the case may be.
Bidder barred from bidding if near Relatives working in	6.2	The Contractor shall not be permitted to bid for works of a Procuring Entity in which his near relative is an employee. He shall also not have a person as his employee who is a near relative of an employee of the Procuring

Procuring Entity's office		Entity. Any breach of this condition by the Contractor shall be considered as breach of Code of Integrity and shall render him liable to action under Section 11(3) of the Act which includes exclusion of his Bid from procurement process, forfeiture of Bid Security, Performance Security or any other security or bond relating to procurement, recovery of payments made, if any, along with interest at bank rate, cancellation of the Contract, if already made, debarment from future bidding for a period up to three years, etc. Note: By the term 'near relative' is meant wife, husband, parents and grand- parents, children and grand- children, brothers and sisters, uncles and cousins and their corresponding in- laws.
Employment of Technical Staff and other Employees	6.3.1	The Contractor shall Engage technical personnel as per list provided for in the Contract and provide all necessary superintendence during execution of the Works and as long thereafter as may be necessary for proper fulfilling of the obligations under the Contract. The project manager of the Contractor shall be his principal technical representative. Other personnel shall be engaged as specified in the qualification criteria.
	6.3.2	The technical staff should always be available at site whenever required by Engineer- in- charge to take instructions. The Contractor shall comply with the provisions of the Apprentices Act, 1961, and the Rules and Orders issued, there under, from time to time. If he fails to do so, his failure will be a breach of Contract. The Contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.
Responsibility of the Technical Staff and employees	6.4	Technical officers/ staff deployed by the Contractor at any construction Site will be responsible for proper quality of Works and physical targeted progress of the Works.
Rate of Wages and Conditions of Labour	6.5	The Contractor shall not pay less than fair wages/ minimum wages to laborer's engaged by him on the Works as revised from time to time by the State Government, but the Procuring Entity shall not be liable to pay anything extra for it except as stipulated in price escalation Sub-Clause of the agreement. Explanation: "Fair Wage" means minimum wages for time or piece work, fixed or revised, by the State Government under the Minimum Wages Act, 1948. The Contractor shall, notwithstanding the provisions of any contract to the contrary, cause to be paid fair wages to laborer's directly or indirectly engaged on the Works, including any Labour engaged by his Sub-Contractors in connection with the said Works as if the laborer's have been immediately or directly employed by him. In respect of all laborer's, immediately or directly employed on the Works, for the purpose of Contractor's part of this agreement, the Contractor shall comply with or cause to be complied with the Public Works Department Contractor's Labour Regulations made, or that maybe made by the State Government from time to time in Regard to payment of wages, wage period, deductions from wages, recovery of wages not paid, and unauthorized deductions, maintenance of wages register, wage card, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and other matters of a like nature. The Engineer-in-charge shall have the right to deduct from the money due to the Contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers, by reasons of non-fulfillment of the conditions of the Contract, for the benefit of the worker or the workers, non-payment of wages or of deductions made there from, which are not justified by the terms of the Contract, or as a result of non-observance of the aforesaid regulations. Vis-à-vis the State Government of Rajasthan, the Contractor shall be primarily liable for all payments to be made and for the observance of the regulations aforesaid, without prejudice to his right to claim indemnity from his Sub-Contractors. The regulations, aforesaid, shall be deemed to be part of this Contract and any breach, thereof, shall be deemed to be breach of the Contract.

Contractor not to engage staff of Procuring Entity	6.6	The Contractor shall not recruit, or attempt to recruit, full time (on leave) or part time the staff and Labour from amongst the Procuring Entity's Personnel in any capacity.
Working Hours	6.7	No work shall be carried out on the Site on locally recognized Days of rest, or outside the normal working hours stated in the Contract Data, unless: i otherwise stated in the Contract, ii. the Engineer-in-charge gives consent, or iii the work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer-in-charge.
Facilities for Staff and Labour	6.8	Except as otherwise stated in the Specifications, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall also provide work site facilities for the Procuring Entity's Personnel as stated in the Specifications. The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works.
Health & Safety	6.9	The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay, doctor at call and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Procuring Entity's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics. The Contractor shall appoint a safety officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified and trained for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority. The Contractor shall send, to the Engineer-in-charge, details of any accident occurred at the Site or to or due to the Works, as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Engineer-in-charge may reasonably require.
Contractor's Superintendence	6.10	Throughout the execution of the Works, and as long thereafter as is necessary to fulfill the Contractor's obligations, the Contractor shall provide all necessary superintendence to plan, arrange, direct, manage, inspect and test the Works. Superintendence shall be given by a sufficient number of persons having adequate knowledge of the language for communications (defined in Sub-Clause 1.4 [Law and Language] and of the operations to be carried out (including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents), for the satisfactory and safe execution of the Works.
Contractor's Personnel	6.11	Contractor's Personnel shall be appropriately qualified, skilled and experienced in respective trades or occupations. The Engineer-in-charge may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative, if applicable, who: i. persists in any misconduct or lack of care, ii. carries out duties incompetently or negligently, iii. fails to conform with any provisions of the Contract, or iv. Persists in any conduct which is prejudicial to safety, health, or the protection of the environment.

		If appropriate, the Contractor shall then appoint (or cause to be appointed) a suitable replacement person.
Records of Contractor's personnel and Equipment	6.12	The Contractor shall provide all required equipment, machinery at the Site and submit to the Engineer-in-charge, details showing the number of each category of Contractor's Personnel and of each type of Contractor's Equipment on the Site. Details shall be submitted each calendar month, in a form approved by the Engineer-in-charge, until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.
Disorderly Conduct	6.13	The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site.
Foreign Personnel	6.14	Is permitted, the Contractor may bring in to the Country any foreign personnel who are necessary for the execution of the Works to the extent allowed by the applicable Laws. The Contractor shall ensure that these personnel are provided with the required residence visas and work permits. The Procuring Entity will, if requested by the Contractor, use his best endeavors in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national, or Government permission required for bringing in the Contractor's personnel. The Contractor shall be responsible for the return of these personnel to the place where they were recruited or to their domicile. In the event of the death in the Country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial.
No unlicensed storage of Explosives and POL	6.15	The Contractor is not authorized to store explosives and POL or other inflammable materials without a valid license from the competent legal authority.
Prohibition of Forced or Compulsory labour	6.16	The Contractor shall not employ forced or compulsory labour, which consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements.
Prohibition of Child Labour	6.17	The Contractor shall comply with the provisions of Acts and rules pertaining to prohibition of employment of child labour including not employing any child to perform any work that is economically exploitative, or is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.
Festivals and Religious Customs	6.18	The Contractor shall respect the Country's recognized festivals, days of rest and religious or other customs.
Employment Records of Workers	6.19	The Contractor shall keep complete and accurate records of the employment of labour at the Site. The records shall include the names, ages, genders, hours worked and wages paid to all workers. These records shall be summarized on a monthly basis and submitted to the Engineer-in-charge, and these records shall be available for inspection by Auditors / labour inspectors and others as per law during normal working hours. These records shall be included in the details to be submitted by the Contractor under Sub-Clause 6.12 [Records of Contractor's Personnel and Equipment].
7. Execution of works and workmanship		
Manner of Execution	7.1	The Contractor shall carry out works, the production of mixes, the procurement of input materials, and all other execution of the Works: i. in the manner (if any) specified in the Contract, ii. in a proper workman like and careful manner, in accordance with recognized good practices, and iii. with properly equipped facilities and non-hazardous materials,

		except as otherwise specified in the Contract.
Samples	7.2	The Contractor shall submit the following samples of Materials, and relevant information, to the Engineer-in-charge for consent prior to using the Materials in or for the Works: - Contractor's standard samples of raw/ produced Materials/tool and equipment's and samples specified in the Contract, all at the Contractor's Cost, - Additional samples instructed by the Engineer-in-Charge as a Variation. Each sample shall be labeled as to origin and intended use in the Works. Samples shall also be collected by the Quality testing/inspection teams from the works in progress and the Contractor shall willingly cooperate with such quality assurance procedures.
Inspection	7.3	The Procuring Entity's Personnel shall at all reasonable times: - Has full access to all parts of the Site and to all places from which natural materials are being obtained, and - During production, manufacture and construction (at the Site and elsewhere), be entitled to examine, inspect, measure and test the materials and workmanship, and to check the progress of manufacture of Plant and production and manufacture of materials. The Contractor shall give the Procuring Entity's Personnel full opportunity to carry out these activities, including providing access, facilities, permissions and safety equipment. No such activity shall relieve the Contractor from any obligation or responsibility. The Contractor shall give notice of minimum 07 days to the Engineer-in-charge whenever any work is ready and before it is covered up, put out of sight, or packaged for storage or transport, beyond measurement, any work in order that the same may be measured and correct dimensions thereof, be taken before the same is covered up. The Engineer-in-charge shall then either carry out the examination, inspection, measurement or testing without unreasonable delay, or promptly give notice to the Contractor that the Engineer-in-charge does not require to do so. If the Contractor fails to give the notice, he shall, if and when required by the Engineer-in-charge, uncover the work and thereafter reinstate and make good, all at the Contractor's Cost.
Materials Supplied by the Contractor	7.8	The Contractor shall, at his own expense, provide all materials conforming to the specifications from the sources approved by the Engineer-In-Charge, required for the Works other than those, which are stipulated, to be supplied by the Procuring Entity. Samples for all such materials shall be collected by the Contractor and tested in the presence of representative of the Engineer-in-Charge, at the field laboratory established by the Contractor at the site. Tests which cannot be carried out at the field laboratory, shall be got tested at an NABL accredited laboratory, or any ISI approved laboratory or a Government/ Departmental laboratory approved by the Engineer-in-Charge/ Employer. Only materials so approved shall be used in the works and any change of materials shall be similarly got approved again. Works constructed/executed with unapproved materials shall be summarily rejected without any further investigation or testing. The Contractor shall not be eligible for any claim or compensation either arising out of any delay in the work or due to any corrective measures required to be taken on account of and as a result of testing of materials. The Engineer-in-Charge shall have full powers to require the removal from the premises, of all materials which in his opinion are not in accordance with the Specifications and in case of default the Engineer-in-Charge shall be at liberty to employ at the expense of the Contractor, other persons to remove the same without being answerable or accountable for any loss for damage that may happen or arise to such Materials. The Engineer-in-Charge shall also have full powers to require

		other proper Materials to be substituted thereof and in case of default the Engineer-in-charge may cause the same to be supplied from other suitable sources and all Costs which may be incurred for such removal and substitution shall be borne by the Contractor.
Testing	7.9.1	This Sub-Clause shall apply to all tests specified in the Contract, other than the Tests after Completion (if any). Except as otherwise specified in the Contract, the Contractor shall provide a field laboratory with all apparatus, assistance, documents and other information, electricity, equipment, fuel, consumables, instruments, labour, materials, and suitably qualified and experienced staff, as are necessary to carry out the specified tests efficiently. The Contractor shall agree, with the Engineer-in-charge, the time and place for the specified testing of any Plant, Materials and other parts of the Works. The Engineer-in-charge may, under Sub-Clause 9.2.1 [Deviations/ Variations, Extent and Pricing], vary the location or details of specified tests, or instruct the Contractor to carry out additional tests. If these varied or additional tests show that the tested Plant, Materials or works or workmanship is not in accordance with the Contract, the Cost of carrying out this variation shall be borne by the Contractor, notwithstanding other provisions of the Contract. The Engineer-in-charge shall give the Contractor not less than 24 hours' notice of the Engineer-in-charge's intention to attend the tests. If the Engineer-in-charge does not attend at the time and place agreed, he may designate a qualified and authorized person to attend the testing, if not, the Contractor may approach the Procuring Entity for deputing an Engineer / any other experienced person to witness the tests. In no case shall the tests be conducted without an Engineer/competent person representing the Procuring Entity.
	7.9.2	i. an extension of time for any such delay, if completion is or will be delayed, and ii. Payment of any such Cost, which shall be included in the Contract Price. After receiving this notice, the Engineer-in-charge shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters The Contractor shall promptly forward to the Engineer-in-charge, duly certified reports of the tests. When the specified tests have been passed, the Engineer-in-charge shall endorse the Contractor's test certificate.
Cost of Samples	7.10	All samples shall be supplied by the Contractor at his own Cost if the supply thereof is clearly intended by or provided for in the Contract.
Cost of Tests	7.11	The Cost of conducting any test shall be borne by the Contractor if such test is: i. clearly intended by or provided for use in the Contract, or ii. particularized in the Contract (In case only of a test under load or of a test to ascertain whether the design of any finished or partially finished work is appropriate for the purposes for which it was intended to fulfill) in sufficient detail to enable the Contractor to price or allow for the same in his Bid.
Cost of Tests not provided for	7.12	If any test required by the Engineer-in-charge which is: i. not so intended by or provided for in the Contract or codes;

		ii. (in the cases above mentioned) not so particularized, or iii. (though so intended or provided for), if required by the Engineer-in-charge to be carried out at any place other than the Site or the place of manufacture, fabrication or preparation of the Materials or Plant, on test shows the Materials, Plant or work or workmanship not to be in accordance with the provisions of the Contract/ specifications to the satisfaction of the Engineer-in-charge, then the Cost of such test shall be borne by the Contractor, but in any other case Department/ Organization will bear the Cost.
Rejection	7.13	If, as a result of an examination, inspection, measurement or testing, any Plant, Materials, works or workmanship is found to be defective or otherwise not in accordance with the Contract, the Engineer-in-charge may reject the works, Plant, Materials or workmanship by giving notice to the Contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the reconstructed/ reproduced/ replaced item complies with the Contract. If the Engineer-in-charge requires this Plant, Materials, works, or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If the rejection and retesting cause the Procuring Entity to incur additional Costs, the Contractor shall subject to Sub-Clause 2.5 [Procuring Entity's Claims] pay these Costs to the Procuring Entity.
Remedial Work	7.14	Notwithstanding any previous test or certification, the Engineer-in-charge may instruct the Contractor to: i. remove from the Site and replace any works, Plant or Materials which is not in accordance with the Contract, ii. remove and re-execute any other work which is not in accordance with the Contract, and iii. execute any work which is urgently required for the safety of the Works, whether because of an accident, unforeseeable event or otherwise. The Contractor shall comply with the instruction within a reasonable time, which shall be the time (if any) specified in the instruction, or immediately if urgency is specified under sub-paragraph iii. If the Contractor fails to comply with the instruction, the Procuring Entity shall be entitled to employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been entitled to payment for the work, the Contractor shall subject to Sub-Clause 2.5[Procuring Entity's Claims] pay to the Procuring Entity all Costs arising from this failure.
Ownership of Plant and Materials	7.15	Except as otherwise provided in the Contract, each item of Plant and Materials shall, to the extent consistent with the Contract, become the property of the Procuring Entity at whichever is the earlier of the following times, free from liens and other encumbrances: i. When it is incorporated in the Works; ii. when the Contractor is paid the corresponding value of the Plant and Materials
Action where no Specifications are provided.	7.17	In the case of any class of works for which there are no specifications in Bureau of Indian Standards Specifications, Indian Road Congress for road Works and Indian Building Congress for building Works or any Central Government agency, or Departmental Specifications, such works shall be carried out in accordance with the relevant International Standards under the instructions and requirements of the Engineer-in-Charge.

Royalties	7.18	The Contractor shall pay all royalties, rents and other payments for: i. natural Materials obtained from outside the Site, and ii. Disposal of materials from demolitions and excavations and of other surplus materials (whether natural or man-made), except to the extent that disposal areas within the Site are specified in the Contract. iii. The liability, if any, on account of quarry fees, royalties, octroi and any other taxes and duties in respect of materials actually consumed on public work shall be borne by the Contractor.
8. Commencement, Delays and Suspension		
Fixing centerlines, reference points and bench marks.	8.1	The basic centerlines, reference points and benchmarks will be fixed by the by the Contractor and checked/confirmed by the Engineer-in-Charge. The Contractor shall establish at his own Cost at suitable points, additional reference lines and benchmarks as may be necessary and instructed by the Engineer-in-Charge. The Contractor shall remain responsible for the sufficiency and accuracy of all the benchmarks and reference lines.
Setting out of works.	8.2	The contractor shall be responsible for the true and proper setting out of the works in relation to permanent bench - marks and its coordinates/drawings given by the owner in Writing. If, at any time during the progress of the works, any error shall appear or arise in the position, levels, dimensions or alignments of any part of the Works, the Contractor shall rectify the same, The checking of any setting out or of any line or level by the owner or the owner's representative shall not in any way relieve the Contractor of his responsibility for the correctness thereof and the Contractor shall carefully -protect and preserve all bench - marks, sight - rails, pegs and other things used in setting out the Works,
Commencement of Works	8.3.1	Except otherwise specified in the Contract Data/ Special Conditions of Contract, the Commencement Date shall be the date at which the following precedent conditions have all been fulfilled and the Engineer-in-charges instruction recording the agreement of both Parties on such fulfillment and instructing to commence the Work is received by the Contractor: i. signature of the Contract Agreement (after submission of Performance security and Insurance by the Contractor) by both Parties, and if required, approval of the Contract by relevant authorities. ii. delivery to the Contractor of reasonable evidence of the Procuring Entity's financial arrangements/ budget provision. iii. except if otherwise specified in the Contract Data, possession of the Site given to the Contractor together with such permission(s) under (a) of Clause 2.1 [Right of Access to the Site] as required for the commencement of the Works. The Contractor shall commence the execution of the Works as soon as is reasonably practicable after the Commencement Date and shall then proceed with the Works with due expedition and without delay. The date of commencement and stipulated completion shall be entered in the Contract Agreement.
	8.3.2	In case, the work cannot be started within one-fourth time of the stipulated period of completion of the Works due to reasons not within the control of the Contractor as decided by the Procuring Entity, either Party may close the Contract. In such eventuality, the Performance

		Security of the Contractor shall be refunded, but no payment on account of interest, loss of profit or damages etc. shall be payable at all.
Time for Completion	8.4	Time is essence of the contract. The Contractor shall complete the whole of the Works, and each Section (if any), within the Time for Completion for the Works or Section (as the case may be), including: - achieving the passing of the Tests on Completion, and - Completing all work which is stated in the Contract as being required for the Works or Section to be considered to be completed for the purposes of taking-over under Clause 12[Taking Over of the Works and Sections]. - Completion of as built drawings and a manual for maintenance and operations, if required. - Completion of each milestone as per the current (original updated every month) construction program. - Rectification and or reconstruction of all deficient items of work or works /items of works for which „Non-Conformance Reports“ were issued. - Restoration of the approach roads, fencing and appurtenant works damaged during execution of the Contracted project and clearance of Site. - O&M period as specified in the contract.
Construction Program (Activity Schedule in case of Lump Sum Contract)	8.5	The Contractor shall submit a detailed execution time program on MS Project or other similar software to the Engineer-in-charge within 28 Days after receiving the notice under Sub-Clause 8.3 [Commencement of Works]. The Contractor shall also submit a revised program whenever the previous program is inconsistent with actual progress or with the Contractor's obligations. Each program shall be revised every month and shall include: - the order in which the Contractor intends to carry out the Works, including the anticipated timing of each stage of design (if any), drawings, Contractor's Documents, procurement, manufacture of Plant, delivery to Site, construction of works, erection and testing, - each of these stages for work by each Sub-Contractor/Nominated Sub-Contractor, iii. the sequence and timing of quality and other inspections and tests specified in the Contract, and iv. a supporting report which includes: - A general description of the time, methods which the Contractor intends to adopt, and of the major stages, in the execution of the Works, and - details showing the Contractor's reasonable estimate of the number of each class of Contractor's Personnel and of each type of Contractor's Equipment, required on the Site for each major stage. Unless the Engineer-in-charge, within 21 Days after receiving a program, gives notice to the Contractor stating the extent to which it does not comply with the Contract, the Contractor shall proceed in accordance with the program, subject to his other obligations under the Contract. The Procuring Entity's Personnel shall be entitled to rely upon the program when planning their activities. The Contractor shall promptly give notice to the Engineer-in-charge of

		specific probable future events or circumstances which may adversely affect the Works, increase the Contract Price or delay the execution of the Works. The Engineer-in-charge may require the Contractor to submit an estimate of the anticipated effect of the future event or circumstances, and/or a proposal under Sub-Clause 9.2 [Deviations/ Variations Extent and Pricing]. If, at any time, the Engineer-in-charge gives notice to the Contractor that a program fails (to the extent stated) to comply with the Contract or to be consistent with actual progress and the Contractor's stated intentions, the Contractor shall submit a revised program to the Engineer-in-charge in accordance with this Sub-Clause.
Extension of Time for Completion	8.6	if and to the extent that completion for the purposes of Clause 12 [Taking Over of the Works and Sections] is or will be delayed by any of the following causes: i. a variation (unless an adjustment to the Time for Completion has been agreed under Clause 9 [Deviations, Variations and Adjustments] or other substantial change in the quantity/design of an item of work included in the Contract, ii. Any time taken by any agency in granting permission which is essential for the work. iii. a cause of delay giving an entitlement to extension of time under a Sub-Clause of these Conditions, iv. exceptionally adverse climatic conditions, including the exceptionally rains, high or low variations in temperatures, v. Unforeseeable shortages in the availability of personnel or Goods caused by epidemic or Governmental actions, or vi. any delay, impediment or prevention caused by or attributable to the Procuring Entity, the Procuring Entity's Personnel, or the Procuring Entity's other Contractors or any agency providing approvals related to work vii. Public protest causing significant hindrance in the work. If the Contractor considers himself to be entitled to an extension of the Time for Completion, the Contractor shall give notice to the Engineer-in-charge in accordance with Sub-Clause [Contractor's Claims]. When determining each extension of time under Sub-Clause 3.5 [Determinations], the Engineer-in-charge shall review previous determinations and may increase, but shall not decrease, the total extension of time.
Delays Caused by Authorities	8.7	If the following conditions apply, namely: i. the Contractor has diligently followed the procedures laid down by the relevant legally constituted public authorities in the Country, ii. these authorities delay or disrupt the Contractor's work, and iii. the delay or disruption was Unforeseeable, then this delay or disruption will be considered as a cause of delay under Sub-Clause 8.6 [Extension of Time for Completion].
Rate of progress of works.	8.8	As soon as possible after the Contract is concluded the Contractor shall submit a time and progress chart (preferably on MS Project or other

		similar software) for each milestone and get it approved by the Engineer-in-Charge. The chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the work. It shall indicate the forecast of the dates of commencement and completion of various tasks or sections of the work and may be amended as necessary by agreement between the Engineer-in-Charge and Contractor within the limitations of time imposed in the Contract documents, and further to ensure good progress during the execution of the work, the Contractor shall in all cases in which the time allowed for any work, exceeds one month complete the work as per milestone. If, at any time: - actual progress is too slow to complete within the Time for Completion, and/or progress has fallen (or will fall) behind the current program under Sub-Clause 8.5 [Construction Program], other than as a result of a cause listed in Sub-Clause 8.6 [Extension of Time for Completion], then the Engineer-in-charge may instruct the Contractor to submit, under Sub-Clause 8.5 [Construction Program], a revised program and supporting report describing the revised methods which the Contractor proposes to adopt in order to expedite progress and complete within the Time for Completion. - Unless the Engineer-in-Charge notifies otherwise, the Contractor shall adopt these revised methods, which may require increases in the working hours and/or in the numbers of Contractor's Personnel and/or Goods, at the risk and Cost of the Contractor. If these revised methods cause the Procuring Entity to incur additional Costs, the Contractor shall subject to notice under Sub-Clause 2.5 [Procuring Entity's Claims] pay these Costs to the Procuring Entity, in addition to delay damages (if any) under GCC Clause 2. - Additional Costs of revised methods including acceleration measures, instructed by the Engineer-in-charge to reduce delays resulting from causes listed under Sub-Clause 8.6 [Extension of Time for Completion] shall be paid by the Procuring Entity, without generating, however, any other additional payment benefit to the Contractor If the progress of the work has fallen so much in arrears as to prevent other contractors on the work from carrying out their part of the work within the stipulated time, he will be liable for the settlement of any claim put in by any of these contractors for the expenses of keeping their labor unemployed to the extent considered reasonable by the Engineer-in-charge.
Compensation/ Damages for Delay (Liquidated Damage) (In case of Lump Sum Contract, the liquidated damages shall be linked to Stage wise completion of Works as stated in Activity Schedule and specified in SCC)	8.9	Deleted

Suspension of Work	8.10.1	The Engineer-in-charge may for recorded reasons, at any time instructs the Contractor to suspend progress of part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage. The Engineer-in-charge may also notify the cause for the suspension.
	8.10.2	The Contractor shall, on receipt of the order in writing of the Engineer-in-Charge (whose decision shall be final and binding on the Contractor) suspend the progress of the Works or any part thereof for such time and in such manner as the Engineer-in-Charge may consider necessary so as not to cause any damage or injury to the work already done or endanger the safety thereof, for any of the following reasons: i. on account of any default on the part of the Contractor; or ii. for proper execution of the Works or part thereof for reasons other than the default of the Contractor; or iii. for safety of the Works or part thereof. The Contractor shall, carry out the instructions given in that behalf by the Engineer-in-Charge. iv. If the suspension is ordered for reasons ii and iii above, the Contractor shall be entitled to an extension of time equal to the period of every such suspension for completion of the item or group of items of work for v. which a separate period of completion is specified in the Contract and of which the suspended work forms a part,
Consequences of Suspension	8.11	Deleted
Payment for Plant and Materials in Event of Suspension	8.12	Deleted
Prolonged Suspension	8.13	If the suspension under Sub-Clause 8.10 [Suspension Work], has continued for more than 84 Days, the Contractor may request the Engineer-in-charge's permission to proceed. If the Engineer-in-charge does not give permission within 28 Days after being requested to do so, the Contractor may, by giving notice to the Engineer-in-charge, treat the suspension as an omission under Sub-Clause 9.2 [Deviations/ Variations Extent and Pricing] of the affected part of the Works.
Resumption of Work	8.14	After the permission or instruction to proceed is given, the Contractor and the Engineer-in-charge shall jointly examine the Works and the Plant and Materials affected by the suspension. The Contractor shall make good any deterioration or Defect in or loss of the Works or Plant or Materials, which has occurred during the suspension after receiving from the Engineer-in-charge an instruction to this effect under Sub-Clause 9.2 [Deviations/ Variations, Extent and Pricing].
Work to be executed strictly as per specifications	8.15	All Works under or in course of execution or executed in pursuance of the Contract shall at all times be executed strictly as per specifications of the Contract as established by regular testing at the specified frequency and be open and accessible to the quality inspection and supervision of the Engineer-in-Charge, his authorized subordinates in charge of the work and all the superior officers, officers of the Quality Control Organization, Third Party Inspection Agency, if engaged by the Procuring Entity, and the Contractor shall, at all times, during the usual working hours and at all other times at which reasonable notice of the visit of such officers has been given to the Contractor, either himself be present to receive written orders and instructions or have a responsible agent duly accredited in writing, present for that purpose. Orders given to the Contractor's agent shall be considered to have the same force as if they had been given to the Contractor himself. All payments shall be linked to the specified quality of works and works failing on tests or not executed as per design, drawings and specifications shall not be paid unless rectified to the specified quality by the Contractor.

Action when Work executed with unsound materials, imperfect and unskilled workmanship	8.16	If it shall be established through regular testing or post execution quality testing by the third party quality inspection agency to the Engineer-in-Charge or his higher authority or his authorized subordinates in charge of the Works, that any work has been executed with unsound, imperfect, or unskillful workmanship, or with Materials or articles provided by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the Contract, the Contractor shall, on demand in writing from the Engineer-in-Charge specifying the work, Materials or articles complained of, notwithstanding that the same may have been passed, certified and paid for, forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the Materials or articles so specified and reconstruct, provide other proper and suitable Materials or articles at his own charge and Cost. In the event of the Contractor failing to do so within a period specified by the Engineer-in-Charge in his demand aforesaid, then the Contractor shall be liable to pay compensation for the specified period, at the same rate as under Sub-Clause for non-completion of the work in time for this default. In such case the Engineer-in-Charge may not accept the item of work at the rates applicable under the Contract but may accept such items at reduced rates as the competent authority may consider reasonable during the preparation of on account bills or final bill if the item is so acceptable without detriment to the safety and utility of the item and the structure and incidental items rectified, or removed and re-executed at the risk and cost of the Contractor. Decision of the Engineer-in-Charge to be conveyed in writing in respect of the same will be final and binding on the Contractor.
9. Deviations, variations and adjustments		
Right to way (Additions and Alterations in case of Lump Sum Contract)	9.1	Variations may be initiated by the Engineer-in-charge at any time during the execution of the Works prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal. The Contractor shall execute and be bound by each Variation, unless the Contractor promptly gives notice to the Engineer-in-charge stating (with supporting particulars) that: - the Contractor cannot readily obtain the Goods required for the Variation, or - such Variation triggers a substantial change in the sequence or progress of the Works. Upon receiving this notice, the Engineer-in-charge shall cancel, confirm or vary the instruction. Each Variation may include: - changes to the quantities of any item of work included in the Contract (however, such changes do not necessarily constitute a Variation), - changes to the quality and other characteristics (like material/ grade/ type of any item of work) supported strong technical justification without compromising output parameter in any form, - changes to the levels, positions and/ or dimensions of any part of the Works, - omission of any work unless it is to be carried out by others, - any additional work, Plant, Materials or services necessary or incidental to the Works, including any associated Tests on Completion, boreholes and other testing and exploratory work, - Changes to the sequence or timing of the execution of the Works. The Contractor shall not make any alteration and/ or modification of the

		Permanent Works, unless and until the Engineer-in-charge instructs or approves a Variation in writing.
Deviations/ Variations Extent and Pricing	9.2.1	The Engineer-in-charge shall have power (i) to make alternations in, omissions from, additions to, or substitutions for the original Specifications, quantities, Drawings, designs and instructions that may be appear to him to be necessary or advisable during the progress of the Works, and (ii) to omit a part of the Works in case of non-availability of a portion of the Site or for any other reasons and the Contractor shall be bound to carry out the Works in accordance with any instructions given to him in writing signed by the Engineer-in-charge after approval from competent authority and such alterations, omissions, additions or substitutions shall form part of the Contract as if originally provided therein and any altered, additional or substituted work which the Contractor may be directed to do in the manner specified above as part of the Works, shall be carried out by the Contractor on the same conditions in all respects including price on which he agreed to do the main work except as hereafter provided.
<i>(In case of Lump Sum Contract, Rates of measured up additions and alterations shall be as per applicable BSR or rates of Day Work given be the Contractor and forming part of the Contract)</i>	9.2.2	The rates for such additional, altered or substituted works shall be determined in accordance with the following provisions: i. If the rates for the additional, altered or substituted work are specified in the Contract for the Works, the Contractor is bound to carry out the additional, altered or substituted work at the same rates as are specified in the Contract for the Works. ii. If the rates for the additional, altered or substituted work are not specifically provided in the Contract for the Works, such rates will be derived from the rates for a similar class of work as are specified in the Contract for the Works. iii. If the rates for the additional, altered or substituted work cannot be determined in the manner specified in the sub-clauses i and ii above, then the rates for such composite work item shall be worked out on the basis of the concerned Schedule of Rates of the district/ area specified above minus/ plus the percentage which the total Bid amount bears to the estimated cost of the entire Works out to bid. Provided always that if the rate for such part or parts of the item is not in the Schedule of Rates, the rate for such part or parts will be determined by the Engineer-in-charge on the basis of the prevailing market rates when the work was done but the percentage of bid discount/ premium will not be subtracted/ added to such market rates. iv. If the rates for the additional, altered or substituted work item cannot be determined in the manner specified in sub sub-clause I to iii above then the contractor shall within 7 days of the date of receipt of order to carry out the work, inform the Engineer-in-charge of the rate which it is his intention to charge for such class of work supported by analysis of the rate(s) claimed and the Engineer-in-charge shall determine the rate/ rates on the basis of prevailing market rates and pay the contractor accordingly. However, the Engineer-in-charge, by notice in writing, will be at liberty to cancel his order to carry out such class of work and arrange to carry it out in such manner as he may consider advisable but under no circumstances, the Contractor shall suspend the work on the plea of non-settlement of rates on items falling under this sub-clause.
	9.2.3	The quantum of additional work for each item shall not exceed 50% of the original quantity of the item given in the Contract and the total value of additional, altered, and substituted items of work shall not exceed 50% of the Accepted Contract Price. <i>(This para is not applicable in case of Lump Sum Contract)</i>
	9.2.4	The time for completion of the Works shall in the event of any deviations resulting in additional Cost over the Contract Price being ordered be extended if requested by the Contractor in the proportion which the additional Cost of the altered, additional or substituted work,

		bears to the original Contract Price. Similarly, the proportionate time period for an item of work deleted shall be reduced from the total time period provided in the Contract.
Value Engineering	9.3	The Contractor may, at any time, submit to the Engineer-in-charge a written proposal which (in the Contractor's opinion) will, if adopted, (i) accelerate completion, (ii) reduce the Cost to the Procuring Entity of executing, maintaining, or operating the Works, (iii) improve the efficiency or value to the Procuring Entity of the completed Works, or (iv) otherwise, be of benefit to the Procuring Entity. The proposal shall be prepared at the Cost of the Contractor and shall include the items listed in Sub-Clause 9.2 [Deviations, Variations and Pricing]. If a proposal, which is approved by the Engineer-in-charge, includes a change in the design of part of the Permanent Works, then unless otherwise agreed by both Parties: i. the Contractor shall design this part, ii. Sub-Clause 4.1 [Contractor's General Obligations] shall apply, and iii. If this change results in a reduction in the Contract value of this part, the Engineer-in-charge shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine a fee, which shall be included in the Contract Price.
No compensation for alterations in or restriction of works to be carried out	9.4	If, at any time after the commencement of the Works, the Procuring Entity shall, for any reason, whatsoever, not require the whole Works, thereof, as specified in the Contract, to be carried out, the Engineer-in-charge shall give notice, in writing, of the fact to the Contractor, who shall have no claim to any payment or compensation, whatsoever, on account of any profit or advantage which he might have derived from the execution of the Works in full but which he did not derive in consequence of the full amount of the Works not having been carried out. Neither shall he have any claim for compensation by reason of alterations having been made in the original specifications, drawings and design and instructions, which shall involve any curtailment of the Works, as originally contemplated. Provided, that the contractor shall be paid the charges for the cartage only, of Materials actually brought to the Site of the Works by him for Bonafede use and rendered surplus as a result of the abandonment or curtailment of the Works or any portion thereof, and taken them back by the Contractor, provided, however, that the Engineer-in-charge shall have, in all such cases, the option of taking over all or any such Materials at their purchase price or at local market rates whichever may be less. In the case of such stores, having been issued from Procuring Entity's Stores, charges recovered, including storage charges shall be refunded after taking into consideration any deduction for claim on account of any deterioration or damage while in the custody of the Contractor and in this respect the decision of the Engineer-in-charge shall be final.
Monthly Return of Extra Claims	9.5.1	Deleted.
	9.5.2	Deleted.
	9.5.2	Deleted.
Provisional Sums	9.6	Each Provisional Sum shall only be used, in whole or in part, in accordance with the Engineer-in-charge's instructions and the Contract Price shall be adjusted accordingly. The total sum paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Engineer-in-charge shall have instructed. For each Provisional Sum, the Engineer-in-charge may instruct: i. Work to be executed (including Plant, Materials, Labour or services

		to be supplied) by the Contractor and valued; and/ or ii. Plant, Materials, or services to be procured by the Contractor from a Nominated Sub-Contractor as defined in Sub-Clause 5.2 [Nomination of Sub-Contractor] or otherwise; and for which there shall be included in the Contract Price: (a) the actual amounts paid (or due to be paid) by the Contractor, and (b) A sum for overhead charges, calculated at 10% percent of these actual amounts. The amount of overheads (10%) shall be subject to tax liability as per law. The Contractor shall, when required by the Engineer-in-charge, produce invoices, vouchers and accounts or receipts in substantiation.
10.0 Price Variation : As per Clause 45 of GCC		
Price Variation due to changes in the prices of Labour, materials, bitumen, petroleum, cement and steel	10.1	If, during the progress of the contract of value exceeding Rs. 50 lakh (accepted Contract Price minus cost of material supplied by the Procuring Entity), and where stipulated completion period is more than 3 months (both the conditions should be fulfilled), the price, of any materials/ bitumen/ diesel and petrol/ cement/ steel incorporated in the Works (not being materials to be supplied by the Procuring Entity) and/ or wages of labor increases or decreases, as compared to the price and/ or wages prevailing at the date of opening of bids or date of negotiations for the Works, the amounts payable to Contractor for the Works shall be adjusted for increase or decrease in the rates of materials (excepting those materials supplied by the Procuring Entity)/ Labour/ bitumen /diesel and petrol/ cement/ steel. If negotiated rates have been accepted, prices as on the date of negotiation shall be considered for price adjustment. Similarly, if rates received on the date of opening of bids have been accepted, then prices on the last date of submission of bid shall be considered for price adjustment. Increase or decrease in the cost of Labour/ material/ diesel and petrol/ cement/ steel shall be calculated quarterly and cost of bitumen shall be calculated on monthly basis in accordance with the following formula:-. (A) Labour $V_L = 0.75 \times \frac{P_L}{100} \times R \times \frac{(I_{L1} - I_{L0})}{I_{L0}}$ Where, V_L = Increase or decrease in the cost of Works during the quarter under consideration due to change in rates for Labour. R = The value of the Works done in rupees during the quarter under consideration excluding the cost of materials supplied by the Procuring Entity and excluding other items as mentioned in this Sub-Clause. I_{L0} = The average consumer price index for industrial workers (whole-sale prices) for the quarter in which bids were opened/ negotiated (as published in Reserve Bank of India Journal/ Labour Bureau Simla, for the area). I_{L1} = The average consumer price index for industrial workers (whole-sale prices) for the quarter of calendar year under consideration (as published in Reserve Bank of India Journal/ Labour Bureau Simla, for the area). P_L = Percentage of labour components. Note : In case of revision of minimum wages by the Government or other competent authority, nothing extra would be payable except the price escalation permissible under this Sub-Clause. (B) Materials (excluding materials supplied by the Procuring Entity). $P_M \quad (L_{M1} - L_{M0})$

		$V_M = 0.75 \times \frac{100}{L_{M0}} \times R$ Where, V_M = Increase or decrease in the cost of Works during the quarter under consideration due to change in rates for materials. R = The value of the Works done in rupees during the quarter under consideration excluding the cost of materials supplied by the Procuring Entity and excluding other items as mentioned in this Sub-Clause. L_{M0} = The average wholesale price index (all commodities) for the quarter in which bids were opened/ negotiated (as published in Reserve Bank of India Journal/ Economic Adviser to Government of India, Ministry of Industries, for the area). L_{M1} = The average wholesale price index (all commodities) for the quarter under consideration (as published in Reserve Bank of India Journal/ Economic Adviser to Government of India, Ministry of Industries, for the area). P_M = Percentage of materials components (excluding materials supplied by the Procuring Entity). (C) Bitumen $V_b = 0.85 \times \frac{P_b (B_i - B_0)}{100} \times R$ Where, V_b = Increase or decrease in the cost of Works during the month under consideration due to changes in the rate for bitumen. R = The value of the Works done in rupees during the month under consideration excluding the cost of materials supplied by the Procuring Entity and excluding other items as mentioned in this Sub-Clause. B_0 = The official retail price of bitumen at the IOC depot at nearest center on the day 28 days prior to date of opening of Bids. B_i = The official retail price of bitumen of IOC depot at nearest center for the 15th day of the month under consideration. P_b = Percentage of bitumen components of the Works.] (D) Petroleum $V_f = 0.75 \times \frac{P_f (F_i - F_0)}{100} \times R$ Where, V_f = Increase or decrease in the cost of Works during the quarter under consideration due to change in rates for fuel and lubricants. R = The value of the Works done in rupees during the quarter under consideration excluding the cost of materials supplied by the Procuring Entity and excluding other items as mentioned in this Sub-Clause. F_0 = The average wholesale price index of High- Speed Diesel (HSD) as published by the Economic Adviser to the Government of India, Ministry of Industry on the day of opening of bids/ negotiations. F_i = The average wholesale price Index of HSD for the quarter under consideration as published weekly by the Economic Adviser to the Government of India, Ministry of Industry for the quarter under consideration. P_f = Percentage of fuel and lubricants components excluding fuel and lubricants supplied by the Procuring Entity (Specified in the sanctioned estimate for the Works). R = Total Works done during the quarter as prescribed under this Sub-
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		Clause. Note: For application of this Sub-Clause price of HSD is chosen to indicate fuel and lubricants components. (E) Cement $L_{C0} VC = 0.75 \times \frac{P_C (L_{C1} - L_{C0})}{R \times 100}$ Where, V_C = Increase or decrease in the cost of Works during the quarter under consideration due to change in the rates of cement. R = The value of the Works done in rupees during the quarter under consideration excluding the cost of cement supplied by the Procuring Entity and excluding other items as mentioned in this Sub-Clause. L_{C0} = The average wholesale price index for the quarter in which bids were opened/ negotiated (as published by the Economic Adviser to the Government of India, Ministry of Industries). L_{C1} = The average wholesale price Index for the quarter under consideration (as published by the Economic Adviser to Government of India, Ministry of Industries). P_C = Percentage of cement components (excluding cement supplied by the Procuring Entity). (F) Steel $L_{S0} V_S = 0.75 \times \frac{P_S (L_{S1} - L_{S0})}{R \times 100}$ Where, V_S = Increase or decrease in the cost of Works during the quarter under consideration due to change in the rates of steel. R = The value of the Works done in rupees during the quarter under consideration excluding the cost of steel supplied by the Procuring Entity and excluding other items as mentioned in this Sub-Clause. L_{S0} = The average wholesale price index for the quarter in which bids were opened/ negotiated (as published by the Economic Adviser to the Government of India, Ministry of Industries). L_{S1} = The average wholesale price Index for the quarter under consideration (as published by the Economic Adviser to Government of India, Ministry of Industries). P_S = Percentage of steel components (excluding steel supplied by the Procuring Entity)
Price Variation in- installation of elevators, supply/installation of centrally Air Conditioning and Central Evaporating cooling works	10.2	In all cases of contracts for installation of elevators, supply/ installation of Central Air Conditioning and Central Evaporating Cooling Works, the price quoted shall be based on the Indian Electrical and Electronics Manufacturers Association (IEEMA) price variation Sub-Clause based on the cost of raw materials/ components and Labour cost as on the last date of bid submission, and the same is deemed to be related to wholesale price index number of metal products and All India Average consumer price index number of industrial workers as specified below. In case of any variation in these index numbers, the prices shall be subject to adjustment up or down in accordance with following formula: $P = \frac{P_0}{100} \left[15 + 55 \frac{MP}{MP_0} + 15 \frac{W_0(D)}{W_0} + 15 \frac{W_0(1)}{W_0} \right]$ Where, P = Price payable as adjusted in accordance with the above price variation formula.

		P_0 = Price quoted/ confirmed. MP_0 = Wholesale Price Index Number for Metal Products as published by the office of the Economic Adviser, Ministry of Industry, Government of India, in their weekly bulletin, Revised Index Number of Wholesale Prices (Base: 1981- 82 = 100) for the week ending first Saturday of the relevant calendar month. The relevant month shall be that in which price was offered or negotiated whichever is later. W_0 = All India Average Consumer Price Index Number for Industrial workers (Base: 1982 = 100), as published by Labour Bureau, Ministry of Labour, Government of India, for relevant calendar month. The relevant month shall be that in which price was offered or negotiated whichever is later. The above index number MP_0 & W_0 are those published by IEEMA as prevailing on the first working day of the calendar month FOUR months prior to the date of bidding. MP = Wholesale Price Index Number for Metal Products as published by the office of the Economic Adviser, Ministry of Industry, Government of India, in their weekly bulletin Revised Index Number of Wholesale Prices (Base: 1981-82 = 100). The applicable wholesale price Index Number for Metal Products as prevailing on 1st Saturday of the month covering the date FOUR months prior to. the date of delivery and would be as published by IEEMA. $W_0(D)$ = All India Average Consumer Price Index Number for Industrial Workers prevailing for the month covering the date FOUR months prior to the date of delivery of manufactured material and would be as published by IEEMA. $W_0(1)$ = All India Average Consumer Price Index Number for Industrial Workers (Base : 1982 = 100) as published by Labour Bureau, Ministry of Labour, Government of India. The applicable All India Consumer Price Index Number of Industrial Workers prevailing for the FOUR months prior to the date of completion of installation/ progress parts of installation and would be as published by IEEMA. The date of delivery shall be the date on which the manufactured material is actually supplied at Site. The date of completion of installation (or progress part of installation) shall be the date on which the Works is notified as being completed and is available for inspection/ duly tested. In the absence of such notification, the date of completion is not intimated, such completion shall be considered by the Engineer In charge which shall be final. Note-1 The Wholesale Price Index Number for Metal Products is published weekly by the office of the Economic Adviser, but if there are any changes, the same are incorporated in the issue appearing in the following week. For the purpose of this Price Variation Sub- Clause, the final index figures shall apply. Note-2 The sole purpose of the above stipulation is to arrive at the entire Contract under the various situations. The above stipulation does not indicate any intentions to sell materials under this Contract as movables. Note-3 The indices MP & W_0 are regularly published by IEEMA in monthly basic price circulars based on information bulletins from the authorities mentioned. These will be used for determining price variation and only IEEMA Circulars will be shown as evidence, if required.
General Conditions for admissibility of Price Variation	10.3	The General Conditions for admissibility of Price Variation are given in Appendix A to these General Conditions.

11. Tests on completion		
Contractor's obligations	11.1	The Contractor shall carry out the Tests on Completion in accordance with the BIS/ IRC and other standard codes and Sub-Clause 7.9 [Testing], after providing the documents in accordance with the requirements for tests on completion. The Contractor shall give to the Engineer-in-charge not less than 15 Days" notice of the date after which the Contractor will be ready to carry out each of the Tests on Completion. Unless otherwise agreed, Tests on Completion shall be carried out within 7 Days after this date, on such day or Days as the Engineer-in- charge shall instruct. In considering the results of the Tests on Completion, the Engineer-in-charge shall make allowances for the effect of any use of the Works by the Procuring Entity on the performance or other characteristics of the Works. As soon as the Works, or a Section, have passed any Tests on Completion, the Contractor shall submit a certificate of the results of these Tests to the Engineer-in-charge. Section, have passed any Tests on Completion, the Contractor shall submit a certificate of the results of these Tests to the Engineer-in-charge.
Delayed Tests	11.2	If the Tests on Completion are being unduly delayed by the Engineer-in-charge, Sub-Clause 7.9.2 of 7.9 [Testing] shall be applicable. If the Tests on Completion are being unduly delayed by the Contractor, the Engineer-in-charge may by notice require the Contractor to carry out the Tests within 21 Days after receiving the notice. The Contractor shall carry out the Tests on such day or Days within that period as the Contractor may fix and of which he shall give notice to the Engineer-in-charge. If the Contractor fails to carry out the Tests on Completion within the period of 21 Days, the Procuring Entity"s/ Engineer-in-Charge"s Personnel may proceed with the Tests at the field laboratory or at an outsourced laboratory at the risk and cost of the Contractor. The Tests on Completion shall then be deemed to have been carried out in the presence of the Contractor and the results of the Tests shall be accepted as accurate and binding on the Contractor.
Retesting	11.3	If the Works, or a Section, fails to pass the Tests on Completion, Sub-Clauses 7.13 [Rejection] and 11.4 [Failure to Pass Tests on Completion] shall apply, and the Engineer-In-Charge or the Contractor may require the failed Tests, and Tests on Completion on any related work, to be repeated under the same terms and conditions.
Failure to Pass Tests on Completion	11.4	Deleted
12. Taking over of the Works and Sections by Procuring Entity		
Taking over of works	12.1	Except Failure to Pass Tests on Completion the Works shall be taken over by the Procuring Entity when (a) the Works have been completed in accordance with the Contract, including the matters described in Sub-Clause 8.4 [Time for Completion] and except as allowed in subparagraph i. below, and (b) a Taking-Over Certificate for the Works has been issued, or is deemed to have been issued in accordance with this Sub-Clause. The Contractor may apply by notice to the Engineer-in-charge for a Taking-Over Certificate not earlier than 14 Days before the Works will, in the Contractor's opinion, be complete and ready for taking over. If the Works are divided into Sections, the Contractor may similarly apply for a Taking-Over Certificate for each Section. The Engineer-in-charge shall, within 28 Days after receiving the Contractor's application: issue the Taking-Over Certificate to the Contractor, stating the

		date on which the Works or Section was completed in accordance with the Contract, except for any minor outstanding work and Defects which will not substantially affect the use of the Works or Section for their intended purpose (either until or whilst this work is completed, and these Defects are remedied); or ii. Reject the application, giving reasons and specifying the work required to be done by the Contractor to enable the Taking-Over Certificate to be issued. The Contractor shall then complete this work before issuing a further notice under this Sub-Clause. If the Engineer-in-charge fails either to issue the Taking-Over Certificate or to reject the Contractor's application within the period of 28 Days, and if the Works or Section (as the case may be) are substantially in accordance with the Contract, the Taking-Over Certificate shall be deemed to have been issued on the last day of that period.
	12.2	The Engineer-in-charge may, at the sole discretion of the Procuring Entity, issue a Taking-Over Certificate for any part of the Permanent Works. After the Engineer-in-charge has issued a Taking-Over Certificate for a part of the Works, the Contractor shall be given the earliest opportunity to take such steps as may be necessary to carry out any outstanding Tests on Completion. The Contractor shall carry out these Tests on Completion as soon as practicable before the expiry date of the relevant Defects Notification Period. If a Taking-Over Certificate has been issued for a part of the Works (other than a Section), the delay damages thereafter for completion of the remainder of the Works shall be reduced. Similarly, the delay damages for the remainder of the Section (if any) in which this part is included shall also be reduced. For any period of delay after the date stated in this Taking-Over Certificate, the proportional reduction in these delay damages shall be calculated as the proportion which the value of the part so certified bears to the value of the Works or Section (as the case may be) as a whole. The Engineer-in-charge shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these proportions. The provisions of this paragraph shall only apply to the rate of delay damages under GCC Clause 2 [Compensation for Delay], and shall not affect the maximum amount of these damages
Taking over if Tests on Completion	12.3	If the Contractor is prevented, for more than 14 days, from carrying out the Tests on Completion by a cause for which the Procuring Entity is responsible, the Procuring Entity shall be deemed to have taken over the Works or Section (as the case may be) on the date when the Tests on Completion would otherwise have been completed.
		The Engineer-in-charge shall then issue a Taking- Over Certificate accordingly, and the Contractor shall carry out the Tests on Completion as soon as practicable, before the expiry date of the Defects Notification Period. The Engineer-in-charge shall require the Tests on Completion to be carried out by giving 14 days" notice and in accordance with the relevant provisions of the Contract. If the Contractor suffers delay and/ or incurs Cost as a result of this delay in carrying out the Tests on Completion, the Contractor shall give notice to the Engineer-in-Charge After receiving this notice, the Engineer-in-Charge shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

Surfaces Requiring Reinstatement	12.4	Except as otherwise states in a Taking Over Certificate, a Certificate for a Section or part of the Works shall not be deemed to certify completion of any ground or other surfaces requiring reinstatement.
13. Defect Liability		
Defect Liability Period	13.1	It is the period, as specified in the Contract data, after certified total completion or after a suspension (short or prolonged) or termination of the Works by the Engineer-in-Charge or the Contractor and handing over of the Works (including Sections or parts handed over earlier) to the Engineer-in-Charge, during which the Contractor is responsible for remedying/ repairing, restoring to the original condition any apparent, virtual or observed defects, deficiencies in the Works, or its performance. The Contractor shall have to repair & restore the defect/ deficiency after a notice issued by the Engineer-in-Charge, who will be free to get it remedied at the risk and cost of the Contractor besides other action being taken as per the Contract, if the Contractor does not get it remedied within the period specified in such notice. The attendances to normal wear and tear due to use by the Procuring Entity/ occupier, in respect of sections or parts taken over for the convenience of the Procuring Entity, shall not be treated as defect.
Completion of Outstanding Work and Remedying Defects.	13.2	In order that the Works and Contractor's Documents, and each Section, shall be in the condition required by the Contract (fair wear and tear excepted) by the expiry date of the relevant Defects Notification Period or as soon as practicable thereafter, the Contractor shall: - completes any work which is outstanding on the date stated in a Taking-Over Certificate, within such reasonable time as is instructed by the Engineer-in-charge, and - Execute all work required to remedy Defects or damage, as may be notified by (or on behalf of) the Procuring Entity on or before the expiry date of the Defects Notification Period for the Works. If a Defect appears or damage occurs, the Contractor shall be notified accordingly, by (or on behalf of) the Procuring Entity. The Contractor is required to repair, rectify, the defects, restore the damages at his own cost with in the period indicated in the notice by the Procuring Entity. If the Contractors fails to do so, action shall be taken.
Cost of Remedying Defects	13.3	Deleted
Extension of Defects Notification Period	13.4	The Procuring Entity shall be entitled subject to Sub-Clause 2.5 [Procuring Entity's Claims] to an extension of the Defects Notification Period for the Works or a Section if and to the extent that the Works, Section or a major item of work (as the case may be, and after taking over) cannot be used for the purposes for which they are intended by reason of a Defect, deficiency or by reason of damage attributable to the Contractor. However, a Defects Notification Period shall not be extended by more than two years. If delivery and/ or erection of Plant and/ or Materials was suspended under Sub-Clause 8.10 [Suspension of Work] the Contractor's obligations under this Sub-Clause shall not apply to any Defects or damage occurring more than two years after the Defects Notification Period for the Plant and/ or Materials would otherwise have expired.
	13.5	Deleted
Failure to remedy the defect	13.6	If the Contractor fails to remedy any Defect, deficiency or damage within a reasonable time, a date may be fixed by (or on behalf of) the Procuring Entity, on or by which the Defect, deficiency or damage is to be remedied. The Contractor shall be given reasonable notice of this

		date. If the Contractor fails to remedy the Defect or damage by this notified date and this remedial work was to be executed at the cost of the Contractor the Procuring Entity may (at his option): - carry out the work himself or by others, in a reasonable manner and at the Contractor's cost, but the Contractor shall have no responsibility for this work; and the Contractor shall subject to Sub-Clause 2.5 [Procuring Entity's Claims] pay to the Procuring Entity the costs reasonably incurred by the Procuring Entity in remedying the Defect or damage; - require the Engineer-in-charge to agree or determine a reasonable reduction in the Contract Price in accordance with Sub-Clause 3.5 [Determinations]; or - If the Defect or damage deprives the Procuring Entity of substantially the whole benefit of the Works or any major part of the Works, terminate the Contract as a whole, or in respect of such major part which cannot be put to the intended use. Without prejudice to any other rights, under the Contract or otherwise, the Procuring Entity shall then be entitled to recover all sums paid for the Works or for such part (as the case may be), plus financing Costs and the Cost of dismantling the same, clearing the Site and returning Plant and Materials to the Contractor.
Removal of Defective Work	13.7	If the Defect or damage cannot be remedied expeditiously on the Site and the Procuring Entity gives consent, the Contractor may remove from the Site for the purposes of repair such items of Plant as are Defective or damaged. This consent may require the Contractor to increase the amount of the Performance Security by the full replacement Cost of these items, or to provide other appropriate security.
Further Tests	13.8	If the work of remedying of any Defect or damage may affect the performance of the Works, the Engineer-in-charge may require the repetition of any of the tests described in the Contract. The requirement shall be made by notice within 28 Days after the Defect or damage is remedied. These tests shall be carried out in accordance with the terms applicable to the previous tests, except that they shall be carried out at the risk and cost of the Party liable for the cost of the remedial work.
Contractor / Third Party Quality Inspection Agency to Search for the Cause of the Defect.	13.9	The Contractor or third-party quality inspection agency shall, if required by the Engineer-in-charge, search for the cause of any Defect, under the direction of the Engineer-in-charge. Unless the Defect is to be remedied at the cost of the Contractor the cost of the search shall be agreed or determined by the Engineer-in-charge in accordance with Sub-Clause 3.5 [Determinations] and shall be included in the Contract Price or of the third-party quality inspection agency.
Performance Certificate	13.10	Performance of the Contractor's obligations shall not be considered to have been completed until the Engineer-in-charge has issued the Performance Certificate to the Contractor, stating the date on which the Contractor completed his obligations under the Contract. The Engineer-in-charge shall issue the Performance Certificate within 28 Days after the latest of the expiry dates of the Defects Liability Periods, or as soon thereafter as the Contractor has supplied all the Contractor's Documents and completed and tested all the Works, including remedying any Defects. A copy of the Performance Certificate shall be issued to the Procuring Entity. Only the Performance Certificate shall be deemed to constitute acceptance of the Works.

Substantial Completion of Parts	13.11	If any part of the Permanent Works has been substantially completed and has satisfactorily passed any Test on Completion prescribed by the Contract, the Engineer-in-charge may issue a Taking-Over Certificate in respect of that part of the Permanent Works before completion of Works and upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete with due expedition any outstanding work in that part of the Permanent Works during Defect Liability Period.
Unfulfilled Obligations	13.12	After the Performance Certificate has been issued, each Party shall remain liable for the fulfillment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of unperformed obligations, the Contract shall be deemed to remain in force.
Right to Access	13.13	Until the Performance Certificate has been issued, the Contractor shall have such right of access to the Works as is reasonably required in order to comply with this Sub-Clause, except as may be inconsistent with the Procuring Entity's reasonable security restrictions.
Clearance of Site	13.14	Deleted
14. Measurement and Evaluation (In case of Lump Sum Contract measurement of only additions and alterations shall be taken)		
Measurement of Work Done	14.1	Whenever the Engineer-in-charge requires any part of the Works to be measured/ re-measured, reasonable notice shall be given to the Contractor's Representative, who shall: i. promptly either attend or send another qualified representative to assist the Engineer-in-charge in taking/ verifying the measurement, and ii. Supply any particulars requested by the Engineer-in-charge for his satisfaction of the measurements. If the Contractor fails to attend or send a representative, the measurement made by (or on behalf) of the Engineer-in-charge shall be accepted as accurate.
Method of measurement.	14.2.1	The measurements (as per IS 1200) of the executed and acceptable work shall be recorded once in a month by the representative of the Engineer-in-Charge and the Contractor or his representative jointly and shall be signed by the Contractor in acceptance. The Engineer-in-Charge shall, except as otherwise provided, shall check, ascertain and determine measurement and the value of the work done in accordance with the Contract. The Procuring Entity reserves to itself the right to prescribe a scale of check measurements of work, in general, or a specific scale for specific works or by other special orders (about which the decision of the Procuring Entity shall be final). Checking of measurement by a superior officer shall supersede the measurements taken by the subordinate officers and the former will become the basis of the payment. Any excess payments detected, as a result of such check measurement or otherwise at any stage up to the date of completion and the Defect Liability Period specified elsewhere in this Contract, shall be recoverable from the Contractor as any other dues payable to the Procuring Entity. Measurement of work done under the Contract shall be taken in accordance with the procedure laid down hereunder: a) In EPC contracts, payments are made on work stage wise . But while recording stages of work, all technical details need to be recorded. b) All items having a financial value shall be measured in the manner as prescribed by the Owner so that a complete record is maintained of all work performed under the Contract. All records shall be made in two copies one copy shall be kept by the Engineer-in-charge and the other copy by the Contractor. c) Measurement shall be taken jointly by the Engineer – in – charge or his authorized representative and the contractor or his

		authorized representative. d) Measurement shall be signed and dated by both Parties on the Site. If there is any dispute in any of the measurements a note to that effect shall be made in the measurement record against the disputed items and such note shall be signed and dated by both parties engaged in taking the measurements and the parties shall discuss and resolve the same immediately thereafter. e) Online/offline measurements of work executed should be done in MB format as per latest Finance Department orders. f) After completion of drawing & design of section, contractor shall submit section wise breakup of cost. The Contractor shall, without extra charge, provided all necessary assistance with labour and equipment necessary for measurements and recording levels. If the Contractor objects to any of the measurements recorded, a note shall be made to that effect with reason and signed by both the parties.
	14.2.2	All measurement of all items having financial value shall be recorded in Measurement Book or MS Excel file and printed out in two copies. The original shall be treated as the Measurement book. Such files in original shall be mailed to the Engineer-in-Charge and shall be saved with a dedicated password. Other data like initial field levels or survey field books or findings of the Geotechnical investigations shall be similarly recorded and protected so that a complete record is obtained of all works performed under the Contract.
	14.2.3	If for any reason the Contractor or his authorized representative is not available and the work of recording measurements is suspended by the Engineer-in-charge or his representative, the Engineer-in-Charge and the Department/ Organization shall not entertain any claim from Contractor for any loss or damages on this account. If the Contractor or his authorized representative does not remain present at the time of such measurements after the Contractor or his authorized representative has been given a notice in writing three (3) Days in advance or fails to countersign or to record objection within seven days from the date of the measurement, then such measurements recorded in his absence by the Engineer-in-charge or his representative shall be deemed to have been accepted by the Contractor. Except where any general or detailed description of the work expressly shows to the contrary, measurements shall be taken of the net actual quantities in accordance with the procedure set forth in the Bill of Quantities and IS 1200 notwithstanding any general or local practice. The Contractor shall give not less than seven Days" notice to the Engineer-in-Charge or his authorized representative in charge of the Works before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured and correct dimension thereof be taken before the same is covered up or placed beyond the reach of measurements and shall not cover and place beyond reach of measurement any work without consent in writing of the Engineer-in-Charge or his authorized representative in charge of the Works who shall within the aforesaid period of seven Days inspect the work, and if any work shall be covered up or placed beyond the reach of measurements without such notice having been given or the Engineer-in-charge"s consent being obtained in writing, the same shall be uncovered at the Contractor"s expense, for the due measurement or in default thereof no payment or allowance shall be made for such works or the materials with which the same was executed. The covering shall then be restored by the Contractor at his cost. Engineer-in-Charge or his authorized representative may cause either themselves or through another officer of the Department/ Organization to check the measurements recorded jointly or otherwise as aforesaid and all provisions stipulated herein above shall be applicable to such

		checking of measurements or levels. It is also a term of this Contract that recording of measurements of any item of work in the measurement sheets/ Measurement book and/ or its payment in the interim, on account or final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates, nor shall it relieve the Contractor from liabilities from any other measurement, Defects noticed till completion of the Defects liability period.
Omissions	14.3	Whenever the omission of any work form's part (or all) of a Variation, the value of which has not been agreed, if: - The Contractor will incur (or has incurred) Cost which, if the work had not been omitted, would have been deemed to be covered by a sum forming part of the Accepted Contract Amount; - The omission of the work will result (or has resulted) in this sum not forming part of the Contract Price; and - This Cost is not deemed to be included in the evaluation of any substituted work; then the Contractor shall give notice to the Engineer-in-charge accordingly, with supporting particulars. Upon receiving this notice, the Engineer-in-charge shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine this Cost, which shall be included in the Contract Price.
15. Contract Price, Payment and Lien		
Contract price	15.1	Unless otherwise stated in the Particular Conditions: - the Contract Price shall be agreed or determined and be subject to adjustments in accordance with the Contract; - the Contractor shall pay all taxes, duties and fees required to be paid by him under the Contract, and the Contract Price shall not be adjusted for any of these Costs - any quantities which may be set out in the Bill of Quantities or other Schedule are estimated quantities and are not to be taken as the actual and correct quantities: - of the Works which the Contractor is required to execute, or - for the purposes of Sub-Clause 14 [Measurement and Evaluation]; and - the Contractor shall submit to the Engineer-in-charge, within 28 Days after the Commencement Date, a proposed breakdown of each lump sum price in the Schedules. The Engineer-in-charge may take account of the breakdown when preparing Payment Certificates, but shall not be bound by it.
Lump sum provisions in Estimate/ Contract	15.2	When the estimate includes lump sum provisions primarily in respect of parts of work/ items whose specifications and costs are not known at the time of framing the Estimate, and if a bid is to be invited on such an estimate, such lump sum shall be excluded from the bid. Subsequently, when the specifications and costs of such items are known, their execution, if to be completed concurrently with the Contract, shall either be done as a variation item or on market rates (without bid premium) of the Contract. Such variation should be approved by the competent authority and then the Contractor shall be entitled to payment in respect of such items of work, or separate bids shall be invited for the work to be executed concurrently with the present Contract.
Schedule of Payments (in case of Lump Sum Contract payments shall be linked to various stages of completion)	15.3	The schedule of payments shall be as included in the Contract. If the Contract does not include a schedule of payments, the Contractor shall submit non-binding estimates of the payments which he expects to become due during each quarterly period. The first estimate shall be submitted within 28 Days after the Commencement Date. Revised estimates shall be submitted at quarterly intervals, until the Taking-Over

of Works given in the Activity Schedule)		Certificate has been issued for the Works. The percentage quoted in the Bid and accepted in the Contract will be deducted/added from/to the gross amount of the bill.
Application for Interim Payment Certificates (Running Account Bills)	15.4	The Contractor shall submit a Statement in required number of copies to the Engineer-in-Charge after the end of each month, in a form approved by the Engineer-in-Charge, showing in detail the amounts to which the Contractor considers himself to be entitled on the basis of measurement (or Activity Schedule in case of Lump sum Contract) and advance payment, secured advance, deductions, etc. as applicable, together with supporting documents which shall include the report on the progress during this month in accordance with Sub-Clause 4.20 [Progress Reports].
Issue of Interim Payment Certificates	15.5	No amount will be certified or paid until the Procuring Entity has received and accepted the Performance Security. Thereafter, the Engineer-in-charge shall, within 28 Days after receiving a Statement and supporting documents, deliver to the Procuring Entity and to the Contractor an Interim Payment Certificate which shall state the amount which the Engineer-in-charge fairly determines to be due, with all supporting particulars for any reduction or withholding made by the Engineer-in-charge on the Statement, if any. However, prior to issuing the Taking Over Certificate for the Works, the Engineer-in-charge shall not be bound to issue an Interim Payment Certificate in an amount which would (after retention and other deductions) be less than the minimum amount of Interim Payment Certificate (if any) stated in the Contract Data. In this event, the Engineer-in-charge shall give notice to the Contractor accordingly. An Interim Payment Certificate shall not be withheld for any other reason, although: i. if anything supplied or work done by the Contractor is not in accordance with the Contract, the cost of rectification or replacement may be withheld until rectification or replacement has been completed; and/or ii. if the Contractor was or is failing to perform any work or obligation in accordance with the Contract, and had been so notified by the Engineer-in-charge, the value of this work or obligation may be withheld until the work or obligation has been performed. The Engineer-in-charge may in any Payment Certificate make any correction or modification that should properly be made to any previous Payment Certificate. A Payment Certificate shall not be deemed to indicate the Engineer-in-charge's acceptance, approval, consent or satisfaction.
Payment of an Interim Payment Certificate	15.6.1	A bill shall be submitted by the Contractor each month on or before the date fixed by the Engineer-in-charge for all work executed in the previous month and the Engineer-in-charge shall take or cause to be taken or check the requisite measurement for the purpose of having the same verified and the claim, as far as admissible, authorized or paid, if possible, before the expiry of thirty days from the presentation for the bill. If the contractor does not submit the bill within the time fixed, as aforesaid, the Engineer-in-charge may depute a subordinate to measure up the said work in the presence of the Contractor, whose signature in the Measurement Book or sheet will be sufficient warrant and the Engineer-in-charge may prepare a bill from such Measurement Book, which shall be binding on the Contractor in all respects.
Payment at Part Rates	15.6.2	Deleted
Payment at Reduced Rates	15.6.3	Deleted

Recovery of Cost of Water and Electricity consumed by the Contractor	15.6.4	Deleted
Recovery of materials issued and hire charges of Machinery and Equipment, etc.	15.6.5	Deleted
Payment on Intermediate Certificate to be regarded as Advances	15.7	Deleted
Application for issue of final completion certificate	15.8	Deleted
issue of final completion certificate	15.9	Deleted
Final Statement of payments	15.10	Within 28 Days after receiving the Taking Over Certificate for the Works, the Contractor shall submit to the Engineer-in-charge, six copies of a draft final statement with as built drawings (with two soft copies also) and all other supporting documents showing in detail in a form approved by the Engineer-in-charge the value of all work done in accordance with the Contract, and any further sums which the Contractor considers to be due to him under the Contract or otherwise. If the Engineer-in-charge disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer-in-charge may reasonably require within 28 Days from receipt of said draft and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer-in-charge the final statement as agreed. This agreed statement is referred to in these Conditions as the “Final Statement”. However if, following discussions between the Engineer-in-charge and the Contractor and any changes to the draft final statement which are agreed, it becomes evident that a dispute exists, the Engineer-in-charge shall deliver to the Procuring Entity’s competent authority (with a copy to the Contractor) an Interim Payment Certificate for the agreed parts of the draft final statement.
Discharge	15.11	When submitting the Final Statement, the Contractor shall submit a discharge which confirms that the total of the Final Statement represents full and final settlement of all moneys due to the Contractor under or in connection with the Contract. This discharge may state that it becomes effective when the Contractor has received the Performance Security and the outstanding balance of this total, in which event the discharge shall be effective on such date.
Payment of Final Bill	15.12	The final value of the acceptable works done, less payments already received, value of claims raised and paid, value of claims not paid along with Interim Payment Certificates, final statement of price escalation due and paid, etc. shall be submitted by the Contractor along with the Final Bill. The final bill shall be submitted by the Contractor in the same manner as specified in interim bills within three Months of physical completion of the work or within one month of the date of the final certificate of completion issued by the Engineer-in-Charge whichever is earlier. No further claims shall be made by the Contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and of items in dispute, for quantities and rates as approved by Engineer-

		in-Charge, will, as far as possible be made within a period of 90 days, the period being reckoned from the date of receipt of the bill by the Engineer-in-Charge complete with accounts of advances, Materials issued, Machinery & Equipment lent on hire by the Procuring Entity, dismantled Materials, etc.
Ensuring Payment and Amenities to Workers if Contractor fails to pay	15.13	In every case in which by virtue of the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and of the Contract Labour (Regulation and Abolition) Central Rules, 1971, any applicable Labour Laws, the Procuring Entity is obliged to pay any amounts of wages to a workman employed by the Contractor in execution of the Works, or to incur any expenditure in providing welfare and health amenities required to be provided under the above said Laws or under the P.W.D. Contractor's Labour Regulations, or under the Rules framed by Government from time to time for the protection of health and sanitary arrangements for workers employed by the Contractor, the Procuring Entity shall recover from the Contractor the amount of wages so paid or the amount of expenditure so incurred; and without prejudice to the rights of the Procuring Entity under sub-section (2) of Section 20, and sub-section (4) of Section 21, of the Contract Labour (Regulation and Abolition) Act, 1970, Government shall be at liberty to recover such amount or any part thereof by deducting it from the Performance Security or from any sum due by the Procuring Entity to the Contractor whether under this Contract or otherwise. The Procuring Entity shall not be bound to contest any claim made against it under sub-section (1) of Section 20, sub-section (4) of Section 21, of the said Act, except on the written request of the Contractor and upon his giving to the Procuring Entity full security for all costs for which the Procuring Entity might become liable in contesting such claim.
Withholding and lien in respect of sums due from Contractor	15.14	i. Whenever any claim or claims for payment of a sum of money arises out of or under the Contract or against the Contractor, the Engineer-in-Charge or the Government shall be entitled to withhold and also have a lien to retain such sum or sums in whole or in part from the Performance Security, if any, deposited by the Contractor and for the purpose aforesaid, the Engineer-in-Charge or the Government shall be entitled to withhold the Performance Security furnished, if any and also have a lien over the same pending finalization or adjudication of any such claim. In the event of the security being insufficient to cover the claimed amount or amounts or if no security has been taken from the Contractor, the Engineer-in-Charge or the Government shall be entitled to withhold and have a lien to retain to the extent of payable or which may at any time thereafter become payable to the Contractor under the same Contract or any other Contract with the Engineer-in-Charge or the Government or any Contracting person through the Engineer-in-Charge pending finalization of adjudication of any such claim. It is an agreed term of the Contract that the sum of money or moneys so withheld or retained under the lien referred to above by the Engineer-in-Charge or Government will be kept withheld or retained as such by the Engineer-in-Charge or Government till the claim arising out of or under the Contract is determined by the arbitrator (if the Contract is governed by the arbitration Sub-Clause) or by the competent court, as the case may be and that the Contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to above and duly notified as such to the Contractor. For the purpose of this Sub-Clause, where the Contractor is a partnership firm or a limited company, the Engineer-in-Charge or the Government shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner/ limited company as the case may be, whether in his individual capacity or otherwise.

		ii. The Procuring Entity shall have the right to cause an audit and technical examination of the Works and the final bills of the Contractor including all supporting vouchers, abstract etc., to be made within two years after payment of the final bill and if as a result of such audit and technical examination any sum is found to have been overpaid in respect of any work done by the Contractor under the Contract or any work claimed to have been done by him under the Contract and found not to have been executed, the Contractor shall be liable to refund the amount of over-payment and it shall be lawful for the Procuring Entity to recover the same from him in the manner prescribed or in any other manner legally permissible; and if it is found that the Contractor was paid less than what was due to him under the Contract in respect of any work executed by him under it, the amount of such under payment shall be duly paid by the Procuring Entity to the Contractor, without any interest thereon whatsoever.
Lien in respect of claims in other Contracts	15.15	Any sum of money due and payable to the Contractor (including the Performance Security returnable to him) under the Contract may be withheld or retained by way of lien by the Engineer-in- Charge or the Government or any other Contracting person or persons through Engineer-in-charge against any claim of the Engineer-in-Charge or the Government or such person or persons in respect of payment of a sum of money arising out of or under any other Contract made by the Contractor with the Engineer-in-Charge or the Government or with such person or persons. It is an agreed term of the Contract that the sum of money so withheld or retained under this Sub-Clause by the Engineer-in-Charge or the Government will be kept withheld or retained as such by the Engineer-in-Charge or the Government till his claim arising out of the same Contract or any other Contract is either mutually settled or determined by the arbitration Sub-Clause or by the competent court, as the case may be and that the Contractor shall have no claim for interest or damages whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this Sub-Clause and duly notified as such to the Contractor.
Levy or Taxes payable by Contractor	15.16	i. GST/ Sales Tax , labour cess , DMFT, RMFT, income tax, service tax or any other taxes and duties on Materials, works or services in respect of this Contract shall be payable by the Contractor according to Law in effect. ii. The Contractor shall deposit royalty and obtain necessary permit for supply of the red earth, moorum, sand, chips, bajri, stone, kankar, etc. from local authorities. The liability, if any, on account of quarry fees, royalties, octroi and other taxes and duties in respect of materials actually consumed on the Works, shall be borne by the Contractor. iii. If pursuant to or under any Law, notification or order any royalty, cess or the hike becomes payable to the Government of India and does not at any time become payable by the Contractor to the State Government/ Local authorities in respect of any Material used by the Contractor in the Works then in such a case, it shall be Lawful to the Government of India and it will have the right and be entitled to recover the amount paid in the circumstances as aforesaid from the dues of the Contractor. iv. In respect of goods and Materials procured by the Contractor, for use in Works under the Contract, GST will be paid by the Contractor himself but in respect of such goods manufactured and supplied by the Contractor and Works executed under the contract, the responsibility of payment of GST shall be that of the Procuring Entity.
Adjustments for changes in Legislation	15.17	i. All the bid rates shall be inclusive of all taxes and levies payable under respective statutes, However if any further tax or levy is imposed by Statute, after the Base Date and the Contractor

		thereupon necessarily and properly pays such taxes/ levies the Contractor shall be reimbursed the amount so paid, provided such payments, if it any, is not, in the opinion of the Procuring Entity (whose decision shall be final and binding on the Contractor) attributable to delay in execution of work within the control of the Contractor. ii. The Contractor shall keep necessary books of accounts and other documents for the purpose of this condition as may be necessary and shall allow inspection of the same by a duly authorized representative of the Procuring Entity and/ or the Engineer-in-Charge and further shall furnish such other information/ document as the Engineer-in-Charge may require from time to time. iii. The Contractor shall, within a period of 30 Days of the imposition of any such further tax or levy, give a written notice thereof to the Engineer-in-Charge that the same is given pursuant to this condition, together with all necessary information relating thereto. This Sub-Clause shall not be applicable if the effect of changes in legislation has been included in price variation formulae [Price Variation].
Pre-Check and Post Check of Bills	15.18	The Government/ Procuring Entity shall have a right to provide a system of pre check of Contractor's bills by a specified organization and payment by an Accounts Organization as the Government/ Procuring Entity may in its absolute discretion decide. Any overpayments detected as a result of such pre check or post check of Contractor's bills can be recovered from the Contractor's bills and the Contractor will refund such excess payments.
16. Termination of Contract by Procuring Entity		
Termination by Procuring Entity	16.1	Subject to the other provisions contained in this Sub-Clause the Engineer-in-charge may, without prejudice to his any other rights or remedy against the Contractor in respect of any delay, inferior workmanship, any claims for damages and/or any other provisions of this Contract or otherwise and whether the date of completion has or has not elapsed by a notice of reasonable period in writing absolutely determine the Contract in any of the following cases: i. If the Contractor, having been given by the Engineer-in-Charge a notice in writing to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or un-workmanlike manner, or by workers who do not understand the instructions of the Engineer-in-Charge, or do not execute the work as per specifications or in contravention of the advice of the third party quality inspections agency about the quality of works, if any, shall omit to comply with the requirement of such notice for a period of fifteen Days thereof. ii. If the Contractor being a company shall pass a resolution or the Court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the Court or the creditor to appoint a receiver or a manager or which entitle the Court to make a winding up order. iii. If the Contractor has, without reasonable cause, suspended the

		progress of the Works for a continuous period of 30 days, or has failed to proceed with the Works with due diligence so that, in the reasoned opinion of the Engineer-in-Charge (which shall be final and binding), he will be unable to secure completion of the Works by the stipulated date of completion and continues to do so after a notice in writing of fifteen Days from the Engineer-in-Charge. iv. If the Contractor fails to complete the Works within the stipulated time or spans of the Works with individual date of completion, if any stipulated, on or before such date(s) of completion and or fails to achieve two continuous mile stones, does not complete them within the period specified in a notice given in writing on that behalf by the Engineer-in-Charge. v. If the Contractor persistently neglects to carry out his obligations under the Contract and/ or commits default in complying with any of the terms and conditions of the Contract and does not remedy it or take effective steps to remedy it within fifteen Days after a notice in writing is given to him on that behalf by the Engineer-in-charge. vi. If the Contractor sublets the Works or a part of Works without specific permission of the Procuring Entity/ Engineer-in-charge. vii. If the Contractor has not been commenced the Works by the Commencement Date or within 1/8th of the stipulated time for completion subject to a maximum of 45 Days, whichever is earlier. When the Contractor has made himself liable for action under any of the cases aforesaid, the Engineer-in-Charge on behalf of the Procuring Entity shall have the powers: (a) To determine or rescind the Contract as aforesaid (of which a 28 days termination or rescission notice in writing to the Contractor under the hand of Engineer-in-Charge shall be conclusive evidence). Upon such determination or rescission the Bid Security and Performance Security under the Contract shall be liable to be forfeited and shall be absolutely at the disposal of the Procuring Entity. (b) To employ labour paid by the Procuring Entity and to supply materials to carry out the Works or any part of the Works, debiting the Contractor with the cost of the labour and the price of the materials (of the amount of which cost and price certified by the Engineer-in-charge shall be final and conclusive against the Contractor) and crediting him with the value of the work done in all respects in the same manner and at the same rates, as if it has been carried out by the Contractor under the terms of this Contract. The certificate of the Engineer-in-Charge, as to the value of the work done, shall be final and conclusive evidence against the Contractor provided always that action under the sub-Sub-Clause shall only be taken after giving notice in writing to the Contractor. Provided also that if the expenses incurred by the Procuring Entity are less than the amount payable to the Contractor at his agreement rates, the difference shall not be paid to the Contractor. (c) After giving notice specifying the date and time to the Contractor to measure up the acceptable (executed as per design, drawings and specifications) work of the Contractor at Site and to take such part thereof, as shall be unacceptable out of his hands and to give
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		it to another contractor to complete, in which case any expenses which may be incurred in excess of the sum which would have been paid to the original Contractor, if the whole work had been executed by him (of the amount of which excess, the certificate in writing of the Engineer-in-charge shall be final and conclusive) shall be borne and paid by the original Contractor and may be deducted from any money due to him by the Procuring Entity under this Contract or any other account, whatsoever, or from his Bid Security, Performance Security or the Enlistment Security or the proceeds of sale thereof, or a sufficient part thereof as the case may be. In the event of any one or more of the above courses being adopted by the Engineer-in-charge the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the Works or the performance of the Contract. In case action is taken under any of the aforesaid provisions, the Contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this Contract unless and until the Engineer-in-charge has certified in writing the performance of such work and value payable in respect thereof and he shall only be entitled to be paid the value so certified.
Valuation at the date of termination:	16.2	As soon as practicable after a notice of termination under Sub-Clause 16.1 has taken effect, the Engineer-in-charge shall proceed in accordance with Sub-Clause 3.5[Determinations] to agree or determine the value of the Works, Goods and Contractor's Documents, and any other sums due to the Contractor for work executed in accordance with the Contract.
Payment after Termination	16.3	After a notice of termination under Sub-Clause 16.1 has taken effect, the Procuring Entity may: - proceeds in accordance with Sub-Clause 3.5 [Procuring Entity's Claims], - withhold further payments to the Contractor until the Costs of execution, completion and remedying of any Defects, damages for delay in completion (if any), and all other Costs incurred by the Procuring Entity, have been established, and - recover from the Contractor any losses and damages incurred by the Procuring Entity and any extra Costs of completing the Works, after allowing for any sum due to the Contractor under Sub-Clause 16.3. After recovering any such losses, damages and extra Costs, the Procuring Entity shall pay balance to the Contractor, if any.
Procuring Entity's Entitlement to Termination for Convenience	16.4	If, at any time after the commencement of the Works, the Government/ Procuring Entity shall, for any reason, whatsoever, not require the whole work, thereof, as specified in the Contract, to be carried out, the Engineer-in-charge shall give notice, in writing, of the fact to the Contractor, who shall have no claim to any payment or compensation, whatsoever, on account of any profit or advantage which he might have derived from the execution of the Works in full but which he did not derive in consequence of the full amount of the Works not having been carried out. Neither shall he have any claim for compensation by reason of alterations having been made in the original specifications, drawings and design and instructions, which shall involve any curtailment of the Works, as originally contemplated. Provided, that the contractor shall be paid the charges for the cartage only, of materials actually brought to the Site of the Works by him for bonafide use and rendered surplus as a result of the abandonment or curtailment of the Works or any portion thereof, and taken them back by the Contractor provided, however, that the Engineer-in-charge shall have, in all such cases, the option of taking over all or any such materials at their purchase price or at local market rates whichever may be less.

Corrupt, Fraudulent, Collusive or Coercive Practices	16.5	If the Procuring Entity determines that the Contractor, his Subcontractors or any of their personnel has breached the Code of Integrity prescribed in the Act, the Rules, or the Instructions to Bidders [Section I of the Bidding Document] or has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then the Procuring Entity may, after giving 14 Days" notice to the Contractor: i. terminates the Contract and expel him from the Site, ii. forfeit or encash performance security and any other security or bond relating to this Contract, iii. recover the payments made under the Contract along with interest thereon at bank rate, iv. recover compensation for loss incurred due to termination of the Contract including excess expenditure, if any incurred in getting the remaining work executed from other agency under Sub-Clause 16.1. For the purposes of this Sub-Clause: i. "corrupt practice" means the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence the action of a public official in the procurement process or in the Contract execution; ii. "fraudulent practice" means a misrepresentation or omission of facts in order to influence a procurement process or the execution of the Contract; iii. "collusive practice" means a scheme of arrangement between two or more bidders, with or without the knowledge of the Procuring Entity, designed to establish bid prices at artificial, non-competitive levels; iv. "Coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the procurement process or affect the execution of a Contract. Should any employee of the Contractor be determined to have engaged in corrupt, fraudulent or coercive practice during the execution of the Works then that employee shall be removed in accordance with Sub-Clause 6.11 [Contractor's Personnel].
	17.0	Deleted
18. Risk and responsibilities		
Indemnities	18.1	The Contractor shall indemnify and hold harmless the Procuring Entity, the Procuring Entity's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of: i. bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any Defects, unless attributable to any negligence, willful act or breach of the Contract by the Procuring Entity, the Procuring Entity's Personnel, or any of their respective agents, and ii. damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss arises out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any Defects, unless and to the extent that any such damage or loss is attributable to any negligence, willful act or breach of the Contract by the Procuring Entity, the Procuring Entity's Personnel, their respective agents, or anyone directly or indirectly employed by any of them. Failure in full or partial functioning of any tool, plant, machinery or any

		component of project for which employer has paid to contractor , as per project objective.
	18.2	All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.
Procuring Entity's Risks.	18.3	The risks referred to in Sub-Clause 18.4 [Consequences of Procuring Entity's Risks] below, insofar as they directly affect the execution of the Works, are: i. war, hostilities (whether war be declared or not), invasion, act of foreign enemies, ii. rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war, within the Country, iii. riot, commotion or disorder within the Country by persons other than the Contractor's Personnel, iv. munitions of war, explosive Materials, ionizing radiation or contamination by radio-activity, within the Country, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, v. pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds, vi. use or occupation by the Procuring Entity of any part of the Permanent Works, except as may be specified in the Contract, vii. design of any part of the Works by the Procuring Entity's Personnel or by others for whom the Procuring Entity is responsible, and viii. Any operation of the forces of nature which is Unforeseeable or against which an experienced Contractor could not reasonably have been expected to have taken adequate preventive precautions.
Consequences of Procuring Entity's Risks	18.4	If and to the extent that any of the risks listed in Sub-Clause 18.3 above results in loss or damage to the Works, materials or Goods or Contractor's Documents, the Contractor shall promptly give notice to the Engineer-in-charge and shall rectify this loss or damage to the extent required by the Engineer-in-charge. If the Contractor suffers delay and/ or incurs Cost from rectifying this loss or damage, the Contractor shall give a further notice to the Engineer-in-charge and shall be entitled subject to Clause 21.2 [Contractor's Claims] to: i. An extension of time for any such delay, if completion is or will be delayed, under Clause 8.6 [Extension of Time for Completion], and ii. payment of any such Cost, which shall be included in the Contract Price. After receiving this further notice, the Engineer-in-charge shall proceed in accordance with Clause 3.5 [Determinations] to agree or determine these matters.
Intellectual and Industrial Property Rights	18.5	In this Sub-Clause, "infringement" means an infringement (or alleged infringement) of any patent, registered design, copyright, trade mark, trade name, trade secret or other intellectual or industrial property right relating to the Works; and "claim" means a claim (or proceedings

		pursuing a claim) alleging an infringement. Whenever a Party does not give notice to the other Party of any claim within 28 Days of receiving the claim, the first Party shall be deemed to have waived any right to indemnity under this Sub-Clause. The Contractor shall fully indemnify and keep indemnified the Procuring Entity and the State Government against any action, claim or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the Contract. The Contractor shall indemnify and hold the Procuring Entity harmless against and from any other claim which arises out of or in relation to (i) the manufacture, use, sale or import of any Goods, or (ii) any design for which the Contractor is responsible. The Procuring Entity shall indemnify and hold the Contractor harmless against and from any claim alleging an infringement which is or was: i. an unavoidable result of the Contractor's compliance with the Contract, or ii. a result of any Works being used by the Procuring Entity: a. for a purpose other than that indicated by, or reasonably to be inferred from, the Contract, or b. in conjunction with anything not supplied by the Contractor, unless such use was disclosed to the Contractor prior to the Base Date or is stated in the Contract iii. If a Party is entitled to be indemnified under this Sub-Clause, the indemnifying Party may (at its Cost) conduct negotiations for the settlement of the claim, and any litigation or arbitration which may arise from it. The other Party shall, at the request and Cost of the indemnifying Party, assist in contesting the claim. This other Party (and its Personnel) shall not make any admission which might be prejudicial to the indemnifying Party, unless the indemnifying Party failed to take over the conduct of any negotiations, litigation or arbitration upon being requested to do so by such other Party.
Limitation of Liability	18.6	Neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any Contract or for any indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract, other than as specifically provided in GCC Clause 2 [Compensation for Delay]; Sub-Clause 16.4 [Payment after Termination]; Sub-Clause 18.1 [Indemnities]; Sub-Clause 18.2 [Contractor's Care of the Works], Sub-Clause 18.4 [Consequences of Procuring Entity's Risks] and Sub-Clause 18.5. [Intellectual and Industrial Property Rights]. The total liability of the Contractor to the Procuring Entity, under or in connection with the Contract shall not exceed twice the Accepted Contract Amount. This amount does not include charges, if any, for consumption of Electricity, Water and Gas provided by the Procuring Entity under Sub-Clause 4.18 [Electricity, Water and Gas]. This Sub-Clause shall not limit liability of the Contractor in any case of fraud, deliberate default or reckless misconduct by the Contractor or Sub-Contractors or their personnel or offences under any other Law for the time being in force.
Use of Procuring Entity's Accommodation/ Facilities	18.7	The Contractor shall take full responsibility for the care of the accommodation and facilities, if any, provided by the Procuring Entity as detailed in the Specifications, from the respective dates of hand-over to the Contractor until cessation of occupation (where hand-over or cessation of occupation may take place after the date stated in the Taking-Over Certificate for the Works). If any loss or damage happens to any of the above items while the Contractor is responsible for their care arising from any cause

		whatsoever other than those for which the Procuring Entity is liable, the Contractor shall, at his own cost, rectify the loss or damage to the satisfaction of the Engineer-in-Charge.
19. Force Majeure		
Definition of Force Majeure	19.1	In this Sub-Clause, "Force Majeure" means an exceptional event or circumstance: i. which is beyond a Party's control, ii. which such Party could not reasonably have provided against before entering into the Contract, iii. which, having arisen, such Party could not reasonably have avoided or overcome, and iv. which is not substantially attributable to the other Party. Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (i) to (iv) above are satisfied: (a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies, (b) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war, (c) riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel, (d) munitions of war, explosive Materials, ionizing radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, and natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.
Notice of Force Majeure	19.2	If a Party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 Days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure. The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them. Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.
Duty to Minimize Delay	19.3	Each Party shall at all times use all reasonable endeavors to minimize any delay in the performance of the Contract as a result of Force Majeure. A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.
Consequences of Force Majeure	19.4	If the Contractor is prevented from performing its substantial obligations under the Contract by Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], and suffers delay and/ or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to Sub-Clause 21.2 [Contractor's Claims] to: i. an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.6 [Extension of Time for Completion], and ii. if the event or circumstance is of the kind described in Sub-Clause 19.1 [Definition of Force Majeure] and, in the case of sub-paragraphs (a) to (e), occurs in the Country, payment of any such Cost incurred rectifying or replacing the Works and/ or Goods damaged or destroyed by Force Majeure, to the extent they are not indemnified through the insurance policy referred to in Sub-Clause 20.2 [Insurance]

		for Works and Contractor's Equipment]. After receiving this notice, the Engineer-in-charge shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or Determine these matters.
Force Majeure Affecting Subcontractor	19.5	If any Subcontractor is entitled under any Contract or agreement relating to the Works to relief from force majeure on terms additional to or broader than those specified in this Sub-Clause, such additional or broader force majeure events or circumstances shall not excuse the Contractor's non-performance or entitle him to relief under this Sub-Clause.
Optional Termination, Payment and Release	19.6	If the execution of substantially all the Works in progress is prevented for a continuous period of 84 Days by reason of Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], or for multiple periods which total more than 140 Days due to the same notified Force Majeure, then either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 Days after the notice is given, and the Contractor shall proceed in accordance with Sub-Clause 17.3 [Cessation of Works and Removal of Contractor's Equipment]. Upon such termination, the Engineer-in-charge shall determine the value of the work done and issue a Payment Certificate which shall include: 1. The amounts payable for any acceptable work carried out for which a price is stated in the Contract; 2. the Cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery: this Plant and Materials shall become the property of (and be at the risk of) the Procuring Entity when paid for by the Procuring Entity, and the Contractor shall place the same at the Procuring Entity's disposal; 3. other Costs or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the expectation of completing the Works; 4. the Cost of removal of Temporary Works and Contractor's Equipment from the Site.
Release from Performance	19.7	Notwithstanding any other provision of this Clause, if any event or circumstance outside the control of the Parties (including, but not limited to, Force Majeure) arises which makes it impossible or unlawful for either or both Parties to fulfill its or their Contractual obligations or which, under the Law governing the Contract, entitles the Parties to be released from further performance of the Contract, then upon notice by either Party to the other Party of such event or circumstance: i. The Parties shall be discharged from further performance, without prejudice to the rights of either Party in respect of any previous breach of the Contract, and the sum payable by the Procuring Entity to the Contractor shall be the same as would have been payable under Sub-Clause 19.6 [Optional Termination, Payment and Release] if the Contract had been terminated under Sub-Clause 19.6.
20. Insurance		
General Requirements for Insurance	20.1	In this Sub-Clause, "insuring Party" means, for each type of insurance, the Party responsible for effecting and maintaining the insurance specified in the relevant Sub-Clause. Wherever the Contractor is the insuring Party, each insurance shall be affected with insurers and in terms approved by the Procuring Entity. These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Sub-Clause. Wherever the Procuring Entity is the insuring Party, each insurance shall be affected with insurers and in terms acceptable to the Contractor.

		These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Sub-Clause. If a policy is required to indemnify joint insured, the cover shall apply separately to each insured as though a separate policy had been issued for each of the joint insured. If a policy indemnifies additional joint insured, namely in addition to the insured specified in this Sub-Clause, (i) the Contractor shall act under the policy on behalf of these additional joint insured except that the Procuring Entity shall act for Procuring Entity's Personnel, (ii) additional joint insured shall not be entitled to receive payments directly from the insurer or to have any other direct dealings with the insurer, and (iii) the insuring Party shall require all additional joint insured to comply with the conditions stipulated in the policy. Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify the loss or damage. Payments received from insurers shall be used for the rectification of the loss or damage. The relevant insuring Party shall, within the respective periods stated in the Contract Data (calculated from the Commencement Date), submit to the other Party: - evidence that the insurances described in this Sub-Clause have been affected, and - Copies of the policies for the insurances described in Sub-Clause 20.3 [Insurance against Injury to Persons and Damage to Property]. - When each premium is paid, the insuring Party shall submit evidence of payment to the other Party. Whenever evidence or policies are submitted, the insuring Party shall also give notice to the Engineer-in-charge. - Each Party shall comply with the conditions stipulated in each of the insurance policies. The insuring Party shall keep the insurers informed of any relevant changes to the execution of the Works and ensure that insurance is maintained in accordance with this Sub-Clause. Neither Party shall make any material alteration to the terms of any insurance without the prior approval of the other Party. If an insurer makes (or attempts to make) any alteration, the Party first notified by the insurer shall promptly give notice to the other Party. If the insuring Party fails to effect and keep in force any of the insurances it is required to effect and maintain under the Contract, or fails to provide satisfactory evidence and copies of policies in accordance with this Sub-Clause, the other Party may (at its option and without prejudice to any other right or remedy) effect insurance for the relevant coverage and pay the premiums due. The insuring Party shall pay the amount of these premiums to the other Party, and the Contract Price shall be adjusted accordingly. Nothing in this Sub-Clause limits the obligations, liabilities or responsibilities of the Contractor or the Procuring Entity, under the other terms of the Contract or otherwise. Any amounts not insured or not recovered from the insurers shall be borne by the Contractor and/ or the Procuring Entity in accordance with these obligations, liabilities or responsibilities. However, if the insuring Party fails to effect and keep in force an insurance which is available and which it is required to effect and maintain under the Contract, and the other Party neither approves the
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		omission nor effects insurance for the coverage relevant to this default, any moneys which should have been recoverable under this insurance shall be paid by the insuring Party.
Insurance against Injury to Persons and Damage to Property	20.3	The insuring Party shall insure against each Party's liability for any loss, damage, death or bodily injury which may occur to any physical property or to any person (except persons insured under [Insurance for Contractor's Personnel]), which may arise out of the Contractor's performance of the Contract and occurring before the issue of the Performance Certificate. This insurance shall be for a limit per occurrence of not less than the amount stated in the Contract Data with no limit on the number of occurrences. Unless otherwise stated in the Special Conditions, the insurances specified in this Sub-Clause: i. shall be affected and maintained by the Contractor as insuring Party, ii. shall be in the joint names of the Parties, iii. shall be extended to cover liability for all loss and damage to the Procuring Entity's property (except things insured under [Insurance for Works and Contractor's Equipment] arising out of the Contractor's performance of the Contract, and iv. may however exclude liability to the extent that it arises from: (a) the Procuring Entity's right to have the Permanent Works executed on, over, under, in or through any land, and to occupy this land for the Permanent Works, (b) damage which is an unavoidable result of the Contractor's obligations to execute the Works and remedy any Defects, and (c) a cause listed in Sub-Clause [Procuring Entity's Risks], except to the extent that cover is available at commercially reasonable terms.
Insurance for Contractor's Personnel	20.4	The Contractor shall affect and maintain insurance against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel. The insurance shall cover the Procuring Entity and the Engineer-in-charge against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of the Procuring Entity or of the Procuring Entity's Personnel. (a) The insurance shall be maintained in full force and effect during the whole time that these personnel are assisting in the execution of the Works. For a Subcontractor's employees, the insurance may be affected by the Subcontractor, but the Contractor shall be responsible for compliance with this Sub-Clause.
21. Claims, disputes and Arbitration		
Dispute Resolution	21.3	All disputes shall be referred to Empowered standing committee as per clause 23 of GCC and decision of committee shall be binding on both the parties.

22. Governing Law Jurisdiction

	22.1	Any action taken or proceeding initiated of any of the terms of this Agreement shall be only in the Court of Competent Jurisdiction at Dholpur
23. Contractor's general responsibility		
	23.1	In addition to the responsibility and obligations of the Contractor elsewhere provided in the Contract, the Contractor shall with due care and diligence and subject to the provisions of the Contract perform, execute and maintain the Works and provide all labour including supervision thereof, materials, construction equipment testing laboratory instrumentation, bindings of different clearances, and all other things whether of a temporary or a permanent nature, required in and for such execution, completion and maintenance of the Works as specifically provided in or to be reasonably inferred from Contract. The Contractor shall take full responsibility for the adequacy, stability and safety of all its operation, including site operations and methods of construction providing/arranging adequate security for all its and its sub-contractor's personnel and their families, property either owned by it or held by it in trust, work –in progress and installation facilities etc. in the Project Area. If the Contractor or his sub- contractor or their employees break, deface or destroy any property belonging to the Owner or others during the execution of the Contract, the same shall be made good by the Contractor at his own expense and in default thereof, the Engineer-in-charge may cause the same to be made good by other agencies and recover expenses from the Contractor for which the certificate of expenses from the Engineer-in-charge shall be final. The Contractor shall be responsible for further up gradation and maintenance of all internal roads in the Project to be made available construct additional roads as necessary including their maintenance, without additional cost to the Owner. The Contractor shall be responsible for all arrangement for water including pumping of all water requirements for all his work, sites and colonies/camps. The Contractor shall be responsible for construction and maintenance of additional access roads wherever necessary for the purpose of transporting all, the materials from the quarry sites and the Contractor shall also' be responsible for operation 'of the quarry sites and supply of the sand, aggregate for the Works. The Contractor shall be responsible for obtaining all licenses, permits consents, right of way, approvals etc. in India for carrying out his obligations and/or the obligations of his sub-contractors under this Contract. The Site shall be handed over to the Contractor on "as is where is" basis. The Contractor shall be responsible for creating up-keeping and maintaining of all the infrastructures.
24. Patent rights/Royalties and Fossils		
	24.1	The Contractor shall save harmless and indemnify the Owner at all times from and against all claims and proceedings for or on account of use of or infringement of any patent rights, design trademark or name or other protected rights in respect of the whole or any part of the Work or any constructional equipment, machine work, or-materials used for or in connection with the Works or any part thereof and from and against all claims, proceedings, damages, costs, charges and expenses whatsoever in: respect thereof or in relation thereto but such indemnity shall not cover any use of the Works otherwise than for the purpose indicated by or reasonably to be inferred from the Contract.
	24.2	In the event of any claim being made or action brought against the Owner arising out of the matters referred to in this Article 24 the Contractor shall be promptly notified thereof and the Contractor shall within reasonable time

		thereafter, take over conduct and conclude all negotiation for the settlement of the same and in the event of any litigation that may arise therefore take over and conduct the same failing which the Owner shall at Contractor's expense conduct the negotiations for the settlement of the same and any litigation that may arise there from. The Owner shall not unless and until the Contractor shall have been notified and shall have failed to take over the conduct of the negotiations or litigations, make any admission which might be prejudicial there to. In the event of the Contractor taking over the conduct of any negotiations or litigations as aforesaid, the owner shall have the right to be represented at such negotiations and litigations.
	24.3	The Contractor shall at his own cost, have the right either to carry out such alterations or modifications of the works or any part thereof which are necessary to avoid the infringement without affecting the efficient operation of the works or to produce a right to permit the use of the infringing part of the works.
	24.4	The Contractor shall pay to the state / local agencies all royalties, and rent, if any, for getting stone, sand ,gravel, clay or other quarried materials required for the Works or any part thereof.
	24.5	All fossils, coins, articles of value or antiquity and structure and other remains or things of geological or archeological interest discovered on the Site shall be the absolute property of the Owner. The Contractor shall take reasonable precautions to prevent his workmen or any other person from removing or damaging any such article or thing and shall immediately upon discovery thereof and, before removal, acquaint the Engineer-in-charge of such discovery and carry out, at the expense of the owner, the engineer-in-charge's orders as to the disposal of the same. Alternatively, the owner may at his discretion undertake such disposal work.
25. Contractor to keep site clear		
	25.1	During the progress of the Works the Contractor shall keep the Site reasonably free from all unnecessary obstruction and shall store or subject to approval from the Engineer-in-charge and subject to the conditions, if any, imposed by the Government of India or any of its officers, dispose of any Construction Equipment and surplus materials and from time to time clear away and remove from the Site any wreckage, rubbish or Temporary Works no longer required. .
26. Transfer of temporary works to owner and clearance of site on completion		
	26.1	On the completion of the works, the contractor shall hand over on "as is where is basis" any/all temporary/infrastructure works.
27. Labour and compliance with labour industrial and other laws		
Health and Sanitary Arrangements for Workers	27.1	In respect of all labour directly or indirectly employed in the Works for the performance of the Contractor's obligations under the Contract the Contractor shall comply with all the rules and regulations of the local sanitary and other authorities or as framed by the Owner from time to time for the protection of health and sanitary arrangements for all works.
Safety Regulations	27.2	In respect of all labour directly or indirectly employed in the Woks. The contractor shall at his own expense arrange for all the safety precisions as per safety codes of Central Public Works Department, Bureau of Indian Standards (ISI). The Mines Act and regulation, rules and orders made there under and such act as are applicable. The contractor shall observe and abide by all fire and safety regulation applicable at work site. Before starting construction work, the contractor shall consult safety personnel of the owner or Engineer-in-charge. The contractor shall make good to the satisfaction of the Engineer-in-charge any loss or damage due to fire to any portion of the work done or to any other existing property.
	27.3	The contractor shall be responsible and liable for observance by his sub-contractors of all the foregoing provisions

	27.4	The contractor shall always give and cause its sub-contractors working at Site to give preference in the employment of unskilled, semi- skilled and skilled labour and workmen to persons from the local area/State. The contractor shall further give preference into its employment or cause its sub-contractors to take in their employment the unskilled, semi- skilled and skilled labour and workmen presently employed by the owner and available locally. All piece rated workmen/ labour to be employed at site by the contractor and or its sub-contractors shall preferably be from the local area/State of Rajasthan.
28. Materials and Workmanship		
	28.1	The contract warrants that plant, equipment, materials etc. forming part of the Permanent works will be new, except normal wear & tear during execution of the Works, free from defects and in accordance with the contract. All such plants, equipment, materials etc. and workmanship shall be of the respective kinds, grades and specifications described in the contract and shall be subjected from time to all necessary tests at the place of manufacturing or fabrication on the site or such other place or place or at all or any of such place as are normal, necessary or required therefore. Such tests shall be as specified in the Special Conditions / technical specification. The Contractor shall provide/arrange, at its costs, such assistance; instrument; machines, labour and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used and shall supply samples or materials before incorporation in the Works for testing as may be selected and required by the Engineer-in-charge. Subject to the availability in requisite quality & quantity, the contractor shall procure all kind of steel & cement to be used in the works, within India.
	28.2	If any plant, equipment, materials etc. forming part of the Permanent works is manufactured or fabricated outside state of Rajasthan and shall be subjected from time to all necessary tests at such place the contractor shall arrange such test and visits at his cost and such cost is deemed to be included in the bid price.
	28.3	All samples shall be supplied by the Contractor at its own cost.
	28.4	The cost of making all tests pursuant to Article 28.1 and 28.2 shall be borne by the Contractor.
	28.5	a) No work shall be covered up or out of view without the approval of the Engineer-in-charge's Representative to and the contractor shall afford full opportunity for the Engineer-in-charge's Representative to examine foundations work before permanent work is placed thereon. The contractor shall give due notice to the Engineer-in-charge's Representative wherever any such work or foundation is or are ready for or about to be ready for examination and the Engineer-in-charge's Representative shall, without unreasonable delay, unless he considers it unnecessary and measuring such work or examining such foundations. b) the contractor shall uncover any part or parts of the Works or make openings in or though the same as the Engineer-in-charge may from time to time direct and shall reinstate and make good such part or part to the satisfaction of the Engineer-in-charge, if any such part or part have been covered up or put out of view after compliance with the requirement, to be executed in accordance with the contract, the expenses of uncovering, making openings in or though, reinstating and making good the same shall be borne by the contractor, but in any other case all costs shall be borne by the contractor.
29.Deduction from Contract price		
	29.1	Costs, charge, damages or expenses of any nature for which the Contractor is liable to the Owner under the Contract shall be deducted by the Owner from payments of the Contract price or any amount due on any other account to the

		Contractor from the Owner and/or shall be recoverable by invoking/enforcing one or more of the bank guarantees furnished by the Contractor. Such deduction shall constitute a valid discharge of the obligation of the Contractor to make the payment to the Owner.
30. Weights, Measures and Standards		
	30.1	All weights and measures, computations, computer programs, plans, schedules, notes and drawing utilize the international metric system.
	30.2	The standards which shall be used for structural calculations and materials, for shop drawings and for the determination of subsequent quantities, if any, shall be as specified in the contract and if not specified, shall be the relevant best international engineering code/practice. Where such code/practice is not in the English language or is not readily -available the contractor shall at its cost furnish prior to the submission to the Owner for the relevant designs/drawings in English language.
31. Work hours		
	31.1	Subject to Indian laws and regulation the Contractor is authorized to work in day/Night, as well as on Sunday and/or festival days, provided that it makes payment of all sums due therefore to its labour and personnel as per prevalent rule.
32. Taxes/Duties/Levies etc		
	32.1	The Contractor shall be responsible for payment of all Taxes/Duties/Levies etc. The contractor's prices are deemed to be inclusive of all such all taxes/duties/levies etc.
	32.2	Notwithstanding anything to the contrary contained herein, any duty, levy or outgoing by the contractor relating to or connected with the activities of the Contractor for execution of the work/performance of its obligations hereunder shall be to the account of and be borne by the Contractor.
	32.3	In addition to the liabilities to borne by the Contractor, all taxes, duties, fees or levies of any kind whatsoever including income taxes and surcharge thereon on the income of expatriate personnel of the Contractor, customs duty excise duties, sales taxes of any kind including sales tax on works Contracts, and octroi of any kind, whether payable in India or anywhere outside. of India, either by the Contractor or its expatriate personnel as a consequence of or incidental to the Contractor's performance of the contract and/or on or in respect of all imported/locally procured supplies and equipment forming part of the works are included in the Contract Price and shall be borne by and be the liability of the Contractor and shall be paid directly by the Contractor to the relevant authorities.
	32.4	If direct payment of taxes, duties etc., which are the liability of and are to be borne by the Contractor as above, is not permitted by Indian law or regulations and/or if any deduction or withholding in respect of such taxes, duties etc. Shall be required to be made, the Owner shall pay the sums due to the Contractor after making such deduction or withholding as may be required by the relevant law/regulations and the Contractor shall receive only the net sum available after such deduction/withholding. The sums so deducted/withheld shall be deposited by the Owner the relevant authorities on behalf of the Contractor, as per applicable Jaw/regulation. 'Immediately thereafter, the Owner shall inform the Contractor of the detailed calculations of such deductions and shall provide the contractor with the corresponding receipts from the tax authorities.
	32.5	The Contractor and all its expatriate personnel shall be responsible for the timely and prompt filling of all returns, documents, estimates, accounts, information and details complete and accurate in all respect as may be required under the application laws /regulations in India by the appropriate authorities in India. In case the Contractor or any of its expatriate personnel do not comply with the above requirements, which result in any penalty, interest or other liability, the same shall be borne by the Contractor.

	32.6	Each party hereby agrees to indemnify and keep indemnified and saved harmless at all times the other party against any loss, cost, expense or damage suffered or incurred by it by reason of the party which has failed to pay taxes, duties/levies etc, which it is obliged to pay and/or arising out of its failure to comply with its obligations under such provisions
	32.7	The Contractor may be entitled to avail deemed export benefits as per the EXIM Policy of Govt. of India which needs to be ascertained by bidder. In that event, the Contractor shall be deemed to have taken into account the benefits of Deemed Export in his bid. The owners shall only be responsible to issue requisite certificates. However, if the benefits of deemed Export are not granted by the Govt. of India to the Contractor, the Owner will not be liable to pay anything extra on this account.
33. Transfer of property		
	33.1	Both indigenous and imported materials, appliances, equipment/plant and spares thereof or things of whatsoever nature intended to form or forming part of the permanent Work and any/all temporary works as per Article-26 shall become the property of the Owner on the issue of the Certificate of Completion by the Owner unless the ownership has prior to such event been transferred to the Owner.
	33.2	On arrival of the shipments in Indian port the Contractor shall be fully responsible for arranging all port clearances including stevedoring, handling, un-loading, loading, storage and inland transportation and receipt of material and equipment and plant at storage yard(s)/site(s) and all the associated activities. The Owner, without obligation, shall use its best efforts to assist the Contractor in obtaining port clearances but on this account no time extension shall be granted and no extra cost will be paid, it is only an assistance if possible:
	33.3	The Contractor shall not create any encumbrance or charge or line or mortgage or hypothecate any of the equipment and materials procured and supplied either imported or indigenously procured in favor of any persons or financial institutions or banks whatsoever.
	33.4	In case of any loss or damage to the equipment and materials thus procured and supplied before' these are incorporated in the works and finally taken over by the Owner, the Contractor shall immediately arrange to replace/repair the lost or damaged materials and equipment and 'supplies entirely at its own cost and irrespective of any claim for such loss or damage with insurer.
	33.5	Notwithstanding the transfer of property in all or any of the materials and equipment procured and supplied by the import or indigenously by the Contractor to the Owner, the Contractor shall continue to remain responsible in all respects for conformity of the materials and equipment supplied to the contractual specifications and for the purpose of the works the Contractor shall not be absolved of his responsibility to properly execute, perform and complete the Works in its entirety.
	33.6	(A) Ownership of all imported documentation (drawings, specifications, etc.) shall be transferred to the Owner upon occurrence of any of the following events: - - the date of delivery to the Owners representative in Jaipur. - the date of the FOB bill of landing or air bill, or - the date of receipt by any post office or recognized courier service in Jaipur. (B) All drawings, design, software's, satellite images and other documents prepared, procured for project shall be property of owner, and contractor shall submit the same to the engineer in charge before approval of relevant design and drawing. All soft copies should be in software operation compatible mode. i.e. all design in excel shall be submitted in excel sheet along with formulae, all drawings shall be in AutoCAD format.
34. Default of contractor		

	34.1	If the Contractor shall become bankrupt, or have a receiving order made against him or shall present his petition in bankruptcy, or shall make an arrangement with or assignment in favor of his creditors, or shall agree to carry out the Contract under a committee of inspection of his creditors, or being a corporation, shall go into liquidation (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) or a petition for winding up its field by or against the Contractor or if the Contractor shall assign the Contract without the consent in writing of the Owner first obtained, or shall have an execution levied on his goods, if the Engineer-in-charge shall certify in writing to the Owner that in his opinion the Contractor. (a) has abandoned the Contract, or (b) has failed to commence the works or has suspended the progress of the Works for fourteen days after receiving from the Engineer-in-charge written notice to proceed, or (c) has failed to remove materials from the site or to pull down and replace work for 14 days after receiving from the Engineer-in-charge written notice that the said materials or work had been condemned and rejected by the Engineer-in-charge under these conditions, or d) despite previous warning by the Engineer-in-charge in writing is not executing the Works in accordance 'with Contract or is persistently or flagrantly to carry out his obligations under the Contract, or. e) has, to the detriment of good workmanship, or in breach of this contract including of the Engineer-in-charge/ Owner's instructions to the contrary, sublet any part of the Contract, Then the Owner may, after giving 8 days" notice in writing to the Contractor, enter upon the site and expel the Contractor there from without hereby voiding the Contract or affecting the rights and powers conferred on the Owner or the Engineer-in-charge by the Contract, and may himself complete the Works or may employ any other Contractor to complete the Works at the risk and cost of the Contractor. The Owner or such other Contractor may use for such completion so much of the construction plant, Temporary Works and materials, which have been deemed to be reserved exclusively for the execution of the works, under the provisions of the Contract, as he may think proper, and the Owner may, at any time sell any of the said construction plant, Temporary Works and unused materials and apply the proceeds of sale in towards the satisfaction of any sums due or which may become due to him from the Contractor under the Contract.
	34.2	If the Owner shall enter and expel the Contractor under this Article 34, he shall not be liable to pay to Contractor any money on account of the Contract until the expiration of the defect"s liability period thereafter until the cost of execution and maintenance, damages for delay in completion, if any, and all other expense incurred by the Owner have been ascertained and the amount thereof has been received by the Owner. The Contractor shall then be entitled to receive only such sum or sum If any, as the Engineer-in-Charge may certify would have been payable to him upon due completion by him after deducting the said amount. If such amount shall exceed the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the Owner the amount of such excess and it shall be deemed a debt due by the Contractor to the Owner and shall be recoverable accordingly by the Owner from the amounts realized by encashing the Contract performance guarantee or other guarantee or otherwise recovered from the Contractor including money due to the contractor on any other accounts whatsoever or by legal action as per law.
35. Watching & Lighting, Site drainage, Protection of tree and prevention of nuisance		
	35.1	The Contractor shall in connection with the Works provide and maintain at his own cost all lights, guards, fencing and watching when and where necessary or required by the Engineer-in-charge or the Engineer-in-charge Representative, or by any duly constituted authority for the protection of the

		works, or for the safety and convenience of the public or others,
	35.2	Unless otherwise provided in the contract, water which may accumulate on the site during the progress of work or in trenches and excavations from any cause or source whatsoever shall be removed from the site by the Contractor to the satisfaction of the Engineer-in-charge, and at the contractor's expense.
	35.3	The Contractor shall endeavor to protect from damage, trees marked by the Engineer-in-charge/forest authorities at the site. Where necessary the Contractor shall provide at his expense temporary fencing to protect such trees.
	35.4	The Contractor shall at no time, cause or permit any nuisance on the Site or cause anything which will cause unnecessary disturbance or inconvenience to the public in general and owners/tenants/occupants of adjacent properties
36. Opportunities for other contractors		
	36.1	The Contractor shall, in accordance with the requirements of the Engineer-in-charge, afford all reasonable opportunities including use of all internal roads/ways for carrying out its work to any other contractors employed by the Owner and their workmen and to the workmen of the Owner and of any other duly constituted authorities who may be employed in the execution on or near the site of any work not included in the Contractor of any contract which the owner may enter into in connection with or ancillary to the works. If, however, the Contractor shall, on the written request of the Engineer-in-charge or the Engineer-in-charge's representatives, make available to such any other contractor, or to the Owner or any such authority, the use of the contractor's scaffolding or other plant on the site, or provide any other service of whatsoever nature for any of them the owner shall pay to the contractor in respect of such use or service such sum or sums as shall be mutually agreed.
37. Obligation of owner		
	37.1	Within 30 days of the date of signing of the Contract the Contractor shall submit for the owner's approval the Contractor phased requirement of land for the various permanent Works and Temporary Works to meet the Contractor's working program and the Owner shall assist in taking of such land on Ownership/lease by the contractor at no cost to the owner except for permanent works. But no time extension shall be granted on this account. All the land required for permanent works; submergence area will be acquired by Owner with help of the Contractor. The Owner will be responsible for payment of compensation for the land required for permanent works, submergence and rehabilitation in respect of private land houses within the submergence area. All costs relating to compensatory and/or catchments area treatment plan as required by State Forest Department or Ministry of Environment and Forest, Govt. of India will be borne by the Owner.
	37.2	The internal roads in the Project Area, shall be made available to the contractor on "as is where is" basis. On the contractor's written request, owner shall provide a recommendation, in the form required by the relevant Indian authorities to obtain: (a) Indian import licenses for the construction and other equipment, materials, appliances, instruments, tools and plants, including all related spares and wearing part required for the execution of the Works. (b) Working permits and visa for expatriates, visa for accompanying family members, permits for transport, storage and use of explosives, permit for transport of heavy equipment and any other permits required as per law during the course of the Contract. (c) Telephone, telex and other means of communications required during the course of the Contract.
38. Effect of changes in Law		
	38.1	The Contract price specified in Bid Proposal Sheets, of Bid document is based on the taxes, duties, levies and all other charges prevailing on the last

		day of preceding month of the last date of bid submission (hereinafter called "Tax" in this SCC Article 48), If any rates of Tax are increased or decreased, a new Tax is introduced in India only, an existing Tax is abolished, or any change in interpretation or application of any Tax resulting from a change or Introduction in India only due to any National or State Statute, Ordinance, Decree or other law or any 'regulation or bye-law of any local or other duly constituted authority in India only, occurring in the preceding month of the last date of submission of bid document, in the course of the performance of contract, which was or will be assessed on the Contractor. in connection with the performance of the contract, an equitable adjustment of the Contract price shall be made to fully take into account any such change by addition to the Contract Price or deduction there from, as the case may be. However, these adjustments would be restricted to direct transactions between the Owner and Contractor and not on procurement of raw materials, manpower, construction plants and equipment, intermediary components etc. by the contractor. Further, no adjustment of the Contract price shall be made on account of variation in deemed export benefits, if any, any increase or decrease which is included in price variation formula incorporated in the contract shall not be accounted for this purpose.
39. Incentive or early completion		
	39.1	As per Finance Department (G&T) Circular (G&T Division) issued vide F2(4)FD/PWF&AR/99 II Jaipur, dated 16.01.2018, in the event that the project completion date occur prior to the scheduled completion date (after taking into account any time extension approved by the competent authority for delays not attributable to contractor), the contractor shall be entitled to receive a payment of incentive equivalent to 0.03% (zero point zero three percent) of the contract prize, for each day by which the project completion date precedes the scheduled completion date, but subjected to a maximum of 3% (three percent) of the contract prize, Provided, however, that the payment of the incentive, if any shall be made only after the issue of the completion certificate. Note :- Contract prize for calculation of above incentive means original cost of work, plus cost of additional and extra items, if any, but excluding price variations/escalations granted if any.
40.Land		
	40.1	Land required for various temporary works i.e. for contractor's colony, facilities area, disposal area, haul roads, yard space for material stacking etc. if needed will be acquired by the contractor himself at his own cost. The Contractor has to prepare the proposal for acquisition of all the land coming under dam, submergence & for permanent building work will be acquired by the Owner as per Land Acquisition Act 2013 & prevailing act and rules and the Contractor shall help to Govt. in land acquisition work. The cost of Land, if any will be paid by Govt. & other miscellaneous expenditure during land acquisition proceeding including preparation & submission of proposal up to issue of award will be borne by contractor and if there is any delay in land acquisition for dam, submergence & permanent building work will be attributable to contractor & no compensation or extra cost will be paid to the contractor. The Land acquisition proceedings of land coming under dam & submergence are under process. All kind of payment to be made against land acquisition (temporary/permanent)/ crop compensation shall be paid/ reimbursed by the department.
	40.2	Forest Land Acquisition -The bidder has to prepare the proposals for diversion of forest land coming under work as well as submergence and will be responsible for obtaining necessary final stage approval for diversion of such land from the competent authority. The department will help the contractor in getting the clearance from the competent authority. The cost of diversion of such forest land, if any, shall be borne by the govt. However, any delay in clearance of the forest land will be attributable to the contractor.

		Costs incurred in preparing proposals and getting clearances shall be borne by the agency other than the costs of forest land and the cost of compensatory a forestation if any No work on forest land is permitted without requisite clearance/approval from the competent authority. If any revision of forest land needed for forest clearance, then owner will submit the case to forest authority, contractor will prepare the proposal with data collection, presentation and also pursue the matter with direction of owner at contractor's own cost.
41. Interpretation of Contract Document		
	41.1	(i) Special conditions shall be read in conjunction with General Conditions Technical Specifications, Bill of Quantities, project profile along with Drawings and other documents forming part of this contract wherever permissible or the context so requires. (ii) Notwithstanding the sub-division of the contract into several contract documents every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and into the contract so far as it may be practicable to do so or context so requires. (iii) In the contract unless otherwise stated specifically, the singular shall include the plural and vice versa wherever the contract so requires. Words importing person shall include incorporate companies/ registered association/body of individuals/firm of partnership as applicable in context thereof. (iv) All headings and marginal notes to the clauses/Articles of the General condition or to the Specification or to any other document forming part of the Contract are solely for the purpose of giving a concise indication of the general subject matter thereof and not a summary of the contents thereof, and they shall never be deemed to be part thereof or be used in the interpretation or construction thereof (v) If during the course of execution of the Works any discrepancy or inconsistency, error or omission in any of the provisions of the Contract is discovered which has any effect on the execution of the Works, and need to be clarified the same shall be referred to the Engineer-in-charge who shall give his decision and issue instructions directing the manner in which the Works are to be carried out. Any and all decisions and/or orders of the Engineer-in-charge shall be deemed decision and/ or orders of the Owner. However, such decisions shall not prevent the Contractor from seeking recourse under clause 23 hereunder. The Contractor shall carry out the Works in accordance with such decisions and/or instructions of the Engineer-in-charge. However Engineer in charge shall seek prior approval from owner, before giving any decision regarding above matter.

		(vi) Where any provision of the General conditions is repugnant to or at variance with any provision of the Special Condition, then the provisions of the Special Condition shall be deemed to override the provision of the General conditions and shall to the extent of such repugnancy or variation, prevail. (vii) Wherever it is mentioned in the contract that the Contractor shall perform certain work or provide certain facilities, it is understood that the Contractor shall do so at his cost and the contract price shall be deemed to have included the cost of such performances and provisions so mentioned. (viii) The materials, design and workmanship shall satisfy the applicable standards, specifications contained herein or approved by owner and codes referred to. Where the contract stipulates. Requirement in additions to those contained in the standards, codes and specifications, those additional requirements shall also be satisfied. (ix) In case there is any discrepancy between various clauses of SCC or other clauses of contract, than contractor shall report to Engineer In charge, or Engineer in charge may take initiative at his own level and after giving technical/contractual justification he will give his final verdict which will be binding on contractor. Engineer In charge shall ensure that his verdict shall be fully sufficient to achieve the project objective without compromising nature, quality and functionality of output parameter.
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APPENDIX - A**General Condition as for admissibility of Escalation**

1. The exact percentage of labour/ material [excluding materials to be supplied by the department] / bitumen/diesel and petrol component and labour component for the work shall be approved by the authority while sanctioning the detailed estimates
2. The breakup of components of labour/materials [excluding materials to be supplied by the department] /bitumen/diesel and petrol as indicated in Clause 45 have been pre-determined as below

[a] Labour	20.00%.
[b] Material	43.00%.
[c] Bitumen	00.10%
[d] Diesel and petrol	18.50%
[e] Cement: -	03.00%
[f] Steel	15.40%
Total	100%
3. While allowing price escalation the following shall be deducted from the value(R):
 - (a) Cost of material supplied by the department
 - (b) Cost of services rendered as per clause 34
 - (c) Secured Advance/any advance added earlier but deducted now after work is Measured
 - (d) Cost of extra item the rates for which have been worked out based on market rates/mutually agreed rates
4. The first statement of escalation shall be prepared at the end of three months in which the work was awarded and the work done from the date of start to the end of this period shall be taken into account for subsequent statement, cost of work done during every quarter shall be taken into account At the completion of work the work done during the last quarter or fraction, thereof shall be taken into account
5. For the purpose of reckoning the work done during any period the bills prepared during the period shall be considered the dates of recording measurement in the measurement book by the Assistant Engineer shall be guiding factor to decide the bills relevant to any period. The date of completion as finally recorded by competent authority in the Measurement Book, shall be the criterion
6. The index relevant to any quarter, for which such compensation is paid, shall be the arithmetical average of the indices relevant of the calendar month.
7. Price adjustment clause shall be applicable only for the work that is carried out within the stipulated time or extension thereof as are not attributable to the contractor
8. If during the progress in respect of contract works stipulated to cost Rs 50.00 lacs or less the value of work actually done excluding cost of material supplied by the Department exceeds Rs 50.00 lac and completion period is more than 3 months then escalation would be payable only in respect of value of work in excess over Rs 50.00 lacs from the date of satisfying both the conditions.
9. Where originally stipulated period is 3 months or less but actual period of execution exceeds beyond 3 months on account of reasons not attributable to contractor escalation amount would be payable only in respect of extended period if amount of work is more than Rs 50.00 lacs.

- 10 In case the contractor does not make prorate progress in the first-or-another time span and the short fall in progress is covered up by him during subsequent time span within original stipulated period than the price escalation of such work expected to be done in the previous time span shall be notionally given based upon the price index of that quarter in which such work was required to be done.
- 11 No claims for price adjustment other than those provided herein shall be entertained
- 12 If the period of completion including extended period attributable to Government exceeds 3 months but cost does not exceed more than 50.00lacs no escalation is admissible.
- 13 Similarly, if cost of works increases more than Rs 50.00 but completion period including extended period attributable to Government is less than 3 months no escalation is admissible
- 14 No Provisional escalation is payable on the basis of indices of the previous quarter in absence of nonpublication of indices for concerned quarter by the RBI.
- 15 Escalation is always payable quarterly and no provisional escalation is payable monthly or fortnightly.
- 16 In case at the time of executing agreement both the conditions [completion period 12 months and amount of works Rs 50.00 lacs] for admissibility of prices escalation are not fulfilled and subsequently due to additional work and extension of time attributable to Government, both the conditions become fulfilled in that case the escalation shall be payable from the date of satisfying both the conditions and only for work done beyond Rs. 50.00 lacs and in period of work beyond 3 months
- 17 The contractor shall for the purpose of this conditions keep such books of account and other documents as are necessary to show the amount of any increase climbed or reduction available and shall allow inspection of the same by a duly authorized representative of Government and further shall at the request of the Engineer in charge furnishes verified in such a manner as the Engineer in charge may require any documents so kept and such other information as the Engineer in charge may require.
- 18 Price variation clause shall be applicable in case of lump sum contracts estimated to more than Rs. 100 crores with stipulated completion period of more than 18 months.\
- 19 The component of operation and maintenance (O&M) cost included in the contract price shall not be subject to price variations. The price may be adjusted by the use of prescribed formula (or formulae) which breaks down the total price into components.
- 20 The amount of price variation in case of lump sum contracts will be made by adding of deducting, as case may be, from the payment made at the stage of work specified in the contract document.

Appendix B

Dispute Resolution During Execution of the Contract

Dispute

Disputes are germane to any contract. A 'dispute' implies an assertion of a right or a claim by one party and repudiation thereof by the other party, either expressed or implied, and may be by words or by conduct. A mere 'difference' is not necessarily a dispute; when the parties fail to resolve it, the difference culminates in dispute.

Dispute Resolution in a Construction Contract

Since arbitrations are fairly time consuming, it is always advisable to sort out the disputes mutually through the mechanism of adjudication through Dispute Resolution Board (DRB), which is a sort of voluntary arbitration. Arbitration can be resorted to if the adjudication decision is not forthcoming or is not acceptable to any party. For dispute resolution following procedure will be followed:

Dispute Resolution Board (DRB)

- (a) A formal Sub-Clause of obtaining dispute resolution through DRB will be inserted in the Conditions of the Contract. A separate Dispute Resolution Agreement will also be drawn up, detailing therein provisions like: Eligibility of Members, date of commencement, manner of entry on the reference by the Members and their resignation; obligation of the Members, the Procuring Entity and the Contractor; terms of payment (monthly retainerhip fee, daily fee for travel & site visits, out-of-pocket expenses); manner of sharing the fees and expenses and of making payments; arrangements of site visits and their frequency; conduct of hearings; termination/phasing out the activities of DRB; default of the Member, and action to be taken in case of dispute in relation to DRB Agreement, etc.
- (b) DRB should be put in place within one month of Letter of Acceptance.
- (c) The DRB for all projects costing more than Rs 10 crore will comprise of three Members, one each to be appointed by the Procuring Entity and the Contractor and approved by the other. The third Member, who will also act as the presiding Member, will be selected by the first two Members and approved by the parties. If either of the first two Members is not so selected and approved, or the parties fail to reach an agreement on the third Member then on request of either or both parties, appointment will be made by concerned Administrative Department in case of Government Departments and Head of the Organization (Chairman, etc.) concerned in other cases.
- (d) The Members to be appointed shall be out of a panel maintained by the Department/ Organization concerned and should be experienced in the type of construction actually involved and/ or finance and accounts and/ or contractual documents. **They should be persons of repute and integrity.**
- (e) If any dispute that arises at any stage between the Procuring Entity and the Contractor in connection with, or arising out of the Contract or the execution of the Works, including any disagreement by either party with any action, inaction, opinion, instruction, determination, certificate or valuation of the Engineer, the matter in dispute shall, in the first place, should be tried to be settled amicably. If the dispute still remains unsettled, it shall be referred to the DRB.
- (f) Both parties shall promptly make available all information, access to the Site, and appropriate facilities, as the DRB may require for the purposes of making a recommendation on such dispute.
- (g) Within 56 days after receiving such reference, or within such other period as may be proposed by the DRB and approved by both parties, the DRB shall give its recommendation with reasons. The recommendation shall be binding on both parties, who shall promptly give effect to it unless and until it shall be revised in an amicable settlement or an arbitral award as described below. Unless the Contract has already been abandoned, repudiated or terminated, the Contractor shall continue to proceed with the Works in accordance with the Contract.
- (h) If either party is dissatisfied with the recommendation, then either party may, within 28 days after

receiving the recommendation, or if the DRB fails to give its recommendation within 56 days (or as otherwise approved), within 28 days after the said period of 56 days has expired, give notice to the other party, with a copy to the Engineer-in-Charge, of its intention to commence arbitration proceedings.

- (i) If the DRB has given its decision within the stipulated period, and no notice of intention to commence arbitration as to such dispute has been given by either party within 28 days of the said decision, then the decision of DRB shall become final and binding.

3.0 Arbitration

- (a) Any dispute in respect of which the recommendations (if any) of DRB has not become final and binding, shall be finally settled by arbitration in accordance with the Indian' Arbitration and Conciliation Act, 1996, or any statutory amendment thereof.
- (b) The Arbitral Tribunal will comprise three Members, one each to be appointed by the Procuring Entity and the Contractor. The third Member, who will also act as the presiding Member, will be appointed by mutual consent of the first two Members. If the parties fail to reach an agreement on the third Member then on request of either or both parties, appointment will be made by concerned Administrative Department in case of Government Departments and Head of the Organization (Chairman, etc.) concerned in other cases.
- (c) The Tribunal shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Engineer-in-Charge, and any decision of the DRB, relevant to the dispute.
- (d) Neither party shall be limited in the proceedings before the Tribunal to the evidence or arguments previously put before the DRB to obtain its decision, or to the reasons for dissatisfaction given in its notice of dissatisfaction.
- (e) Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, the Engineer-in-Charge and the DRB shall not be altered by reason of any arbitration being conducted during the progress of the Works.

4.0 Language

All proceedings before DRB/ arbitral tribunal shall be in the Language of the Contract/ English.

5.0 Terms and conditions for engagement of DRB Member and Chairman

The terms and conditions including the remuneration and other facilities to be given to the Members of DRB and Arbitrators in case of civil engineering construction contracts/ consultancies shall be as notified by the State Government from time to time. Each Party to the Contract (the Contractor/ Consultant) shall be responsible for paying one-half of the remuneration. Since the fee structure has to be agreed by both the parties i.e. Procuring Entity and Contractor/ Consultant, the fee structure may also be got accepted by the respective Contractor/ Consultants. In the contracts the fee structure may be included as part of the bidding documents/ contract documents and the acceptance of the fee structure by the Contractors/ Consultants may be kept as a pre-condition for signing the Contract.

SPECIAL CONDITONS OF CONTRACT
(Part-II)

Section VI B: Contract Data/ Special Conditions of contract

Ref to GCC	Subject	Description
1.	Bill of Quantity	Bill of quantity means the details of quantities quoted by bidder in price bid schedule 1 to 9 The component wise activities are to be assessed and quantities & Rates are to be filled by bidder in these schedules (1 to 9.) Activity schedule means details of the activities given in the Payment Schedule in the Performa's schedules (1 to 7.)
2.	Schedules of BOQ	- Schedule means details given in price bid under schedule 1 to 9 These schedules contain indicative breakup of all project components. - Employer has given breakup of project in the schedules 1 to 7 in the financial bid contract. Contractor needs to develop the further breakup for calculating the cost of each activity to arrive at the total cost of project and schedule of payment. - Total cost of each schedule (schedule 1 to 7) of the project i.e. Cost of Design, build and operate will be freeze at the time of acceptance of financial proposal. Contractor shall submit detailed design, drawing, estimated quantities and rates of activities of each component of project for all schedules after acceptance of bid. In case, if there is any variation in quantity due to inclusion of new activity as per design requirement/ deletion of original activity during the design stage/ Modification of original activity, no variation in the total cost of the schedule shall be allowed. Variation shall be accepted by the employer with recording technical justification. - After finalization of the design and drawings of the project / component, contractor will submit the revised activity schedule with quantity estimation and rates keeping the total cost of respective schedule same as accepted by the employer at the of acceptance of financial proposal of the successful bidder. - The revised activity schedule and revised payment schedule shall be approved by the employer on the basis of approved Design & Drawing. Payment schedule can be revised in multiple stages due to revision in drawings at various stages of the work
3.	Specifications	In addition to the provision given in Contract document, relevant national/ International codes, MoRTH specification, Departmental practices, Industrial specifications and other specifications as decided by procurement entity shall be referred. Engineer in Charge shall decide the priority of adoption of specifications keeping the output parameters of the scope of work fixed.
4.	Procuring Entity's designation and address are:	Add. Chief Engineer Water Resources Zone Jaipur Note: Wherever mentioned in the bid as "owner, Employer, Department or procurement entity "it will mean as above.

5.	The work or work is:	Wherever “work / project / scheme” is mentioned in document, it stands for. Construction of Kaliteer Lift Scheme, Dholpur on Engineering, Procurement and Construction Basis (single Responsibility Turn-Key project) and its operation & maintenance for 8 years
6.	The sections of the works are (if any):	wherever sections of work / component of works / subcomponent mentioned in the document, shall mean the various components as per scope of work.
7.	The site is:	The work site is located as per enclosed Index Map
8.	The contractor and his address are:	To be named by the contractor
9.	Engineer-in-charge’s Designation and address and communication details are”	Officer authorized by Add. Chief Engineer Water Resources Zone Jaipur Executive Engineer WR Division II Dholpur
10.	The contractor’s Representative’s name and communication details are:	To be named by the contractor
11.	The commence/ start date is:	Within ten days after signing the agreement.
12.	Project completion for design and Build component Survey designand investigation Construction period	30 Months
13.	Defect liability period (DLP)/Defect notification period (DNP) is	Eight years after issuance of completion of the project.
14.	Quality Control:	Sole responsibility of maintaining the quality of all goods material and process will be of contractor. The Contractor shall establish a fully equipped field laboratory at site. Contractor will ensure providing requisite technical / support staff and all necessary raw materials required for conducting all tests at specified frequencies as specified in the specification. Contractor will ensure to provide sample collection, transportation, testing facility in the laboratory or outside the laboratory as per direction of engineer in charge. Any test facility which cannot be developed at contractor's lab, shall be got tested in NABL laboratories approved by Employer.
15.	The Engineer-in-charge shall obtain approval of the competent authority of the Department/Organization	All Engineering plan, design, drawings are to be approved from Procurement Entity or his designated representative. In all matters prevailing Schedule of Power, standing order, circulars and rules of business issued by WRD, State Finance Department GoR shall govern and engineer in charge perform contractual obligations accordingly.
16.	Additional Performance Security	In addition to the details specified in relevant clause, if the quoted price is less than 15% of estimated cost (Rs 705.86 Crore) i.e., below Rs 105.88 Crore, then successful bidder must submit additional performance security. The Additional Performance Security shall be equal to fifty percent of Unbalanced Bid Amount. The Additional Performance

		Security shall be deposited in lump sum by successful bidder before execution of Agreement. The Additional Performance Security shall be deposited through e-Grass, Demand Draft, Banker's Cheque, Government Securities or Bank Guarantee (Inserted by Finance Department Order Dated October 22,2021) i. Unbalanced Bid means any bid below more than fifteen percent of Estimated Bid Value. ii. Estimated Bid Value means value of subject matter of procurement mention in bidding documents by Procuring Entity. iii. Unbalanced Bid Amount means positive difference of eighty-five percent of Estimated Bid Value minus Bid Amount Quoted by the bidder.
17.	Performance Security	The Contractor shall have to furnish a Performance Security at the time of signing of the contract agreement as per the relevant RTTP act and Rules in one of the following forms - deposit though e-GRAS. - National Savings Certificates and any other script/instrument under National Savings Schemes for promotion of small savings issued by a Post Office in Rajasthan, if the same can be pledged under the relevant rules. They shall be accepted at their surrender value at the time of bid and formally transferred in the name of procuring entity with the approval of Head Post Master; - Bank guarantee/s of a scheduled bank. It shall be got verified from the issuing bank. Other conditions regarding bank guarantee shall be same as mentioned in the rule 42 for bid security; (Refer FD circular dated 18.12.2020 and 12.01.2022 as per rule) - Fixed Deposit Receipt (FDR) of a scheduled bank. It shall be in the name of procuring entity on account of bidder and discharged by the bidder in advance. The procuring entity shall ensure before accepting the Fixed Deposit Receipt that the bidder furnishes an undertaking from the bank to make payment/premature payment of the Fixed Deposit Receipt on demand to the procuring entity without requirement of consent of the bidder concerned. In the event of forfeiture of the performance security, the Fixed Deposit shall be forfeited along with interest earned on such Fixed Deposit. - In case of procurement of works, the successful bidder at the time of signing of contract agreement, may submit option for deduction of performance security from his each running bill and final bill (as per prescribed RTTP Rules and Act) - Bank guarantee. It shall be of a scheduled Bank in India in prescribed or other acceptable format or from other Issuer acceptable to the Procuring Entity. The bank guarantee shall be got verified from the issuing bank and confirmer, if any. Note: Performance security shall govern as per prevailing circulars of Rajasthan Govt Finance Department. i.e., on increase or decrease of performance security on running contracts, performance security shall be modified accordingly.
18.	Refund of Performance Security	As per GCC Clause 37 and prevailing rules of finance department rules regarding performance security
19.	Third Party Quality Inspections as per ISO 17020	Up to the satisfaction of Employer, quality / efficiencies of all instrumentation and other HEM parts and machineries are to be

	by a Departmental Authority or QCI approved/ accredited bodies	tested in presence of authorized officers in the designated laboratories / IIT/ CPAT / RITES/ or any laboratory/ agency who has good past experience in such works as decided by the employer at the expenses of contractor including cost of sample collection, transportation etc. All the expenses of travel, lodging & boarding of experts / authorized officers for quality inspection are to be borne by the contractor.
20.	Issue of Procuring Entity's equipment and materials, if any	Preliminary design, drawings, investigations etc available with the department for tentative parameters shall be provided to prospective bidders after submission of written request to procurement entity.
21.	Signing of the contract Agreement:	Contract is to be signed within 10 days of issuance of letter of acceptance, after submission of Performance security and Additional Performance security.
22.	Compensation/ Damages for delay	(1) For design and build part Pro-rata progress is to be maintained by the contractor otherwise penalty shall be imposed as per GCC provisions. (2) For operation and maintenance period Penalty shall be imposed as indicated in Section V-(C) Technical Specification, & sub section of O& M
23.	Price Escalation*	(1) Bidder shall be required to quote lump sum Design Build Cost for implementing the project for all project components as detailed in Employer's Requirements and Scope of Work in Section V B. separate escalation shall be paid as per clause 45 of GCC. The breakup of components given in the contract is indicative based on indicative technical estimate. After completion detailed design and BOQ of the work, revised components breakup shall be submitted by contractor to Engineer in charge. Engineer in charge after checking, submit it to employer for approval. During execution stages of work, Breakup may change at multiple times due to change in designs and BOQ, It will be responsibility of contractor to submit revised Break up, within 30 days from approval in change in BOQ by the employer. (2) Payment of escalation bill will be paid on the basis of Indices published by Reserve Bank of India Journal. All escalation bills will be paid based on above. Payment of any price escalation bill will be done as per the published provisional index values also, however payment so made will be adjusted in subsequent price escalation / variation bills soon after publication of final indexes. Break of components taken in the contract document is indicative. As the contract is EPC Turnkey, details of quantities are likely to change during Detailed Engineering Process, hence, contractor need to submit revised breakup of components. Employer shall approve this break up. Break, may change multiple time due to change in Details of quantities. During each time of change in design and quantities details, break shall be submitted by contractor and got it approved from owner. Any effect of change in breakup on past payment shall be got adjusted in subsequent bills by engineer in charge. Like other payment conditions, No interest shall be payable on pending escalation payment to contractor.

24.	Advance Payment	Mobilization Advance on demand of Bidder shall be governed as per order No. F. (2) FD/GF&AR/2020 Jaipur dated: 16-06-2022 of Finance (GF&A Rules) Department of GoR. In respect of works costing more than Rs. 50.00 Crore (Rs. Fifty Crore) only the department will, if provided in bidding document and requested by the Contractor to make mobilization advance, payment to the Contractor (at 9% per annum interest compounded annually basis) to assist in defraying the initial expenses that necessarily be incurred by the Contractor for mobilization. The total of such advance payments and the number & timing of installments is stated here under- The total amount of Advance shall not be more than 10% of the Capital work. Payment of Mobilization Advance shall be made in two equal installments, out of these first installment shall not be more than 5% of the Capital work and on compliance of the requisite Conditions as stated in the bidding document, the remaining amount of 5% of Capital work shall be in second installment. Release of Mobilization Advance: On recommendation of the Engineer-in-charge, Mobilization Advance shall be released, as follows: i. Execution of the Agreement by the parties thereto, ii. Submission by the Contractor of an unconditional and irrecoverable bank guarantee in amounts and currencies equal to the advance payment being requested. Such bank guarantee shall be issued either by a Nationalized or Scheduled Bank as declared by the RBI, should be encashable in Rajasthan and acceptable to the Department. The guarantee shall remain effective until the full recovery of the advance payment with total interest payable thereon. If the advance payment has not been repaid by the date 28 days prior to expiry date of B.G. the contractor shall extend the validity of B.G. until the advance payment has been repaid. iii. The mobilization advance payments shall be made in two installments as stated above, subject to the conditions described below. The advance payments shall be used by the Contractor exclusively for mobilization expenses, as per the programme approved by the Engineer-in-charge. iv. For this purpose, the Contractor shall open a dedicated Contract Bank Account in a bank located at divisional office headquarter or in case of non-functioning of bank's branch at divisional office headquarter than at the nearest place to divisional office headquarter in Rajasthan and the Department will transfer or deposit the advance payments directly into the aforesaid dedicated Bank Account of the Contractor. The Contractor will not be permitted to use these funds for any purpose other than for expenditures under the Contract and the Department will be entitled to verify that the transactions from this account are used exclusively for the purposes for which they are intended. In case the advance payment is not utilized by the Contractor as per the approved programmed and within the stipulated period to the satisfaction of the Engineer-in charge, default proceedings as per the relevant clause of Contract, shall be initiated against the Contractor. Release of First Installment: The Department will make, payment of the first installment of the mobilization advance only after the
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		Contractor has fulfilled the following conditions : a. Contractor has executed the agreement with department. b. Requisite Bank Guarantee has been deposited by the contractor. c. Established the dedicated Contract Bank Account. d. Any other condition mentioned in bid document in order to release installment Release of Second Installment: After the first installment of the advance payment has been utilized as per the approved programme, substantiated by relevant documents and to the satisfaction of the Engineer-in-charge, the Contractor may then apply for the second installment after complying the conditions stated in the bid. The Department will make payment of the second installment after the Contractor has successfully fulfilled the following conditions: a. Actual deployment of (i) such Personnel (ii) Machinery and Equipment, as per the approved deployment schedules, if stated in bid document. b. Established the fully furnished Site Office(s), if stated in bid document. c. Established and staffed, with qualified personnel, completely equipped testing laboratory(s) at Site for quality control purposes, if stated in bid document. d. Placed confirmed orders for supply of major items of material and equipment, which is to be incorporated into the Permanent works as per the approved procurement schedule, if stated in bid document. e. Commenced construction work at the site in accordance with the approved construction program, if stated in bid document. f. The second Installment of Mobilization Advance would be released after submission of utilization certificate by contractor for the first Installment of advance released earlier. g. Requisite Bank Guarantee has been deposited. h. Any other condition mentioned in bid document in order to release second installment. Schedule of Re-payment of Mobilization Advance: The Advance Payment shall be repaid through percentage from the running bill as under: a. deductions shall commence in the first running bill. b. deductions shall be made at the rate of 15% (fifteen percent) of each running bill until such time as the advance payment has been repaid along with interest thereon; provided that the advance payment shall be completely repaid prior to the time when 75% (seventy five percent) of Payment of works or 13 months from the date of first installment of Advance, whichever is earlier." following other specific milestones for Mobilization Advance: <table><tr><th>Advance (% of contract value)</th><th>Milestone</th></tr><tr><td>5%</td><td>After submission of request by the Bidder after signing agreement for the work. On request by the Bidder after establishment of site office.</td></tr></table>	Advance (% of contract value)	Milestone	5%	After submission of request by the Bidder after signing agreement for the work. On request by the Bidder after establishment of site office.
Advance (% of contract value)	Milestone					
5%	After submission of request by the Bidder after signing agreement for the work. On request by the Bidder after establishment of site office.					

		5.00%	On request by the Bidder after submission of work Program and Work methodology.
		Note: a. The contractor shall demonstrate that the advance payment shall be used for the purpose specified above by supplying copies of invoices or other documents to the Engineer in charge b. If scheduled recovery period is extended by any reason, the contractor has to extend the B.G. up to extended period plus 3 months. c. It is to be noted by Tenderer that there shall be no relation between recovery of Advance and completion period. Mobilization Advance on demand of Bidder shall be governed as per order No. F. (2) FD/GF&AR/2020 Jaipur dated: 16-06-2022 of Finance (GF&A Rules) Department of GoR.	
25.	Priority of Documents	The documents forming the Contract are to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance with the following sequence: 1. The Contract Agreement, 2. The Letter of Acceptance/ Letter of Intent/ Work Order, 3. Financial Bid (BoQ) accepted by The employer 4. Special Conditions of Contract, 5. The General Conditions of Contract, 6. The Specifications, 7. The Drawings 8. The Instructions to Bidders, 9. The Notice Inviting Bids, and 10. The Schedules and any other documents forming part of the Contract. Note: If an ambiguity or discrepancy is found in the contract documents, the Engineer-in-Charge (after consulting procurement entity) shall issue any necessary clarification or instruction. Engineer in charge decision regarding specifications of project components shall be final and binding on the contractor. and it will be given priority over all above clauses of contract.	
26. Design Consultant			
	26.1.	The owner's design consultant (ODC) for this-work will be Central Water Commission (CWC), or any IIT or MNIT Jaipur as approved by the Owner. There may be multiple ODC for different project components. All the designs and drawings related to the work i.e. Civil, work shall be prepared by the contractor at his own cost and will be got vetted from ODC by the contractor for which contractor will depute his design experts to the premises of the ODC. All the expenses will be borne by the contractor for vetting/ approval of the design and drawings from ODC. The owner's Geological Consultant for this work will be Department of Geological Survey of India (GSI) or any equivalent	

		institute as approved by the Owner. All the expenses for the Geological investigations/studies regarding project/consultation/expenses of GSI or any equivalent institute as per approved by Owner etc. will be borne by the contractor.
27. General Experience of design team of Tenderer		
	27.1.	The bidder shall constitute and / or hire a design team / consultant. Bidder Design Consultant (BDC) has experience in design of similar concrete gravity dam/barrage/ weir. BDC shall have designed at least one similar project or it's relevant component in last seven years. Further, the construction of such a project shall have actually started on the ground. A certificate to this effect that construction of the project designed by the BDC for the relevant component wherever allowed on the basis of such a design has actually got started shall be enclosed in support of this claim. a) The experience and records of staff members (education, length of experience and type of positions held) to be assigned to the work. b) Suitability for the project (experience of performing the duties\ which will be assigned to BDC in the project. c) All designs, drawing, design; memo and design briefs shall be duly signed by the authorized representative of BDC also.
28. Tenderer actions requiring Owner's prior approval		
	28.1.	The tenderer shall obtain the owner's prior approval in writing before taking any of the following actions: Appointing personnel to carry out any part of the services, including the terms and conditions of such appointments. Entering into a sub - contract for the performance of any part of the services, it be understood (i) that the selection of the BDC and the terms and conditions of the sub - contract shall have been approved in writing by owner prior to the execution of the sub-contract, and (ii) that the contractor and BDC/ subcontractor both shall remain jointly and severally liable for the performance of the services by BDC/ Sub contractor and its personnel pursuant to this contract.
	28.2.	Approval of Personnel In respect of personnel/sub-contractor which the tenderer proposes to use in the carrying out of the services, the tenderer shall submit a copy of their biographical data to owner for review and approval.
29. Design Liaison with the Owner		
	29.1.	Design liaison with the Owner from the start of the additional investigations and until completion of the project. (i) Design liaison with the owner by 'way of providing required information/clarifications and assistance to the owner for visits to the laboratory etc., in connection with testing of hydraulic models and assessment of their performance. (ii) Assistance to the Owner at the Contractor's home office in connection with testing.

		(iii) Visits to similar completed and ongoing works
	29.2.	Note: The above list is not exhaustive. The obligations of the Contractor shall extend to all other necessary jobs to be done including necessary additional investigations, not specifically/ listed above but are necessary for the proper completion and functioning of the works, and all such items shall be deemed to have been included in the scope of work. The scope of work under this contract shall mean the overall and detailed planning of the project, all necessary additional investigations, the basic and detailed design of the civil, preparation of Design Criteria & Technical Specifications and Review of Design of all Civil Works, co-ordination of the design of the civil works and the studies required for these purposes as specified in the scope of work or as are necessary. During detailed Engineering, the Contractor may propose to modify or change preliminary design of the Civil Works of the Project as described in the 'Scope of work' in Technical Bid for techno-economic "reason and time effectiveness, provided always that the design of the Project shall be in accordance with the Internationally accepted practice and for the performance of the Works as warranted under the Contract. Such changing should be brought out in detailed techno memo to establish the superiority of the proposal which is to be executed on specific approval of Owner. Such changes will not however, entitle the contractor to additional cost whatsoever, other than the contract price under Special Condition Article 8. Additional technical data and information related to the Project and available with the Owner and required for the Services shall be furnished to the Contractor without charge and the Owner may without obligation give assistance for obtaining of any additional data and information as may reasonably be requested by the Contractor.

30. Supply of Drawings, Reports etc.		
	30.1.	The Contractor's Scope shall furnish to the Owner's office at Jaipur/Dholpur the following copies of drawings, reports and other technical documents: 1. Drawings for information only shall be submitted in sets of four or more paper copies. 2. Drawings for approval of CWC/ any IITs/ MNIT Jaipur (ODC) shall be submitted in sets of one AutoCAD soft copy, six paper copies full size and one paper copies A-3 size. One paper copy of full size shall be returned to the Contractor after vetting, approval or comments from ODC. All design shall be in excel (with formulae) or in the design software compatible format. 3. Approved drawings for Construction of Civil Works shall be submitted in sets of one Auto CAD soft copy and seven full size paper copies. The Contractor will be furnished with one approved copy by the owner for reproduction at site. The soft copies of approved construction drawing shall also be provided in CDs and other electronic devices. 4. As-built drawings shall be submitted in sets of one transparent copy, and seven paper full size copies three A3-size and one soft copy in CDs. 5. Final version of review report, overall planning report and design briefs/design memos shall be submitted in five copies each with on soft copy. Draft version may however be submitted in duplicate. In addition, approved final version of these documents shall also be provided as soft copies in CDs. 6. Approved manuals in ten copies for Owner's reference and records in addition to soft copies. 7. Monthly/Quarterly reports shall be submitted in five copies. 8. The Project completion Report shall be submitted in ten copies with soft copy. 9. Design computations shall be submitted in duplicate in hard and soft copy. 10. All Software used shall also be loaded in Owner's and Engineer in Charge computers for design verification and Owner's and Engineer in Charge subsequent use at no additional cost.
31. Overall and Detailed Planning of the Project		
	31.1.	Review of the preliminary design as described in 'Scope of Work' as a basis for the preparatory work and the additional field and geotechnical investigations and preparation of an Overall Planning Report. Preparation of a report including a Project layout and details of important features on the basis of the results available from the

		additional investigation and tests. Detailed design and reports will be prepared for the various parts of the Project for the approval of the owner of amendments to the Overall Planning Report and for the establishment of a firm basis for the detailed design. A final Report on the detailed planning of the Project will be compiled. This will include the coordination of the design of the Civil Works. The final report shall be submitted to ODC for approval, the tenderer will arrange his expert in ODC for discussions and timely compliance of the observations of ODC for clearance of the report.
32. Program-scheduling and Re-scheduling		
	32.1.	The Works shall be executed and performed in accordance with the Program which shall clearly indicate the interlinking/interdependencies of all the works of the Contract including relative activities of Civil Works. The Program shall be reviewed jointly by the Owner and the Contractor, at least at 3 months intervals, where-in the hold ups/delays, if any in the progress of Works, with reference to the agreed Schedule shall be give Special Attention. Necessary modification (updating/ Revisions) of the Program, within the overall Time for Completion, shall be carried out by mutual agreement between the owner and the Contractor.
33. Contractor's liability		
	33.1.	The Contractor shall be responsible for performing the Scope of Work. The Contractor shall exercise all reasonable skill care and diligence in the performance of the Services and shall carry out his responsibilities in accordance with recognized professional standards. Contractor's liability shall expire on the issue by the Owner of the last final Acceptance Certificate in accordance with the Special Conditions of Contract.
34. Contractor's Work Program		
	34.1.	The work program indicates the sequence of various activities and highlights critical activities shall from part of the contract. i. Two months after the Date of Order to Commence, the Contractor shall submit to the Owner a work program along with a project management/monitoring software showing the order of procedure in which he progress to carry out various components for completing the works as per the work program within the TIME FOR COMPLETION. Such work program shall be subject to review and revision by the contractor in consultation with the Owner from time to time in order to achieve completion of the Works within the TIME FOR COMPLETION. ii. Within one month after submission of work program, the contractor shall submit to the Owner a detailed construction methodology along with schedule for deployment of men, plant & machineries which shall successively be adjusted in order to meet the actual requirement to complete the work within the TIME FOR COMPLETION.

35. Ecological Balance		
	35.1.	The contractor shall try to maintain ecological balance by preventing deforestation, disturbance to the wildlife of adjoining forest, water pollution and defacing of natural landscape in the vicinity of work areas. The contractor shall be conducting his construction operations as to prevent any unnecessary destruction of, scarring or defacing the natural, surroundings in the vicinity of the work area. In order to maintain the ecological balance, the contractor shall specifically observe the following instructions: - Where unnecessary destruction, scarring, damage or defacing may occur as a result of the Contractor's operation the same shall be repaired, replanted or otherwise corrected at the Contractor's expense. The Contractor will prevent scattering of rocks or other debris outside the work areas. All work areas shall be smoothed and graded in a manner to conform to the natural appearance of the landscape as directed by the Engineer-in-charge. - All trees shrubs which are not specifically required to be cleared or removed for construction purposes; shall be preserved and shall be protected from any damage that may be caused by the Contractor's construction Operation and equipment. The removal of trees or shrubs will be permitted only after prior approval by the Engineer-in-charge. Special care shall be exercised where trees or shrubs are exposed to injuries by construction equipment, blasting, excavating, dumping, chemical damage or other operation and the Contractor shall adequately protect such trees by use of protective barriers or other methods approved by the Engineer-in-charge. Trees shall not be used for anchorage. - The Contractor's construction activities shall be performed by methods that will prevent entrance or accidental spillage of solid matter contaminants, debris and other objectionable pollutants and wastage into the river. Pollutants and wasters shall be disposed of in a manner and at sites approved by the Engineer-in-Charge. - In the Conduct of construction activities and operation of equipment, the Contractor shall utilize such practicable methods and devices as are reasonably available to control, prevent and otherwise minimize air pollution. Burning of materials resulting from clearing of tree, bush combustible construction materials and rubbish may be permitted only when atmospheric condition for burning is considered favorable.
	35.2.	Construction of Kaliteer Lift Scheme, Dholpur on Engineering, Procurement and Construction Basis (single Responsibility Turn-Key project) and its operation & maintenance for 8 years
	35.3.	Separate payment will not be admissible to the Contractor for complying with the provisions of this clause and all costs shall be deemed to have been included in the lump sum price of the bid. If any provisions (s) are not complied with, within a reasonable time even after issue of a notice in this respect, the necessary operations would be carried out by the Engineer-in-Charge at the cost of the Contractor.

36. Dismantled Materials		
	36.1.	The Contractor, in course of the Works, all materials e.g. stone, bricks, steel and other materials obtainable in the Works by dismantling etc. will be considered as the property of the contractor and will be disposed of , as per directions, of the Engineer-in-charge. Excavated material viz. stones, soil will be used for construction activities of project only.
37. Cost Adjustment		
	37.1. Residential and non-residential building	The rates are to be quoted per Sqm of plinth area & total cost of above-mentioned plinth area is to be mentioned in Bid proposal sheet. The total building area (residential and non-residential) mentioned in bid document is tentative however the exact requirement shall be finalized after approval of building programme by competent authority. Accordingly, the payment shall be made as per the actual area of buildings constructed per Sqm of Plinth Area. Contractor should include cost of construction as per scope of work in his quoted rate, but if area exceeds then extra payment shall be made and if area reduces then proportionate amount will be deducted
38. Terms of Payment		
	38.1.	In EPC contracts. all payment shall be made on construction stage basis but not on quantitative measurement basis. Contractor shall submit payment schedule with justified stage of work linked with % of total payment. Engineer in charge shall ensure that stage wise payment given in Price Bid schedule should be justified keeping total payment of work fixed as per contract value. The payment terms will be as follows: Progress Payment
	38.2.	After approval of design and drawings or in partial completion of design and drawings, contractor will prepare a payment schedule and link the payment with specific stages of work, keeping total amount of payment fixed as accepted in work order. It should be kept in view that payment linked with work component and its stages should be judiciously and logically distributed. Payments schedule shall be checked by engineer in charge and approved by Employer. At stage of work, if it appears that excess payment has been made due to any reason, engineer in charge will have full liberty to initiate revised payment schedule for approval from Employer.
	38.3.	Progress certificate shall be established as per program accepted by Department. The contractor shall be entitled to receive the progress payments as per the agreed payment terms. The contractor shall link up the progress payments with specific milestones to be achieved by him in respect of Planning, Design and Engineering Services.

39. Measurement and Payment		
Scope of item of work and rates	39.1.	All items of works discussed in the technical specifications shall comprise all kind of taxes, cost of labour, construction Plant and equipment, materials and its performance required for satisfactory completion of item of work in accordance with stated/standard specifications.
	39.2.	Items and specifications provided in the Document are indicative. Contractor shall review the data, design and specifications given. The data design and specification adopted in the design approved by the owner shall be final and binding. It is clarified specifications adopted in the design and drawings must be robust enough to with stand all kind of probable forces that are likely to come in the adverse most condition during design life of the structure.
40. Establishment of Project Monitoring unit		
	40.1.	Contractor shall establish a project monitoring unit/site at the Head quarter of Engineer in charge and provide facilities for project monitoring and constriction supervision of the work
	40.2. 2	i. Three new A/c Sedan Car (not less than 1250 CC), one Innova car or equivalent new five A/c Bolero (4 x 4 Gear) are to be purchased by the contractor. On submission of original invoice, payment will be made to contractor. Vehicles shall be registered in the name of Employee representative. ii. Establishment of site office and furnishing it and providing office accessories including one computer operators with computer and Printers.
41. Review of existing data/studies and new designs and studies		
	41.1.	The Project being EPC Turnkey contract, Review of preliminary data and design provided in bid shall be done by the contractor and design shall be prepared as per realistic and authentic data to fulfill the project objective.
42. Detailed Design		
	42.1. 1	i. Preparation of basic design will be on the basis of detailed planning under article (iii) below and will include general arrangement drawings. ii. Preparation of design briefs design memorandum on all components of the project. These design briefs shall be submitted to the Owner for information and comments if any these will form a basis for further design briefs and construction drawings to be submitted to the ODC through owner. iii. Preparation of detailed design for the All Works including drawings required for the execution of the Works. Methods of construction and sequence of work will be coordinated with the Construction program. All Calculation performed and the Construction drawings while submitting to the ODC shall be submitted to Owner for his information also. iv. Follow-up of the All Works in order to verify the suitability of the design during construction and make or initiate such modifications as may be required. v. Detailed technical specifications in respect of all individual items such as concreting, excavation, foundation treatment work etc. covering the following aspects in respect of each item are to be prepared and got approved from the Owner prior to of commencement of

		the said works: i) Scope of work ii) Definitions iii) Standards (along with soft and hard copies) iv) Submittals if any v) Details of item execution on ground vi) Measurement/ dimensions. Only after approval of the technical specifications by the Owner, the commencement of the work at site and preparation of the drawings shall be started by the Contractor. Elaboration of the technical specifications of bid documents shall not be considered as detailed technical specifications as the same are indicative only.
43. Approvals by the Owner		
	43.1.	The Contractor shall successively submit design and drawings for the approval from ODC to the Owner in accordance with Article-30 above. The Owner shall give his approval/comments on all design and drawings, properly referred to him after approval/vetted from ODC within 15 days of the date of receipt of approval/vetted/comments of ODC in his office.
Civil & HEM Works	43.2.	The following documents/drawings will be submitted for approval of the Owner: i. Design criteria Design memo ii. Detailed technical specifications as mentioned in Scope of Work. iii. General arrangement and layout drawings of each component and its related structures and infrastructure layouts of project area. iv. Hydraulic Model Studies/geotechnical Reports. v. Detailed Design Calculations (In excel or Appropriate Design software like STAAD Pro , Midas etc) vi. Excavation Drawings vii. Concrete outline drawings viii. Reinforcement drawings ix. Foundation treatment drawings x. Assembly drawings. xi. Pump House Drawing and Design. xii. General Electrification drawing. xiii. Instrumentation Drawings. xiv. Detailed construction drawings of all civil, HEM works of each block and panel of proposed work.
	43.3.	1. In case the Owner has any comments on such documents, he shall within the 15 days period referred to above inform the Contractor of the same and technical discussions shall, if required, be held thereafter without delay to finalize and approve the Drawings. 2. In case approval or comments of the Owner have not been communicated within the 30 days then the Contractor shall notify the Owner and the Owner and the Contractor

		shall meet within 15 days in order to discuss and settle the issue within 15 days at owner's premises. 3. The Contractor may make minor alterations to designs during the course of construction as may be necessary or expedient, under prior approval of the Owner. 4. All software's used and their manuals shall be loaded in Owner's and Engineer in charge's Computers for design verification and Owner's subsequent use at no additional cost. 5. Contractor's Consultant shall attend meetings / follow up the vetting of design and drawings in vetting agency.
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OTHER SPECIAL CONDITIONS OF CONTRACT		
1	MS pipe & Fittings	All pipes and specials (Fittings) are to be sourced from same manufacturer.
2	HDPE pipe & Fittings	All pipes and specials (Fittings) are to be sourced from same manufacturer.
3	Power Charges	All the power consumption charges of the Pump House / Rest House/ Offices/ Chowkidar huts and other public places / offices in the campus are to be paid by the contractor. This payment will be reimbursed to the contractor by the department after submission of the bills in the office of Engineer in Charge except any type of penalty if imposed by DISCOM / JVVNL.
7	Furnishings	All residential buildings are to be constructed fully furnished as per the scope of work. All residential buildings are to be constructed with proper illumination and fan provisions.
8	Energy efficient pumps and motors	All pumps and motors shall be energy efficient. Contractor shall submit life cycle cost for design period of each pump and machine including for main pump and Chak Pumps. Owner shall finalize the specification to achieve economy and efficiency.
9	Vehicles	Three new A/c Sedan Car (not less than 1250 CC), one Innova car or equivalent new five A/c Bolero (4 x 4 Gear) are to be purchased by the contractor. On submission of original invoice, payment will be made to contractor. Vehicles shall be registered in the name of Employers representative.
10	Payment Schedule for Design Build Period	As per payment, schedule Performa however, during design stage, contractor may submit the revised payment schedule for approval from Procurement entity.
11	Deployment of Personals during Design Build and operation period	Contractor shall provide details of each personal/ expert along with his monthly salary and wages in price bid schedule-8.1. In case of non-deployment of personal as per deployment schedule, employer may impose penalty at the double rate of his salary.
12	List of Equipment's	To be provided by the Bidder Employer may ask to deploy specific equipment which is required for execution of project as per construction schedule and efficient operation and maintenance of system.
13	Liquidated Damages during O & M Period	Shall be leviable as described in of Technical Specifications "in Section 12 "operation and maintenance "
14	List of vendors for HEM equipment's	Procurement entity shall decide to select the specification of equipment from the given vendor list at Annexure - VL of technical specification. The equipment's required but not covered in the vendor list, procurement entity shall select & finalize the vendor and specifications for the desired item.

15	Protection of Environment	The Contractor shall comply with all applicable national, State and local environmental Laws and regulations. The Contractor shall: (a) establish all operational systems for managing environmental impacts; (b) carry out all of the monitoring and mitigation measures as per law and regulatory statutes. Requirement. (c) Contractor shall submit monthly reports on the implementation and monitoring of such measures to the Employer. (d) Contractor shall comply relevant laws.
16	Progress Reports	Contractor will provide: 1. During Design Build period contractor will submit fortnightly progress report prepared on project management software mentioning target activities, and achievement. 2. For monitoring of project, a monthly review meeting shall be conducted in office of procurement entity. Team leader of Contract shall attend all the meetings. During operation and maintenance period, all the reports generated at SCADA shall be submitted on daily basis. Contractor will maintain record of all delivered service and performance of each project components and appliance like Main pump (pressure , discharge, electricity consumption, temperature, pressure and other features), Chak level Pumps (water level in Diggies, discharge, pressure), pipe network (all motorized valves, pressure transducers, flow meters, sensors for measuring silt level in Intake well, siltation well, and sump of main pump , daily power production at solar power plant , power meters and other activities shall be reported on daily basis in routine and immediately in emergency. Contractor shall develop formats for reporting and maintenance during O&M period.
17	Contract Management	Contractor will use the suitable computer operated software MS Project / Prima viera to manage the contract.
18	Software's	As far as possible, Contractor will use open source softwares or if commercial softwares are used they should be well accepted and compatible with prevailing softwares. Contractor shall purchase software license in the name of procuring entity.
19	Operation and Maintenance Manuals	Shall prepare and submit Operation and Maintenance Manuals as per direction of Engineer in Charge.
20	Labour Laws	Insert the following at the end of the Sub-Clause: The Contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The Contractor shall base the employment relationship upon equal opportunity and fair treatment and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The Contractor shall provide equal wage and benefits to men and women for work of equal value or type. The Contractor shall not employ forced labour, which consists of any work or services, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labour, such as indentured labour, bonded labour, or similar labour-contracting arrangements.

21	Mandatory spares	Contractor shall maintain three months stock of mandatory spares at the site as suggested by original equipment manufacturer (OEM).
22	System Handing Over	Contractor will hand over the system to engineer in charge or his representative in good condition. At the time of hand over: 1. He will provide spare from OEM for 6 months operation and maintenance. 2. Perform required test for checking the system efficiency and functionality. 3. Provide list of replaceable spares, address of service center of OEM and spare parts dealer 4. Operation manual and service manual 5. All tools & tackles, vehicles, accessories, furniture's, furnishings, hardware, software etc. procured for this project are to be handed over to the Engineer in Charge 6. All bills, guarantee cards and licenses etc.

Section VI C : Contract Forms

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1. Letter of Acceptance**Letter of Acceptance*****[on letterhead paper of the Procuring Entity]***

No

Dated

To: ***[name and address of the Contractor]***Subject: ***[Notification of Award for the Works]***This is to notify you that your Bid dated . . . ***[date]*** for execution of the...... ***[name of the contract and identification number, as given in the Contract Data]***

..... for the Accepted Contract Amount of the equivalent of [. ***amount in numbers and words and name of currency***] , as corrected and modified in negotiations and in accordance with the Instructions to Bidders has been accepted by ***[designation of the Procuring Entity]*** The date of commencement and completion of the Works shall be:

.....

You are requested to furnish the Performance Security/ Performance Security Declaration within Days in the form given in the Contract Forms for the same for an amount equivalent to Rupees within.....days of notification of the award valid up to 60 days after the date of expiry of Defects Liability Period and maintenance period, if applicable, and sign the Contract, failing which action as stated in sub-section 2 of section 42 of the Rajasthan Transparency in Public Procurement Act, 2012 and Instructions to Bidders shall be taken.

Authorized Signature:

Name and Title of Signatory:

Designation:

2. Contract Agreement

Contract Agreement

THIS AGREEMENT made the day of, between the Governor of Rajasthan/ **[name of the Procuring Entity if other than a department of the State Government]** hereinafter “the Procuring Entity”) which expression shall, where the context so admits, be deemed to include his successors in office and assigns, of the one part, and **[name of the Contractor]** (hereinafter

“the Contractor”), which expression shall, where the context so admits, be deemed to include his heirs, successors, executors and administrators, of the other part:

WHEREAS the *Procuring Entity* desires that the Works known as **[name of the Contract]** should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects therein, and for which the Contractor has submitted Performance Security for Rupees in the form of

The Procuring Entity 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. This Agreement shall prevail over all other Contract documents.
 - a) the Letter of Acceptance.
 - b) the Bid of the Contractor as accepted along with the correspondence done on it, if any.
 - c) the Special Conditions of Contract/ Contract Data.
 - d) the General Conditions of Contract.
 - e) the Specifications.
 - f) the Drawings.
 - g) the Instructions to Bidders.
 - h) Notice Inviting Bids.
 - i) _____
3. In consideration of the payments to be made by the Procuring Entity to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Procuring Entity to execute the Works and to remedy defects therein (and, if applicable, maintain the Works for a period of) in conformity in all respects with the provisions of the Contract.
4. The Procuring Entity hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects

therein (and, if applicable, maintain the Works for a period of -----), 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 the Central and the State Government the day, month and year first mentioned herein before.

Signed by
Name, Designation, Date
for and on behalf of the Governor/ Procuring
Entity

Signed by
Name, Designation, Date
for and on behalf the Contractor

in the presence of

Witness 1

Witness 2

Signature, Date, Name, Address

in the presence of

Witness 1

Witness 2

Signature, Date, Name, Address

3. Performance Security**Performance Security*****[Bank's Name, and Address of Issuing Branch or Office]*****Beneficiary: *[Name and Address of Procuring Entity]*****Date:** **Performance Guarantee No.:** We have been informed that ***[name of the Contractor]***

(Hereinafter called "the Contractor") has entered into Contract No

[reference number of the Contract] dated..... with you, for theexecution of ***[name of contract and brief description of Works]*** . . .

(Hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance security is required.

At the request of the Contractor, we ***[name of the Bank]*** hereby

irrevocably undertake to pay you any sum or sums not exceeding in total an

amount of Rupees* ***[amount in figures]*** (. Rupees...... . . ***[amount in words]***.....) such sum being payable upon receipt by us of your first

demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

The Guarantor agrees to extend this guarantee for a specified period in response to the Procuring Entity's written request for such extension for that specified period, provided that such request is presented to the Guarantor before the expiry of the guarantee.

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 Authorised Signature(s)***The Guarantor shall insert an amount representing the percentage of the Contract Price specified in the Contract***

Insert the date sixty days after the expected completion date, including defect liability period and maintenance period, if any.

Notes: 1. All italicized text is for guidance on how to prepare this advance payment guarantee and shall be deleted from the final document.

- 2. The Procuring Entity should note that in the event of an extension of the time for completion of the Contract, the Procuring Entity 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.*

4. Performance Security Declaration**Form of Performance Security Declaration**Date: _____ ***[insert date (as day, month and year)]***Contract Name and No.: _____ ***[insert name and number of Contract]***To: _____ ***[insert Designation and complete address of Procuring Entity]***

We, the undersigned, declare that:

We understand that, according to your conditions, the Contract must be supported by a Performance Security Declaration as a guarantee to ensure fulfillment of our all-performance obligations under the Contract for ----- ***[insert name of subject matter of procurement.***

We accept that we will automatically be suspended from being eligible for bidding in any contract with you for the period of time of ***[Procuring Entity to indicate here the period of time for which the Procuring Entity will declare a Bidder ineligible to be awarded a Contract if the performance Security Declaration is to be executed]*** starting on the date that we receive a notification from you, the ***[Designation of the Procuring Entity]*** that our Performance

Security Declaration is executed, if we are in breach of any of our performance obligation under the conditions of the Contract,

We understand this Performance Security Declaration shall expire after 60 days of completion of our all obligations under the Contract including Defect Liability, warranty/ Guarantee, operation, maintenance, etc. in accordance with the conditions of the Contract.

Signed: _____

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

In the capacity of: _____

[insert legal capacity of person signing the Performance Security Declaration]

Name: _____

[insert complete name of person signing the Declaration]

Duly authorized to sign the Contract for and on behalf of: _____

[insert complete name and address of the Bidder]Dated on _____ day of _____, _____ ***[insert date of signing]***

Corporate Seal _____

5. Advance Payment Security**Advance Payment Security*****Bank's Name, and Address of Issuing Branch or Office*****Beneficiary:** ***[Name and Address of Procuring Entity]*****Date:****Advance Payment Guarantee No.:**

We have been informed that ***[name of the Contractor]***..... (hereinafter called "the Contractor") has entered into Contract No ***[reference number of the Contract]*** dated with you, for the execution of ***[name of contract and brief description of Works]*** (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum ***[name of the currency and amount in 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.

It is a condition for any claim and payment under this guarantee to be made that the advance payment referred to above must have been received by the Contractor on its account number ***[Contractor's account number]*** at ***[name and address of the Bank]***

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as indicated in copies of interim 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 entire amount of the advance payment has been repaid or on ***[the Intended Completion Date of the Works]***, whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

The Guarantor agrees to extend this guarantee for a specified period in response to the Procuring Entity's written request for such extension for that specified period, provided that such request is presented to the Guarantor before the expiry of the guarantee.

Seal of Bank and Authorised Signature(s)

Notes: 1. All italicized text is for guidance on how to prepare this advance payment guarantee and shall be deleted from the final document.

2. The Procuring Entity should note that in the event of an extension of the time for completion of the Contract, the Procuring Entity 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.

SECTION VII: PRICE BID SCHEDULE

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INSTRUCTIONS

1. The Bill of Quantities (BOQ) shall be read in conjunction with the Conditions of Contract (General and Special), Technical Specifications (including BIS and IRC), design 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 by the Contractor and as measured and verified by the Engineer-in-charge and valued at the rates and prices tendered in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer-in-charge may fix within the terms of the Contract.
3. The rates and prices tendered in the priced Bill of Quantities shall, except in so far as it is otherwise provided under the Contract, include all constructional plant, labour, supervision, materials, machinery & equipment, T&P, quality assurance, erection, defect liability, maintenance (if included in the Contract), insurance, profit, taxes and duties, together with all general risks, liabilities and obligations set out or implied in the Contract.
4. The rates and prices shall be quoted in the units indicated and entirely in Indian Rupees.
5. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the priced Bill of Quantities, including miscellaneous items involved in the concerned item, and items not mentioned in the BOQ but required to be executed will be considered as variation items.
6. General directions and descriptions of works and materials are not necessarily repeated or summarized in the Bill of Quantities. References to the relevant sections of the contract documentation shall be made before entering rates or prices against each item in the Bill of Quantities. The execution of various items shall be in full conformance to the relevant specifications and codes, drawings and designs as confirmed through sampling and testing and the third-party quality inspection as per ISO 17020.
7. The method of measurement of completed work for payment shall be in accordance with IS 1200.
8. Against the eligible price breakup for activities / sub activities of schedule-1, as per quoted rates, payment shall be released as per payment breakup schedule given in bid document. The Price Breakup shall be subject to the recoveries on account of interim compensation / delay damages imposed on the contractor in accordance sub clause of general condition of the contract Part-Ist.
9. Above break up is indicative only, contractor need to perform detailed analysis for each activity regarding design, procurement, construction, testing, operation and commissioning, training etc for all civil, electrical, mechanical and instrumentation work of the project. Detailed breakup of the each schedules, need to be analyzed by the contractor during design stage of project. Detailed quantities which is Outcome of above project components should be based on design of each subcomponent covered in schedules 1 to 9. As per design outcome contractor may include / delete any

new activity in any schedule . After acceptance of financial bid, the cost of each schedule and price bid shall be freezed.

10. The design / drawing approved from competent authority may be revised, if due to field conditions felt necessary in favor of work.
11. After approval of the tender if any new activity /items are required to be included, the payment for that item shall not be done additionally. Contractor is required to develop all the required design, estimation, cost break up to analyse the proposed activities under the work.

PRICE BID GENERAL ABSTRACT

This Price comprise Three parts

- (1) Cost for planning, design- build of all civil, electromechanical and instrumentation work for all project components
- (2) Cost for operation and maintenance excluding power cost during O&M of 8 years
- (3) Cost for power as quoted by contractor for maximum power requirement during O&M

S.No	Description of work	Cost in INR	
		In Figure	In words
	Part –I		
1	Design Build cost of all Project Components (Sum of amount calculated in Schedule 1 to 6)		
2	Annual Operation and Maintenances Cost for 8 years for whole system as Calculated in Schedule 7		
3	Evaluated Power cost for 8 years for running of Main Pumping stations, Pumps House -1 (As Calculated in Schedule 8)		
	Total Cost of Bid		

PRICE BID ABSTRACT			
This Price comprise four parts			
(1) Cost for planning, design- build of all civil, electro mechanical and instrumentation work for all project components			
(2) Cost for operation and maintenance excluding power cost during O&M of 8 years			
(3) Cost for power as quoted by contractor for maximum power requirement during O&M			
PRICE BID SCHEDULES			
S.No	Description of work	Cost in Indian Rupees	
	Part –I	In words	In Figure
Schedule 1	Survey, Investigation, Planning, Design, Drawing and Estimations		
Schedule 2	Civil Works of Head works (Intake well, MS pipeline, Pump house) Pump house No.1, HDPE pipeline general civil works, work for equipment installation, finishing, clean up and restoration for the following Work.		
Schedule 3	Mechanical, Electrical and Instrumentation Works for Head works (Intake well, MS pipeline, Pump house), Pump House No.1, HDPE pipeline, for the whole system.		
Schedule 4	Automation PLC-SCADA for monitoring and control of complete system		
Schedule 5	Schedule 5.1: Peripheral Activities		
Schedule 6	Schedule 5.2: Construction of Residential and Non-Residential Building Works		
	Total of Part I =		
Part -II			
Schedule 7	Schedule 7: Price schedule for operation and maintenance		
Schedule 8	Schedule 8: Break up of price schedule for operation & maintenance		
Schedule 9	Schedule 9: Power loading schedule		
	Total Part II=		
	Grand Total Part I & II =		

Schedule- 1

Schedule 1: Survey, Investigation, Planning, Design, Drawing and Estimations

S.No	Description of work	Rate quoted by the bidder			
		Unit	Rate	Qty.	Amount
A.	Topographic survey				
1	Conduction topographic survey (if required to be done) with DGPS/ Total station to verify, rectify and filling the data gap on Contoured Cadastral map provided by the department and to carry survey if any required for planning of pressurized piped network and fixing of Benchmarks in the field. Preparation of contour map, Complete plan L- section and X section of Scheme				
a.	For Intake Well with pumping station				
b.	Another pumping Station, retention tank				
c.	Mains, MS/HDPE Pipelines, outlet and other accessories.	km			
	Sub Total (A)				
B.	To carry all necessary investigations required for design, installation and construction of all civil, electrical and Mechanical structures of project components.				
a.	Soil Investigations for				
i.	Bearing capacity both pump house, retention tank	Per Job			
ii.	Soil resistivity	Per Job			
b.	Other investigation and testing of civil construction material, etc. (all test as per IS specification)				
c.	Other investigation and testing of electrical and mechanical equipments. (all test as per IS specification)				
	Sub Total (B)				

Schedule 1: Survey, Investigation, Planning, Design, Drawing and Estimations					
S.No	Description of work	Rate quoted by the bidder			
		Unit	Rate	Qty.	Amount
C.	Civil , hydraulic, structural design of :				
a.	Designing of pressure piped network, MS/HDPE pipes including all accessories on any standard software including details of all aspects of Civil, hydraulic design for safe& smooth operation/ monitoring and control of the system.				
b.	Civil, hydraulic, structural Designs of Intake structure, pipeline, Pump house and Pump House -1, Buildings other structures including preparation of working drawings.				
c.	Design, drawing of Electrical system including panels, transmission lines, transformers, and other related accessories for complete system Power transmission from 220 KV GSS.				
	Sub Total (C)				
D.	Design, drawing of Mechanical, Electrical and Instrumentation of				
a.	Design and drawing of Mechanical and Electrical Machines of Intake structure, pumping station, and Pump House-1				
b.	Design, drawing of PLC-SCADA of complete system up to pump Houses at outlet point and integration with web and android based monitoring through SCADA.				
c.	Preparation and submission of technical specification of all types of mechanical and electrical equipment's				
	Sub Total (D)				

Schedule 1: Survey, Investigation, Planning, Design, Drawing and Estimations					
S.No	Description of work	Rate quoted by the bidder			
		Unit	Rate	Qty.	Amount
E.	Other studies / documents preparation				
a.	Conduction of Environmental Impact Assessment (EIA) and Environmental Management plan (EMP) and getting it approved from appropriate authority as per environmental protection act.				
b.	Preparation of operation Manual				
c.	Training Manual for Engineers / WUA members / Farmers				
	Sub Total (F)				
G.	Establishment of QC laboratory				
	Sub Total (G)				
	Grand Total (A-G)				

Schedule 2: Civil Works

Schedule 2 : Civil Works of Head works (Intake well with pump house, MS/HDPE pipeline, another Pump house, Pump House -1), General civil works, work for equipment installation, finishing, clean up and restoration for the following Works:

SN	Particulars of items	Unit Rate, quantities and amount quoted by the bidder			
		Unit	Rate	Qty.	Amount
A	Headworks				
1	Construction of Intake structure with necessary protection works, fixing removable motorized dual gate arrangement, installing trash rack, SS screens etc arrangement for retention of unwanted floating material and Sludge removal arrangements				
2	Construction of Sump well cum RCC Pump House for installation of pump, motors, control panels, suction-delivery pipes, manifold, ducting, operation platforms for valves and/or allied equipment etc. including foundation treatment and all required works.				
3	Construction RCC structure for control room, duty room, Battery room, office area, store area, staff room and PLC control room etc.				
4	Construction of outdoor partly covered RCC framed structure for switchyard including foundation, substation building for indoor switchboard, transformer foundations, gantry structure, cable trenches, access road and other civil works required for electrical installations.				
5	Civil works required for cabling system from Switch yard to pump house and control room and inside the pump house, control room.				
6	Civil Works for Pump House No-1 including Detention Tank and all allied work				
	Sub Total (A)				

Schedule 2: Civil Works

Schedule 2: Civil Works of Head works (Intake well, MS/HDPE pipeline, Pump house, Pump House -1), General civil works, work for equipment installation, finishing, clean up and restoration for the following Works:

SN	Particulars of items	Unit Rate, Quantities and amount quoted by the bidder			
		Unit	Rate	Qty.	Amount
B	MS/HDPE Pipeline				
1	Excavation work and back filling in trenches (all leads and lift) and preparation of bedding as per CPHEE manual and IS specifications for laying and jointing of MS/HDPE Pipeline for all depth including stacking of the excavated material at suitable location and disposal (all leads and lift) of surplus material. This will also include barricading on locations as required. all type of strata.				
2	Supplying, laying, jointing, testing MS/HDPE water pumping mains including, but not limited to, general civil works, all equipment's like valves, measuring devices etc. installation, finishing, clean up and restoration for the following Works:				
3	RCC work including steel, curing, compaction etc. complete in grade M20 for construction of thrust blocks and encasing of pipe etc. including required formwork/shuttering.				
4	Providing and laying cement concrete in RCC work complete in grade M20 for construction of portal frame/ pedestals, saddles, exit channel at scour valves etc. including required formwork/shuttering and scaffolding.				
5	Providing, lowering, laying, aligning, fixing in position at all level/ depths MS/HDPE pipe of various diameter as per design including all specials and fittings complete as per Technical Specifications and as per direction of Engineer.				
6	Construction of scour valve chambers (dry & wet type), isolation valve chamber, air valve chamber, chamber and room for installation of flow meter as per approved design and drawing complete including installation scour valve and accessories				
7	Civil work for providing, erecting and commissioning of complete surge protection system.				
8	Cutting of trench bottom in soil and/or compacted bedding to follow the curvature of outer pipe dia to support the HDPE pipe				
9	Civil work for Fixing of all types of valves, joints, flow meter and other necessary devices as per design and specifications				

Schedule 2: Civil Works

Schedule 2: Civil Works of Head works (Intake well, MS/HDPE pipeline, Pump house, Pump House -1), General civil works, work for equipment installation, finishing, clean up and restoration for the following Works:

SN	Particulars of items	Unit Rate, quantities and amount quoted by the bidder			
		Unit	Rate	Qty.	Amount
	Note above break up is to be prepared for each dia Pipe.				
B1	Subtotal MS pipe network Mains / Sub-mains for 2500 mm Dia of MS PIPE				
(a)	Rate per KM				
B2	Subtotal HDPE pipe network Mains / Sub-mains for 2500 mm Dia PE 100 Grade and PN 8 Pressure Rating of HDPE PIPE				
(a)	Rate per KM				
B3	Subtotal HDPE pipe network Mains / Sub-mains for 2500 mm Dia PE 100 Grade and PN6 Pressure Rating of HDPE PIPE				
(a)	Rate per KM				
B4	Subtotal HDPE pipe network Mains / Sub-mains for 2500 mm Dia PE 100 Grade and PN4 Pressure Rating of HDPE PIPE				
(a)	Rate per KM				
B5	Subtotal HDPE pipe network Mains / Sub-mains for 1600 mm Dia PE 100 Grade and PN10 Pressure Rating of HDPE PIPE				
(a)	Rate per KM				
B6	Subtotal HDPE pipe network Mains / Sub-mains for 1600 mm Dia PE 100 Grade and PN8 Pressure Rating of HDPE PIPE				
(a)	Rate per KM				
B7	Subtotal HDPE pipe network Mains / Sub-mains for 1600 mm Dia PE 100 Grade and PN6 Pressure Rating of HDPE PIPE				
(a)	Rate per KM				
B8	Subtotal HDPE pipe network Mains / Sub-mains for 1600 mm Dia PE 100 Grade and PN3 Pressure Rating of HDPE PIPE				
(a)	Rate per KM				
	Sub Total (B)				

Schedule 2: Civil Works					
Schedule 2: Civil Works of Head works (Intake well, MS/HDPE pipeline, Pump house, Pump House -1), General civil works, work for equipment installation, finishing, clean up and restoration for the following Works:					
SN	Particulars of items	Unit Rate, quantities and amount quoted by the bidder			
		Unit	Rate	Qty.	Amount
C	Service Roads, Allied Structures, temporary office, QC lab building and Ancillary Civil Works				
1	Complete Civil Works including, but not limited to, general civil works, equipment installation, finishing, cleanup and restoration for the following Works:				
2	Construction of BT approach road from Madanpur village to both Pump house 3.75 M Wide				
3	Construction of 3.75m CC internal road within project area connecting pump house to residential and non-residential buildings and other project units.				
4	Construction of 3.75 M BT service road within project area connecting valve chambers to nearest public road.				
5	Temporary office building, QC lab etc.				
	Sub Total (C)				
D	Any other items required for proper and efficient construction and execution of the system				
	Grand Total (A-D)				

Schedule 3

Schedule 3: Mechanical, Electrical and Instrumentation Works for Head works (Intake well, MS pipeline, Pump house), Pump House No.1, HDPE pipeline, for the whole system.

S.No.	Particulars	Unit Rate, quantity and amount quoted by			
		Unit	Rate	Qty.	Amount
Item No	Mechanical, Electrical and instrumentation work for the following units				
A	Intake well, trenchless work, siltation well				
1	Supply, Installation, testing, commissioning and Other Services of Mechanical Electrical, instrumentation work of Intake structure with necessary, fixing removable motorized dual gate arrangement, installing trash rack, SS screens etc arrangement for retention of unwanted floating material and . and Sludge removal arrangements, level sensors and other instruments.				
2	Supply, Installation, testing, commissioning and Other Services of Mechanical Electrical, instrumentation work				
3	Cabling system, and all other appliances from Switch yard to pump house and control room and inside the pump house, control room etc.				
	Sub Total (A)				
B	Pump House and Pump House-1				
B(1)	Providing, installation, testing and commissioning of Mechanical Equipment Including, but not limited to, supply, erection installation, testing commissioning, installation, testing and commissioning required to complete the Works in all respects for the following equipment:				
1	Vertical turbine pump with all accessories				
2	Dewatering and sludge removal pump pump with flexible piping, exhaust fans with accessories, fire extinguishers, air conditioning for main Control Room				

the item shown in price bid schedule is indicate **pordder may** add/delete items above as per their requirement of above

S.No.	Particulars	Unit Rate, quantity and amount quoted by			
		Unit	Rate	Qty.	Amount
3	Lubricating water pumps, pressure filters and associated instruments with all accessories such as piping, bends, tees etc				
4	EOT crane with Design Capacity				
5	Delivery pipes and specials from pump to pumping manifold				
6	PN 1.0/1.6 Butterfly valves at delivery piping of pumps				
7	PN 1.0/1.6 Dual Plate Check Valves at delivery piping of pumps				
8	Dismantling Joints in delivery pipes				
9	PN 1.0 Butterfly valves at delivery manifold of pumps				
10	PN 1.0 Butterfly valve at delivery manifold of pumps for isolation of normal and preclosure pumps				
11	Dismantling Joints in delivery manifold piping with Butterfly valves of 1200mm				
12	PN 1.0 Kinetic Air Valves (As per required size) at delivery piping of pumps				
13	Delivery manifold pipes, specials, tamper proof air valve etc. from pump house upto junction with raw water transmission main.				
14	Electric Actuators for all Butterfly valves in the Headworks				
	Sub Total (B1)				
B(2)	Installation of Electrical Equipment including, but not limited to, safe storage, protection, civil works, erection, installation, testing and commissioning required to complete the Works in all respects for the following equipment:				
1	33/6.6 KV Outdoor Sub-Station				
2	Energy efficient motors for vertical turbine pumps with all accessories				
3	Indoor switchboard as per approved single line diagram				

S.No.	Particulars	Unit Rate, quantity and amount quoted by			
		Unit	Rate	Qty.	Amount
4	33 KV HT switchgear housing two incomers, VCBs, relays, metering system, CT, PT, Bus Bar, Bus Couplers etc. with requisite number of outgoing cubicles as per requirement.				
5	6.6 KV HT switchgear housing two incomers, VCBs, relays, metering system, CT, PT, Bus Bar, Bus Couplers etc. with requisite number of outgoing cubicles to have Motor control units with soft starters for all HT motors for main pumps				
6	0.415 KV LT Panels for Electric Actuators, Hoist, Exhaust fans, Main lighting distribution panel, outside lighting distribution panel, welding socket and spare cubicles etc. as per given scope of work and specifications including switchgear for DG system				
7	Capacitor banks for the installed motors in the pump house				
8	APFC panel for the installed motors in the pump house				
9	Local push button station for pump motors, actuators, Hoist as per given specifications for motors				
10	110V DC system with batteries, battery charger, DC DB in panel to operate spring charging motors and LED supply on LT panel.				
11	Incoming cables from transformers within Headworks to the switchgear				
12	HT cable with cable trays and accessories for motors & all electrical equipment's to be provided in Headworks as per given scope of work and specifications				
13	LT cable with cable trays and accessories for all electrical equipment's other than HT Motors to be provided in Headworks as per given scope of work and specifications				

S.No.	Particulars	Unit Rate, quantity and amount quoted by			
		Unit	Rate	Qty.	Amount
14	Providing control cables within the pump houses and head works				
15	Exhaust Fans, wall mounted and pedestal type air circulators and other ventilating arrangements like roof extractors etc for both the bottom and top floors of Pump House				
16	Earthing system for HV and LV systems and motors installed in the contract in the Head works				
17	Diesel generation set of 7.5 KVA capacity including all associated accessories for lighting load				
18	Complete lighting system including energy efficient lighting fixtures, lighting poles, wires, conduits, cables and necessary accessories - indoor				
19	Complete lighting system including energy efficient lighting fixtures, lighting poles, wires, conduits, cables and necessary accessories - outdoor				
20	Complete earthing / lightning protection system including earth electrode, earth strip, wires, junction box for test links, treated and non-treated earth pits, etc. with necessary accessories				
21	Air conditioning of control room				
	Sub Total (B2)				
1	Installation of Instrumentation and Control Equipment including, but not limited to, safe storage, protection, civil works, erection, installation, testing and commissioning required to complete the Works in all respects for the following equipment:				

S.No.	Particulars	Unit Rate, quantity and amount quoted by			
		Unit	Rate	Qty.	Amount
2	Instrument control panel comprising Programmable Logic Controller (PLC) along with preferably open source (or licensed software), alarm enunciator, selector switches etc				
3	24 VDC battery and battery charger system for control system				
4	Lap top computer for programming the PLC System common for RWPS, WTP and CWPS				
5	PC based local SCADA system comprising of adequate hardware, software, color monitor, laser printer, ink jet printer, UPS. (All required/specified licensed software packages to be preloaded, along with CDs of the same)				
6	Radar type level measurement system for intake sump ,level switch for intake sump ,temperature scanners for pump/ motor units (pressure measurement system for pumping main pressure gauges on discharge of pumps pressure switch on pumping main (1 No.), Pressure Transmeter, Instrumentation and control cables along with cable glands and lugs, cable trays/ conduits, etc. and all the installation hardware				
7	Electromagnetic full bore flow meter on the pumping mains.				
8	4 - path ultrasonic flow meter with wet insertion probes on the pumping mains.				
9	Miscellaneous items				
	Sub Total (B3)				
	Sub Total (B)				

S.No.	Particulars	Unit Rate, quantity and amount quoted by			
		Unit	Rate	Qty.	Amount
C	<u>DI pipe network Mains / Sub-mains</u>				
C (1)	Providing, installation, testing and commissioning of Mechanical, Electrical and instrumentation Equipment related to water pumping mains including, but not limited to, general, equipment installation, finishing, clean up and restoration for the following Works:				
i	Sluice valves, butterfly valves on delivery piping along with extension spindle and electric actuators, Dual plate type check valves, installation of flow meter, Metallic bellows, scour valve and accessories kinetic air valves with isolating sluice valves as per specifications.(contractor has to find exact size and length during complete design of pipe network and command area planning)				
ii	Electrical and Mechanical Accessories for Waterhammer protection in Pipe lines.				
iii	Providing, erecting and commissioning of complete surge protection system and dismantling joint/ bellow per specifications and as approved for pipeline including all, electrical, mechanical and instrumentation works.				
iv	All types of Electrical instrumentation for monitoring and control of flow hydraulics in MS/HDPE pipenetwork				
	Subtotal MS pipe network Mains / Sub-mains for Dia of MS PIPE				
1	Rate per KM				
C(2)	Subtotal MS pipe network Mains / Sub-mains for Dia of MS PIPE				
1	Rate per KM				
C(3)	Subtotal MS/HDPE pipe network Mains / Sub-mains for Dia of MS/HDPE PIPE				
1	Rate per KM				
C(4)	Subtotal M S / H D P E pipe network Mains / Sub-mains for Dia of MS/HDPE PIPE				
1	Rate per KM				
C(5)					
1					
C(6)					
1					
C(7)	Subtotal DI pipe network Mains / Sub-mains				
1					
C (8)	Mains / Sub-mains for				

S.No.	Particulars	Unit Rate, quantity and amount quoted by			
		Unit	Rate	Qty.	Amount
1	Rate per KM				
1	Delivery pipes to pump including all valves (Sluice valve, Non return valve, Pressure relief valve) Pressure guage, Digital type flow meter with required pipes and specials and accessories fittings such as flanges, bends, tees, reducers, enlargers, tail piece, blind flanges, dismantling piece, nut & bolts, gaskets and any other items required to pass the required discharge etc. upto the interconnection to the rising mains of the respective section as per scope of work and specifications and structural support for pump and header.				
2	Electric Control Panel of 16 SWG (CRCA) thick powdered coated suitable for floor mounting of the respective section, fully automatic starter, Delta Starter with Auto switch single phase preventor, MCCB, MCB, VM, AM & indicators, copper bus bar, timer & relay, auto & manual switch, flow sensor, switch, capacitor, suitable copper wiring and any other item required and as per scope of work and specification.				
3	LT (Aluminum PVC insulated PVC sheathed armoured cable with aluminum conductor 3 core x 10 sq mm) cables to provide pump houses as per given scope of work and specifications from Electric Panel to motors.				
4	LT (Aluminum PVC insulated PVC sheathed armoured cable with aluminum conductor 3.5 core x 25 sq mm) cables as per given scope of work and specifications from Transformer to Electric Panel.				
5	Earthing two pits including materials, to be installed as per given scope of work and specifications.				
6	Providing & installation of hydro cyclone filter, the capacity of filter selected not be less than the system flow to be provided as per given scope of work & specifications.				
7	Exhaust fans for electrical rooms				

S.No.	Particulars	Unit Rate, quantity and amount quoted by			
		Unit	Rate	Qty.	Amount
8	Energy efficient motors with all accessories for pumps				
9	Complete cabling system with HV & MV cables, cable trays, route marker, steel structure for cable trench, MS pipes and accessories				
10	Complete cabling system with LV cables, cable trays, route marker, steel structure for cable trench, MS pipes and accessories				
11	Installation of Instrumentation and Control Equipment including, but not limited to, safe storage, protection, Erection, installation, testing and commissioning required to complete the Works in all respects for the following equipment:				
12	Instrument control panel comprising Programmable Logic Controller (PLC) system along with software and panel mounted instruments.				
13	24 VDC battery and battery charger for control system				
14	Full bore electromagnetic flow meters -				
15	HEM work for each Chak Pumping rooms and Diggies				
16	Testing Equipment's for quality control laboratory				
	Sub Total (C)				
D	Any other items required for proper and efficient construction, execution and functioning of the system				
	Grand Total (A-D)				

Schedule 4: Automation PLC-SCADA for monitoring and control of complete system					
S.No.	Particulars	Rate quoted by the bidder			
		Unit	Rate	Qty.	Amount
1	Designing the PLC-SCADA system for centralized monitoring and operation this complete scheme from intake pump house to another pump room and both outlet point				
. 2	Supply of PLC-SCADA instrumentation and accessories				
3	Installation, of PLC-SCADA system for Main Pumping station, Pipe network of MS/HDPE Pipeline				
4	Testing and calibration of PLC-SCADA system for individual system like Main Pumping stations, Pipe network, off line and on web based online				
5	Testing and calibration of PLC-SCADA system for integrated system like Main Pumping station, Pipe network.				
	Total =				

Schedule 5: PERIFERIAL ACTIVITIES					
S.No.	Particulars	Unit Rate, Quantity and amount quoted by the bidder			
		Unit	Rate	Qty.	Amount in Rs
A	Peripheral Development works				
1	Development of Peripheral works under this Scheme				
	i. Full development of both Pump house Campus and other three campus as per scope of work				
	ii. Construction of boundary wall, fencing and security system .				
	iii. Landscaping and plantation work in				
	iv. Procurement of Vehicle for inspection				
	a) 3 no's Sidan Cars (1200 CC)				
	b) 1 no Innova car or equivalent				
	c) 5 Nos Bolero Jeep				
	d) Cost of providing 9 no's drivers during entire build design and O&M period				
B	Any other items required for proper and efficient construction, execution and functioning of the system				
	Total				

Schedule 6: Construction of Residential and Non-Residential Building Works					
S.No.	Particulars	Rate quoted by the bidder			
		Unit	Rate	Qty.	Amount
A.	Construction of Residential and Non-Residential buildings in plinth area of 6443 Sqm. as per specification and design				
	Cost of civil Work.				
	Cost of water supply & sanitary Work				
	Cost of electrical Work				
B.	Cost of Furnishing Work				
	Cost of Furnishing of office buildings or equivalent				
	Cost of Furnishing of rest house buildings				
	Total				

Schedule 7: Price schedule for operation and maintenance				
S.No	Item	Amount to be quoted by the bidder in Rs		
		In Figures		in words
	Cost of O&M to be taken from Sub Schedule 8.1, excluding power Charges for 1st year of O&M starting after commissioning of the complete project			
	Year after completion of project	Escalation Factor @ 7 % per Annum	Discount Factor @ 10.0 % per Annum	Evaluated Annual O&M cost = Annual O&M cost quoted x Col 3 x Col 4
1	2	3	4	5
1	I st Year	1.18	0.79	
2	II nd Year	1.27	0.72	
3	III rd Year	1.36	0.65	
4	IV th Year	1.45	0.59	
5	V th Year	1.55	0.54	
6	VI th Year	1.66	0.49	
7	VII th Year	1.78	0.44	
8	VIII th Year	1.90	0.40	
	Total Evaluated O&M cost =			

1. Contractor shall fill the rate for 1ST Year only and factor of 7% shall be applied to increase the cost of O&M for each subsequent year. Overall cost of 8 years O&M shall be 6.80 X O&M Cost of 1ST year quoted by contractor.

Schedule 8: Break up of Price schedule for operation and maintenance					
S.No	Name the post / Material required for O&M	No of Staff / qty. of material	No of Man Days in a year	Rate / day including all perks and facilities	Amount
1	2	3	4	5	6
1	Engineering Staff (Mention Different Type required)				
(i)	to be filled by bidder				
(ii)	 Do				
(iii)	 Do				
(iv)	 Do				
2	Supervisory Staff (Mention Different Type required)				
(i)	to be filled by bidder				
(ii)	 Do				
(iii)	 Do				
(iv)	 Do				
3	Skilled / Semi- Skilled Labour (Mention Different Type required)				
(i)	to be filled by bidder				
(ii)	 Do				
3	Labour				
(i)	to be filled by bidder				
(ii)	 Do				
4	Materials required for O & M (Mention Types of material required)				
(i)	to be filled by bidder				
(ii)	 Do				
(iii)	 Do				
(iv)	 Do				
	Any other item cost for O&M				
	Total Annual O&M cost =				

1. Contractor shall fill the rate only for one Year and factor of 7% shall be applied to increase the cost of O&M for each subsequent year.

Schedule 9: Power loading schedule								
S.No	Year after completion of project	Maximum Guaranteed Power Requirement in Kwh/day			Annual cost of power in Rs = Col 4 X 92 X 7 . 5	Escalation Factor @ 7 %per Annum	Discount Factor @ 5 10.0 % Per Annum	Evaluated Power cost = Col 5 x Col 6 x Col 7
		Intake Cum Pumping Station	Pump House No-1	total Guaranteed Power Requirement in Kwh/ day				
	1	2	3	4	5	6	7	8
1	I st Year					1.18	0.79	
2	II nd Year					1.27	0.72	
3	III rd Year					1.36	0.65	
4	IV th Year					1.45	0.59	
5	V th Year					1.55	0.54	
6	VI th Year					1.66	0.49	
7	VII th Year					1.78	0.44	
8	VIII th Year					1.90	0.40	
					Total Evaluated Power cost =			
1. Bidder will quote maximum daily power requirement for main pumping station and pumping station 1. Contractor shall fill daily power requirement for all years Power requirement shall be calculated for 92 days. For calculating the power cost escalation factor of 7% and discount factor 10% shall be applied to calculate the cost of O&M for each subsequent year. Power consumption for subsequent years shall not be less than previous year. 2. Cost of power consumption for main pump and balancing reservoir beyond the maximum guaranteed power quoted by the bidders, shall be deducted from bidders @ 1.5 times the prevailing power charges of DISCOM for the eligible tariff category. 3. All the power charges within the limits of annual power consumption quoted by bidder shall be borne by the employer and shall be reimbursed on monthly basis.								

PAYMENT SCHEDULE

SCHEDULE-VIII

Payment Schedule : Survey, Investigation, Planning, Design, Drawing and Estimations
Performa :1

S.No	Description of work	% of payment allowed			Remarks		
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	StageI	Stage II	Stage III
A.	Topographic survey						
1	Conduction topographic survey (if required to be done) with DGPS/ Total station to verify, rectify and filling the data gap on Contoured Cadastral map provided by the department and to carry survey if any required for planning of pressurized piped network and fixing of Benchmarks in the field. Preparation of contour map, Complete plan of command, L- section and X section of main / sub mains.	60%	40%		Submission of Deptt.	Approval	
a.	For Intake Works, Main pumping Station	60%	40%		Submission of Deptt.	Approval	
b.	Pumping Station No.1	60%	40%		Submission of Deptt.	Approval	
c.	Mains Pipelines, sub main, and other accessories.	60%	40%		Submission of Deptt.	Approval	
	Sub Total (A)						
B.	To carry all necessary investigations required for design, installation and construction of all civil, electrical and Mechanical structures of project components and planning						

S. No	Description of work	% Of payment allowed			Remarks		
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	StageI	Stage II	Stage III
a.	Soil Investigations for	60%	40%		Submission of Deptt.	Approval	
i.	Bearing capacity (main pump house)	60%	40%		Submission of Deptt.	Approval	
ii.	Soil resistivity	60%	40%		Submission of Deptt.	Approval	
b.	Other investigation and testing of civil construction material, etc. (all test as per IS specification)	60%	40%		Submission of Deptt.	Approval	
c.	Other investigation and testing of electrical and mechanical equipments. (All test as per IS specification)	60%	40%		Submission of Deptt.	Approval	
	Sub Total (B)						
C.	Civil, hydraulic, structural design of:						
a.	Designing of pressure piped network including water hammer design of Mains / Sub mains, MS and HDPE pipes including all accessories on any standard software including details of all aspects of Civil, hydraulic design for safe & smooth operation/ monitoring and control of the system.	50%	25%	25%	Submission of Deptt.	Approval	

S. No	Description of work	% Of payment allowed			Remarks		
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	Stage I	Stage II	Stage III
b.	Civil, hydraulic, structural Designs of Intake structure, Siltation well, pipeline, Pump houses, Buildings other structures including preparation of working drawings.	50%	25%	25%	Submission of Deptt.	Approval	C E
c.	Design, drawing of Electrical system including panels, transmission lines, transformers and other related accessories for complete system Power transmission from 220 kv GSS.	50%	25%	25%	Submission of Deptt.	Approval	
	Sub Total (C)						
D.	Design, drawing of Mechanical, Electrical and Instrumentation of	50%	25%	25%	Submission of Deptt.	Approval	commissioning
a.	Design and drawing of Mechanical and Electrical Machines of Intake structure, siltation main pumping station, and pump House No.1	50%	25%	25%	Submission of Deptt.	Approval	
b.	Design, drawing of PLC-SCADA of complete system up to pump room and outlet point and integration with web and android based monitering through SCADA.	50%	25%	25%	Submission of Deptt.	Approval	
c.	Preparation and submission of technical specification of all types of mechanical and electrical equipment's	50%	50%		Submission of Deptt.	Approval	
	Sub Total (D)						
E.	Estimation and preparation of BOQ						
a.	for all Civil,	50%	50%		Submission of Deptt.	Approval	

S.No	Description of work	% of payment allowed			Remarks		
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	StageI	Stage II	Stage III
b.	electrical and Mechanical works	50%	50%		Submission of Deptt.	Approval	
	Sub Total (E)						
F.	Other studies / documents preparation						
a.	Preparation of operation Manual	50%	50%		Submission of Deptt.	Approval	
b.	Training Manual for Engineers	50%	50%		Submission of Deptt.	Approval	
c.	Development of Geospatial Model for Project.	50%	50%		Submission of Deptt.	Approval	
	Sub Total (F)						
G.	Preparation of QC&QA manual	50%	50%				
I.	Establishment of QC laboratory	50%	50%		On establishment	Approval	
H.	Miscellaneous items	50%	50%		Submission of Deptt.	Approval	
	Sub Total (I-H)						
G	Any other items required for proper and efficient construction and execution of the system						
	Grand Total (A-H)						

Payment schedule for Civil Works Performa :2					
Civil Works of Head works (Intake well, Pump house),MS/HDPE pipe network for mains, sub main general civil works, work for equipment installation, finishing, clean up and restoration for the following Works:					
		% Of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
A	Headworks				
1	Construction of Intake structure with necessary protection works, fixing removable motorized dual gate arrangement, installing trash rack, SS screens etc arrangement for retention of unwanted floating material and Sludge removal arrangements	100%	0%	0%	1. Stage I is Completion of civil work 2. stage II is commissioning of project
2	Construction of siltation well with proper silt / sludge and grit removal arrangements	70%	30%		1. Stage I is Completion of civil work 2. stage II is commissioning of project

		% Of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
3	Construction of Sump well cum RCC Pump House for installation of pump, motors, control panels, suction-delivery pipes, manifold, ducting, operation platforms for valves and/or allied equipment etc. including foundation treatment and all required works .	30%	30%	40%	1. Stage I is excavation of foundation and casting of raft fundation 2. Stage II is casting of roof 3. Stage III is finishing in all respect
4	Construction RCC structure for Pump House No.1 control room, duty room, Battery room, office area, store area, staff room and PLC control room etc.	30%	30%	40%	1. Stage I is excavation of foundation and casting of raft fundation 2. Stage II is casting of roof 3. Stage III is finishing in all respect
5	Construction of outdoor partly covered RCC framed structure for switchyard including foundation, substation building for indoor switchboard, transformer foundations, gantry structure, cable trenches, access road and other civil works required for electrical installations.	30%	30%	40%	1. Stage I is excavation of foundation and casting of raft fundation 2. Stage II is casting of roof 3. Stage III is finishing in all respect
6	Civil works required for cabling system from Switch yard to pump house and control room and inside the pump house, control room.	70%	30%		1.Stage I is Completion of civil work 2.stage II is commissioning of project
	Sub Total (A)				
B	MS/HDPE pipe network Mains / Sub-mains including Supplying, laying , testing, commissioning of network.:				

		% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
1	Excavation work and back filling in trenches (all leads and lift) and preparation of bedding as per CPHEE manual and IS specifications for laying and jointing of MS/HDPE Pipeline for all depth including stacking of the excavated material at suitable location and disposal (all leads and lift) of surplus material. This will also include barricading on locations as required. all type of strata.				
2	Supplying , laying, jointing, testing MS/HDPE water pumping mains including, but not limited to, general civil works, all equipments like valves, measuring devices etc installation, finishing, clean up and restoration for the following Works:				
3	RCC work including steel, curing, compaction etc. complete in grade M20 for construction of thrust blocks and encasing of pipe etc including required formwork/shuttering.				
4	Providing and laying cement concrete in RCC work complete in grade M20 for construction of portal frame/ pedestals, saddles, exit channel at scour valves etc including required formwork/shuttering and scaffolding.				

		% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
5	Construction of scour valve chambers (dry & wet type), isolation valve chamber, air valve chamber, chamber and room for installation of flow meter as per approved design and drawing complete including installation of 400 scour valve and accessories				
6	Civil work for providing, erecting and commissioning of complete surge protection system.				
	Note above break up is to be prepared for each dia Pipe.				
B1	Subtotal MS pipe network Mains / Sub-mains for..... Dia of MS PIPE				
(a)	Rate per KM	60%	20%	20%	1. Stage I is Supply of pipe 2. Stage II Excavation, laying, jointing of pipe network 3. Stage III iTesting , commissioning and refilling of earth
B2	Subtotal MS pipe network Mains / Sub-mains for..... Dia of MS PIPE				

		% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
B3	Subtotal HDPE pipe network Mains / Sub-mains for..... Dia of HDPE PIPE				
(a)	Rate per KM	60%	20%	20%	1. Stage I is Supply of pipe 2. Stage II Excavation, laying, jointing of pipe network, Testing 3. Stage III, commissioning and refilling of earth
	Sub Total (B)				

		% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIRD Stage payment	
1	Civil Works and Installation Services including, but not limited to, general civil works, finishing, cleanup and restoration for installation water transmission Line and related appurtenances as follow:				
2	Cutting of trench bottom in soil and/or compacted bedding to follow the curvature of outer pipe dia to support the HDPE pipe as per design				
3	Providing, lowering, laying, aligning, fixing in position at and jointing at all level/ depths ISI marked HDPE pipes of per as per specifications; beyond chak outlet point in trenches complete with all fittings, specials, accessories like Bend, Tee, Reducer, Stub end, End cap etc including all material, labour, testing and commissioning as per Technical Specifications and as per direction of Engineer.				
4	Civil work for Fixing of all types of valves, joints, flow meter and other necessary devices as per design and specifications				
5	Providing, Erecting and commissioning of complete surge protection system as per specifications and as approved for pipeline including all civil, electrical, mechanical and instrumentation works.				
	Note above break up is to be prepared for each dia Pipe.				
C1	Subtotal HDPE pipe network Mains / Sub-mains for Dia HDPE PIPE				

		% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
(a)	Rate per KM	60%	20%	20%	1. Stage I is Supply of pipe 2. Stage II Excavation, laying, jointing of pipe network 3. Stage III iTesting , commissioning and refilling of earth
C2	Subtotal HDPE pipe network Mains / Sub-mains for Dia HDPE PIPE				
(a)	Rate per KM	60%	20%	20%	1. Stage I is Supply of pipe 2. Stage II Excavation, laying, jointing of pipe network 3. Stage III iTesting , commissioning and refilling of earth
C3	Subtotal HDPE pipe network Mains / Sub-mains for Dia HDPE PIPE				
(a)	Rate per KM	60%	20%	20%	1. Stage I is Supply of pipe 2. Stage II Excavation, laying, jointing of pipe network 3. Stage III iTesting , commissioning and refilling of earth
C4	Subtotal HDPE pipe network Mains / Sub-mains for Dia HDPE PIPE				
(a)	Rate per KM	60%	20%	20%	1. Stage I is Supply of pipe 2. Stage II Excavation, laying, jointing of pipe network 3. Stage III iTesting , commissioning and refilling of earth
C5	Subtotal HDPE pipe network Mains / Sub-mains for Dia HDPE pipe				

		% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
(a)	Rate per KM	60%	20%	20%	1. Stage I is Supply of pipe 2. Stage II Excavation, laying, jointing of pipe network, Testing 3. Stage III , commissioning and refilling of earth
C6	Subtotal HDPE pipe network Mains / Sub-mains forDia HDPE PIPE				
(a)	Rate per KM	60%	20%	20%	1. Stage I is Supply of pipe 2. Stage II Excavation, laying, jointing of pipe network 3. Stage III iTesting , commissioning and refilling of earth
C7	Subtotal HDPE pipe network Mains / Sub-mains for Dia HDPE PIPE				
(a)	Rate per KM	60%	20%	20%	1. Stage I is Supply of pipe 2. Stage II Excavation, laying, jointing of pipe network 3. Stage III iTesting , commissioning and refilling of earth
C8	Subtotal HDPE pipe network Mains / Sub-mains for Dia HDPE PIPE				
(a)	Rate per KM	60%	20%	20%	1. Stage I is Supply of pipe 2. Stage II Excavation, laying, jointing of pipe network 3. Stage III iTesting , commissioning and refilling of earth
C9	Subtotal HDPE pipe network Mains / Sub-mains for Dia HDPE PIPE				

		% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
(a)	Rate per KM	60%	20%	20%	1. Stage I is Supply of pipe 2. Stage II Excavation, laying, jointing of pipe network 3. Stage III iTesting , commissioning and refilling of earth
	Sub Total (C)				
D	Pump House No.1				
(a)	Complete Civil Works including, but not limited to, general civil works, equipment installation, finishing, clean up and restoration for the following Works:				
1	Construction of pump House No.1 building, switchboards and other minimum facilities including, valves, valve chambers, water supply, sanitary, lighting for centrifugal pumpingwith 100% standby				
	Sub Total (D)				

		% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
E	Service Roads, Allied Structures, temporary office, QC lab building and Ancillary Civil Works				
	Complete Civil Works including, but not limited to, general civil works, equipment installation, finishing, cleanup and restoration for the following Works:				
1	Construction of BT approach road from Madanpur to both Pump house	100%			1.Stage I is Completion of civil work
2	Construction of 3 .75 M CC internal road within project area connecting pump house to residential and non residential buildings and other project units .	100%			1.Stage I is Completion of civil work
3	Construction of 3 .75 M BT service road within project area connecting valve chambers to nearest public road..	100%			1.Stage I is Completion of civil work
4	Temporary office building , QC lab etc.	100%			
	Sub Total (E)				
	Grand Total (A-E)				

Performa :3

Payment schedule for Machenical, Electrical and Instrumentation Works for Head works (Intake well , Siltation well, Pump house and Pump House No.1), MS/HDPE pipe network for mains, sub main					
S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIRD Stage payment	
Item No	Mechanical, Electrical and instrumentation work for the following units				
A	Intake well ,trenchless work, siltation well				
1	Supply, Installation, testing, commissioning and Other Services of Mechanical Electrical, instrumentation work of Intake structure with necessary, fixing removable motorized dual gate arrangement, installing trash rack, SS screens etc arrangement for retention of unwanted floating material and . and Sludge removal arrangements,level sensors and other instruments.	50%	25%	25%	1. Stage I: Supply of components with testing of each unit 2.Stage II: Installation 3.Stage III : Commissioning
2	Supply, Installation, testing, commissioning and Other Services of Mechanical Electrical, instrumentation work of Approach channel connecting Intake structure and siltation well (Approximately 1.05 KM in length)	50%	25%	25%	
3	Cabling system, and all other appliances from Switch yard to pump house and control room and inside the pump house, control room etc.	50%	25%	25%	
	Sub Total (A)	75%	15%	10%	1. Supply of components with testing of each unit 2. Testing commissioning of plant 3. Operation Period
B	Pump House & Pump House No.1				
B(1)	Providing, installation, testing and commissioning of Mechanical Equipment Including, but not limited to, supply, erection installation, testing commissioning, installation, testing and commissioning required to complete the Works in all respects for the following equipment:				
1	Vertical turbine pump with all accessories				

S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
Item No	Mechanical, Electrical and instrumentation work for the following units				
2	Dewatering and sludge removal pump pump with flexible piping, exhaust fans with accessories, fire extinguishers, air conditioning for main Control Room				
3	Lubricating water pumps, pressure filters and associated instruments with all accessories such as piping, bends, tees etc				
4	EOT crane with Design Capacity				
5	Delivery pipes and specials from pump to pumping manifold				
6	PN 1.0 Butterfly valves at delivery piping of pumps				
7	PN 1.0 Dual Plate Check Valves at delivery piping of pumps				
8	Dismantling Joints in delivery pipes				
9	PN 1.0 Butterfly valves at delivery manifold of pumps				
10	PN 1.0 Butterfly valve at delivery manifold of pumps for isolation of normal and preclosure pumps				
11	Dismantling Joints in delivery manifold piping with Butterfly valves of 1200mm				
12	PN 1.0 Kinetic Air Valves (As per required size) at delivery piping of pumps				
13	Delivery manifold pipes, specials, tamper proof air valve wtc. from pump house upto junction with raw water transmission main.				
14	Electric Actuators for all Butterfly valves in the Headworks				
	Sub Total (B1)	50%	25%	25%	1. Stage I: Supply of components with testing of each unit 2.Stage II: Installation 3.Stage III : Commissioning

S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
Item No	Mechanical, Electrical and instrumentation work for the following units				
B(2)	Installation of Electrical Equipment including, but not limited to, safe storage, protection, civil works, erection, installation, testing and commissioning required to complete the Works in all respects for the following equipment:				
1	33/6.6 KV Outdoor Sub-Station				
2	Energy efficient motors for vertical turbine pumps with all accessories				
3	Indoor switchboard as per approved single line diagram				
4	33 KV HT switchgear housing two incomers, VCBs, relays, metering system, CT, PT, Bus Bar, Bus Couplers etc. with requisite number of outgoing cubicals as per requirement.				
5	6.6 KV HT switchgear housing two incomers, VCBs, relays, metering system, CT, PT, Bus Bar, Bus Couplers etc. with requisite number of outgoing cubicals to have Motor control units with Soft starters for all HT motors for main pumps				
6	0.415 KV LT Panels for Electric Actuators, Hoist, Exhaust fans, Main lighting distribution panel, outside lighting distribution panel, welding socket and spare cubicals etc. as per given scope of work and specifications including switchgear for DG system				
7	Capacitor banks for the installed motors in the pump house				
8	APFC panel for the installed motors in the pump house				
9	Local push button station for pump motors, actuators, Hoist as per given specifications for motors				
10	110V DC system with batteries, battery charger, DC DB in panel to operate spring charging motors and LED supply on LT panel.				
11	Incoming cables from transformers within Headworks to the switchgear				
12	HT cable with cable trays and accessories for motors & all electrical equipments to be provided in Headworks as per given scope of work and specifications				

S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
Item No	Mechanical, Electrical and instrumentation work for the following units				
13	LT cable with cable trays and accessories for all electrical equipments other than HT Motors to be provided in Headworks as per given scope of work and specifications				
14	Providing control cables within the pump house and head works				
15	Exhaust Fans, wall mounted and pedestal type air circulators and other ventilating arrangements like roof extractors etc for both the bottom and top floors of Pump House				
16	Earthing system for HV and LV systems and motors installed in the contract in the Head works				
17	Diesel generation set of 7.5 KVA capacity including all associated accessories for lighting load				
18	Complete lighting system including energy efficient lighting fixtures, lighting poles, wires, conduits, cables and necessary accessories - indoor				
19	Complete lighting system including energy efficient lighting fixtures, lighting poles, wires, conduits, cables and necessary accessories - outdoor				
20	Complete earthing / lightning protection system including earth electrode, earth strip, wires, junction box for test links, treated and non-treated earth pits, etc. with necessary accessories				
21	Air conditioning of control room				
	Sub Total (B2)				
		50%	25%	25%	1. Stage I: Supply of components with testing of each unit 2.Stage II: Installation 3.Stage III : Commissioning
1	Installation of Instrumentation and Control Equipment including, but not limited to, safe storage, protection, civil works, erection, installation, testing and commissioning required to complete the Works in all respects for the following equipment:				

S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
Item No	Mechanical, Electrical and instrumentation work for the following units				
2	Instrument control panel comprising Programmable Logic Controller (PLC) along with preferably open source (or licensed software), alarm enunciator, selector switches etc				
3	24 VDC battery and battery charger system for control system				
4	Lap top computer for programming the PLC System common for RWPS, WTP and CWPS				
5	PC based local SCADA system comprising of adequate hardware, software, color monitor, laser printer, ink jet printer, UPS. (All required/specified licensed software packages to be preloaded, along with CDs of the same)				
6	Radar type level measurement system for intake sump ,level switch for intake sump ,temperature scanners for pump/ motor units (pressure measurement system for pumping main pressure gauges on discharge of pumps pressure switch on pumping main (1 No.), Pressure Transmeter, Instrumentation and control cables along with cable glands and lugs, cable trays/ conduits, etc. and all the installation hardware				
7	Electromagnetic full bore flow meter on the pumping mains.				
8	4 - path ultrasonic flow meter with wet insertion probes on the pumping mains.				
9	Miscellaneous items				
	Sub Total (B3)				1. Stage I: Supply of components with testing of each unit 2.Stage II: Installation 3.Stage III : Commissioning
		50%	25%	25%	
	Sub Total (B)				
C	<u>MS/HDPE pipe network Mains / Sub-mains</u>				

S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
Item No	Mechanical, Electrical and instrumentation work for the following units				
C(1)	Providing, installation, testing and commissioning of Mechanical, Electrical and instrumentation Equipment related to water pumping mains including, but not limited to, general, equipment installation, finishing, clean up and restoration for the following Works:				
i	Sluice valves, butterfly valves on delivery piping along with extension spindle and electric actuators, Dual plate type check valves, installation of flow meter, Metallic bellows, scour valve and accessories kinetic air valves with isolating sluice valves as per specifications.(contractor has to find exact size and length during complete design of pipe network and command area planning)				
ii	Electrical and Mechanical Accessories for Water hammer protection in Pipe lines.				
iii	Providing, erecting and commissioning of complete surge protection system and dismantling joint/ bellow per specifications and as approved for pipeline including all, electrical, mechanical and instrumentation works.				
iv	All tyoes of Electrical instrumentation for monitoring and control of flow hydraulics in DI pipe network				
	Sub total MS pipe network Mains / Sub-mains for Dia of MS PIPE				
1	Rate per KM				
C(2)	Subtotal MS pipe network Mains / Sub-mains for Dia of MS PIPE				
1	Rate per KM				
C(3)	Subtotal MS pipe network Mains / Sub-mains for Dia of MS PIPE				
1	Rate per KM				
C(4)	Subtotal HDPE pipe network Mains / Sub-mains for Dia of HDPE PIPE				
1	Rate per KM				

S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
Item No	Mechanical, Electrical and instrumentation work for the following units				
C(5)	Subtotal HDPE pipe network Mains / Sub-mains for Dia of HDPE PIPE				
1	Rate per KM				
C(6)	Subtotal HDPE pipe network Mains / Sub-mains for Dia of HDPE PIPE				
1	Rate per KM				
C(7)	Subtotal HDPE pipe network Mains / Sub-mains for Dia of HDPE PIPE				
1	Rate per KM				
C(8)	Subtotal HDPE pipe network Mains / Sub-mains for Dia of HDPE PIPE				
1	Rate per KM				
	Sub Total (C)	60%	20%	20%	1. Stage I: Supply of components with testing of each unit 2.Stage II: Installation 3.Stage III : Commissioning
E	<u>HDPE pipe network</u>				
E1	Providing, installation, testing and commissioning of Mechanical , Electrical and instrumentation Equipment for HDPE network				
E2	Electromagnetic Flow Meter, Resilient Seated D/F DI Sluice valves of approved make & design standard (including jointing & jointing material), in pipeline dia D/F DI Plunger valve (Flow Control Valve) with electrical actuator suitable for SCADA compatibility complete, Fixing of all types of valves, joints, as per technical specification and as per direction of Engineer.				

S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IIInd Stage payment	IIIrd Stage payment	
Item No	Mechanical, Electrical and instrumentation work for the following units				
E3	Providing, Erecting and commissioning of complete surge protection system as per specifications and as approved for pipeline including all civil, electrical, mechanical and instrumentation works.				
	Subtotal of HDPE pipe network for Dia of HDPE PIPE				
1	Rate per KM				
E4	Subtotal of HDPE pipe network for Dia of HDPE PIPE				
1	Rate per KM				
E5	Subtotal of HDPE pipe network for Dia of HDPE PIPE				
1	Rate per KM				
E6	Subtotal of HDPE pipe network for Dia of HDPE PIPE				
1	Rate per KM				
E7	Subtotal of HDPE pipe network for Dia of HDPE PIPE				
1	Rate per KM				
	Sub Total (E)	60%	20%	20%	1. Stage I: Supply of components with testing of each unit 2.Stage II: Installation 3.Stage III : Commissioning
F	HEM for pump House No.1				
1	Supply, Installation, testing, commissioning and Other Services of Mechanical Electrical, instrumentation work with necessary including fixing motorized valves, measuring arrangement for flow control level sensors and other instruments.				
2	Suction pipes to pump inlet including Vacum Pumps, all valve, Foot valve, Foot valve strainer with required pipes and fittings such as flanges, bends, tees, reducers, enlargers, tail piece, blind flanges, dismantling piece, nut & bolts, gaskets etc and any other items required for pumps at following pumping stations.				

S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
Item No	Mechanical, Electrical and instrumentation work for the following units				
3	Delivery pipes to pump including all valves (Sluice valve, Non return valve, Pressure relief valve) Pressure guage, Digital type flow meter with required pipes and specials and accessories fittings such as flanges, bends, tees, reducers, enlargers, tail piece, blind flanges, dismantling piece, nut & bolts, gaskets and any other items required to pass the required discharge etc. upto the interconnection to the rising mains of the respective section as per scope of work and specifications and structural support for pump and header.				
4	Electric Control Panel of 16 SWG (CRCA) thick powdered coated suitable for floor mounting of the respective section, fully automatic starter, Delta Starter with Auto switch single phase preventor, MCCB, MCB, VM, AM & indicators, copper bus bar, timer & relay, auto & manual switch, flow sencer, switch, capacitor, suitable copper wiring and any other item required and as per scope of work and specification.				
5	LT (Aluminum PVC insulated PVC sheathed armoured cable with aluminum conductor 3 core x 10 sq mm) cables to provide pump houses as per given scope of work and specifications from Electric Panel to motors.				
6	LT (Aluminum PVC insulated PVC sheathed armoured cable with aluminum conductor 3.5 core x 25 sq mm) cables as per given scope of work and specifications from Transformer to Electric Panel.				
7	Earthing two pits including materials, to be installed as per given scope of work and specifications.				
8	Providing & installation of hydro cyclone filter, the capacity of filter selected not be less than the system flow to be provided as per given scope of work & specifications.				
9	Exhaust fans for electrical rooms				
10	Horizontal centrifugal pumps at each Diggee with all accessories.				
11	Energy efficient motors with all accessories for pumps				

S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIRD Stage payment	
Item No	Mechanical, Electrical and instrumentation work for the following units				
12	Total HEM for For Pump House No.1including all items				
13	Complete cabling system with HV & MV cables, cable trays, route marker, steel structure for cable trench, MS pipes and accessories				
14	Complete cabling system with LV cables, cable trays, route marker, steel structure for cable trench, MS pipes and accessories				
15	Installation of Instrumentation and Control Equipment including, but not limited to, safe storage, protection, Erection, installation, testing and commissioning required to complete the Works in all respects for the following equipment:				
16	Instrument control panel comprising Programmable Logic Controller (PLC) system along with software and panel mounted instruments.				
17	24 VDC battery and battery charger for control system				
18	Full bore electromagnetic flow meters -				
19	HEM work for each Pumping rooms				
20	Testing equipments for quality control laboratory				
	Sub Total (F)	60%	20%	20%	1. Stage I: Supply of components with testing of each unit 2.Stage II: Installation 3.Stage III : Commissioning
G	Any other items required for proper and efficient construction and execution of the system				
	Grand Total (A-G)				

**Schedule 4: Automation of System by PLC-
SCADA**

Performa : 4

S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
1	Designing the PLC-SCADA system for centralized monitoring and operation this complete scheme from intake to pump House and at outlet point	50	50		1. Stage I :Submission 2. Stage II :Approval
2	Supply of PLC-SCADA instrumentation and accessories	60%	20%	20%	1. Stage I :on supply and installation 2. Stage II :Testing and calibration of indiaviual SCADA of each Unit 3. Stage III: Testing and calibration of integrated SCADA system off line and online
3	Installation, of PLC-SCADA system for Main Pumping station, Pipe network of MS and , HDPE	60%	20%	20%	
4	Testing and calibration of PLC-SCADA system for individual system like Main Pumping station, Pipe network, Pumps in off line and on web based online	60%	20%	20%	
5	Testing and calibration of PLC-SCADA system for integrated system like Main Pumping station, Pipe network, Pumps house No1 and intake	60%	20%	20%	
6	Any other items required for proper and efficient construction and execution of the system				
	Total =				

Schedule 5.1: PERIFERIAL ACTIVITIES

Performa : 5.1

S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IInd Stage payment	IIIrd Stage payment	
A	Peripheral Development works				
1	Development of Peripheral works under this Scheme				
	i. Full development of the Main Pump house Campus and Pump house No.1 and other three campus as per scope of work	100%			On Completion of task
	ii. Construction of boundary wall, fencing and security system .	100%			On Completion of task
	iii. Landscaping and plantation work in	50%	50%		Stage I On full development of landscaping work Stage II On growth of plants upto man height
	iv. Procurement of Vehicle for inspection				
	a) 3 no's Sidan Cars (1200 CC)	100%			On procurement of vehicle
	b) 1 Innova Car or equivalent	100%			On procurement of vehicle
	c) 5 Nos Bolero Jeep	100%			On procurement of vehicle
	d) Cost of providing 9 nos drivers during entire build design and O&M period				Reimbursement of monthly salary as per pay slip
B	Any other items required for proper and efficient construction and execution of the system				
	Total				

Schedule 5.2: Construction of Residential and Non-Residential Building Works					
Performa : 5.2					
S.No.	Particulars	% of payment allowed			Remarks
		Ist Stage payment	IIInd Stage payment	IIIrd Stage payment	
A.	Construction of Residential and Non-Residential buildings in plinth area of 6443 Sqm. as per specification and design				
	Cost of civil Work.	20	50	30	Stage I Construction up to Plinth Level Stage II Construction up to Roof Level Stage III Completion of Finishing of all respect
	Cost of water supply & sanitary Work				
	Cost of electrical Work	90	10		Stage I Installation and laying Stage II Testing & Commissioning
B.	Construction of Rest House buildings for Sqm				
	Cost of civil Work.	20	50	30	Stage I Construction up to Plinth Level Stage II Construction up to Roof Level Stage III Completion of Finishing of all respect
	Cost of water supply & sanitary Work	80	20		Stage I Installation and laying Stage II Testing & Commissioning
	Cost of electrical Work	80	20		Stage I Installation and laying Stage II Testing & Commissioning
C.	Cost of Furnishing Work	100			Fixing and Procurement
	Cost of Furnishing of office buildings	100			Fixing and Procurement
	Cost of Furnishing of rest house buildings	100			Fixing and Procurement
D.	Any other items required for proper and efficient construction and execution of the system				
	Total				

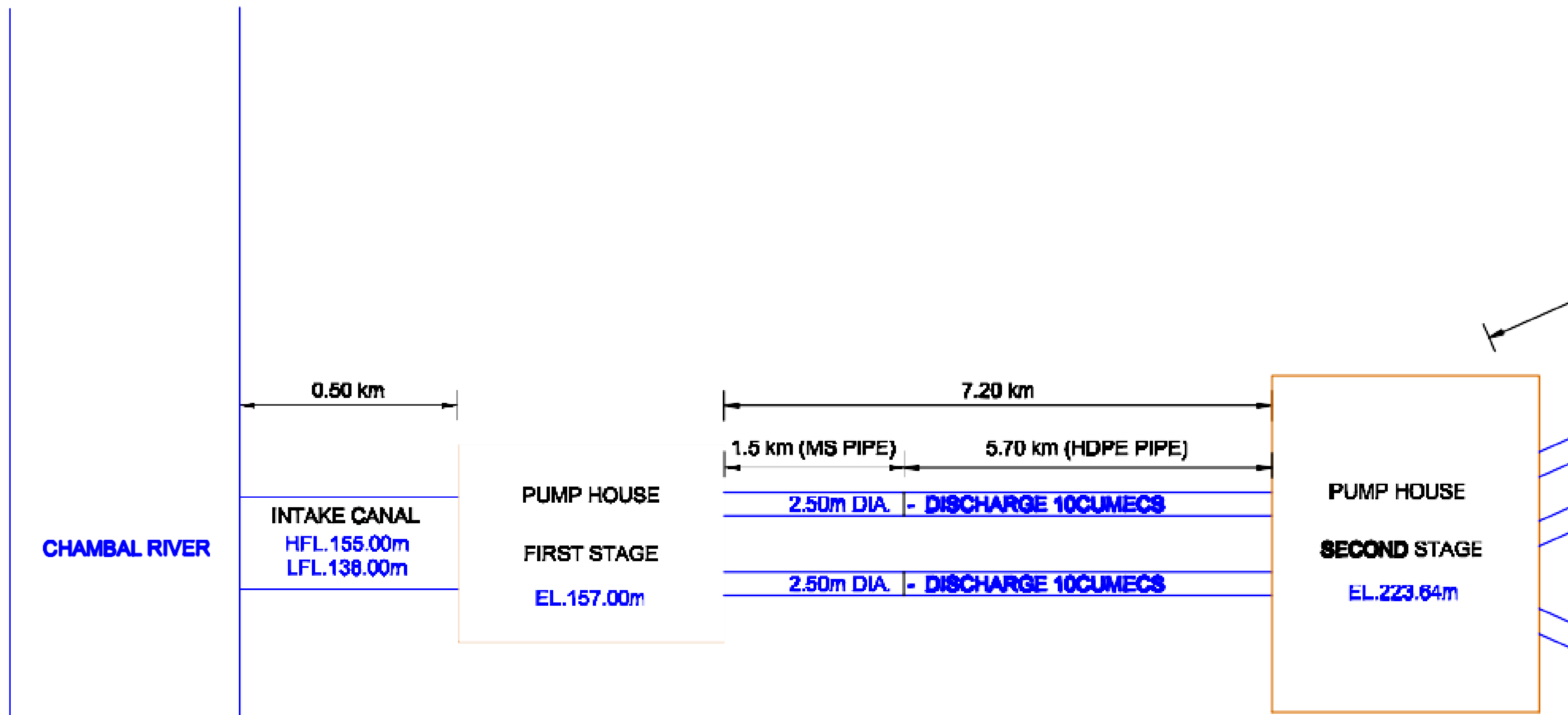
Schedule 6: Price schedule for operation and maintenance					
	Performa: 6				
	Item	Cumulative Payment release schedule in % of rate			
	Cost of O&M excluding power Charges for Ist year of O&M starting after commissioning of the complete project	I quarter	II quarter	III quarter	IV quarter
S.No	Year after completion of project	25%	50%	75%	100%
1	2				
1	I st Year				
2	II nd Year				
3	III rd Year				
4	IV th Year				
5	V th Year				
6	VI th Year				
7	VII th Year				
8	VIII th Year				
	Total Evaluated O&M cost =				

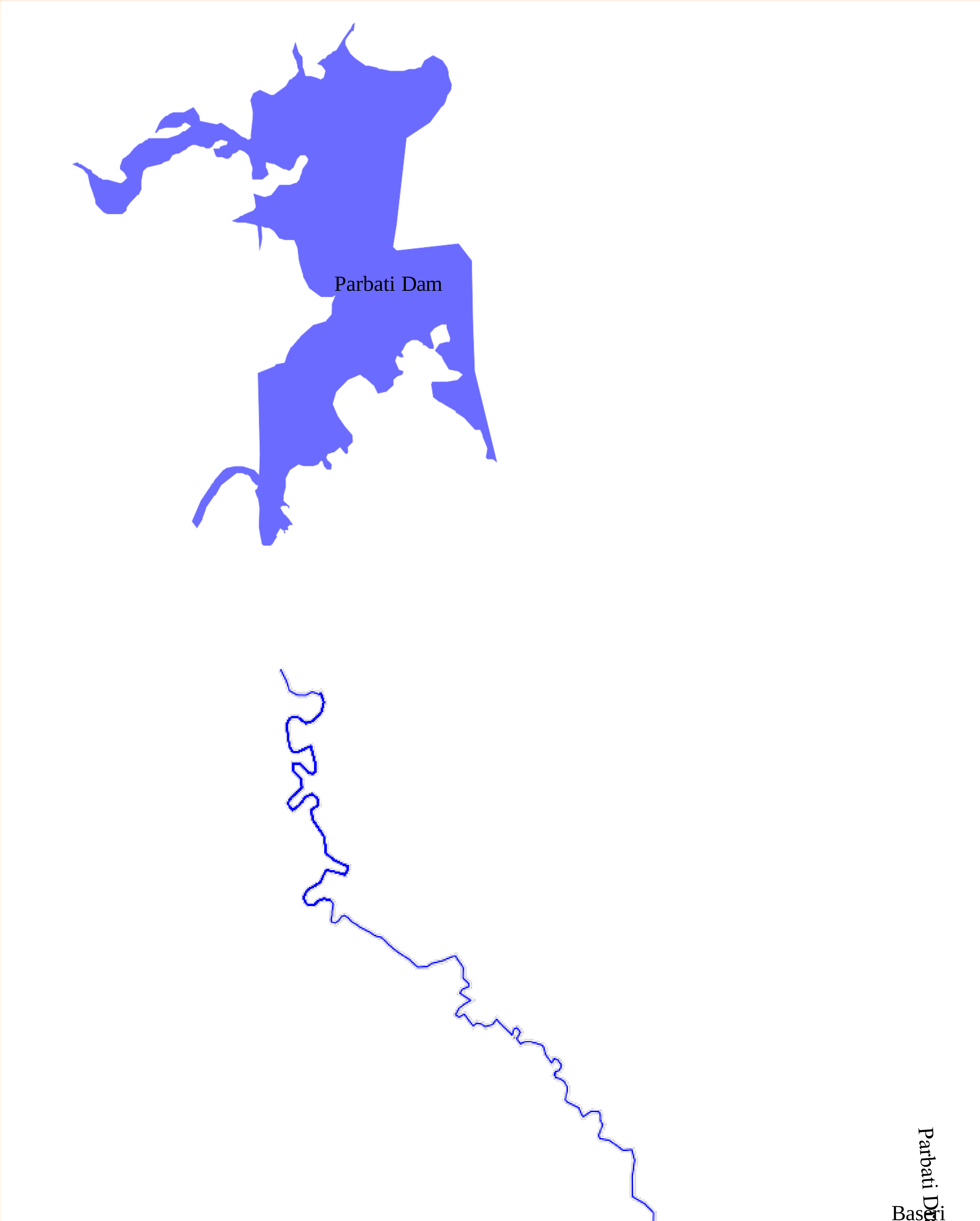
1. Contractor shall fill the rate for 1ST Year only and factor of 7% shall be applied to increase the cost of O&M for each subsequent year. Overall cost of 8 years O&M shall be 6.80 X O&M Cost of 1ST year quoted by
2. The rate quoted for annual O&M for each year shall be in between ½ to 1% of total cost arrived from sum of schedule 1,2, 3, 4, 5, 6 A & 6B

Schedule 7: Power loading schedule

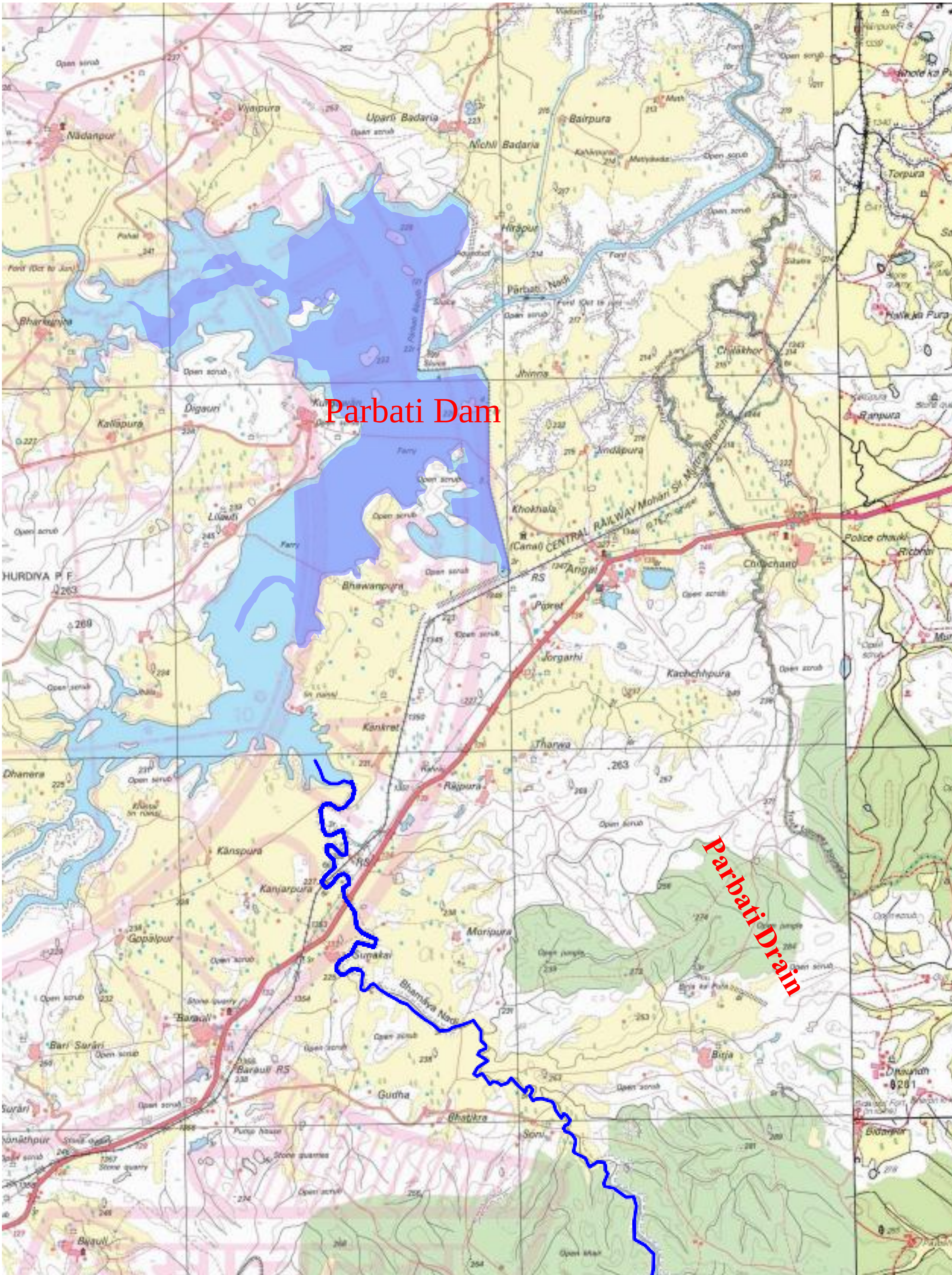
Performa: 7

S.No	Year after completion of project	Payment shall be reimbursed as per actual consumption subjected to conditions of SCC, after submitting the invoice issued by DISCOM to the department
	O year (partly commissioned)	NIL
1	I st Year	As per Actual
2	II nd Year	As per Actual
3	III rd Year	As per Actual
4	IV th Year	As per Actual
5	V th Year	As per Actual
6	VI th Year	As per Actual
7	VII th Year	As per Actual
8	VIII th Year	As per Actual





KALITEER LIFT SC



Parbati Dam

Parbati Drain

SECTION - VII

APPURTENANCES AND MISCELLANEOUS ITEMS

APPURTENANCES AND MISCELLANEOUS ITEMS

SL. NO.	PARTICULARS	PAGE NO.
1	SLUICE VALVES	
	Constructional features	
	Material of Construction	
2	BUTTERFLY VALVES	
	Constructional features	
	Features of construction	
	Material of Construction	
	Actuators operated valves	
	Materials/ Design details	
	Specific performance gaurantee	
	Marking	
	Testing & inspection	
	Electric motor actuators for butter fly valves	
	Design requirement	
	Electro Hydraulic actuators	
	Design criteria	
	AIR VALVES	
	General	
	Specifications	
	material of construction	
4	DUEL PLATE CHECK VALVES	
	Specifications	
	Material of construction	
5	PUMP CONTROL VALVES	
	Specifications of pump control valves	
	Material of construction	
6	M.S EXPANSION JOINT	
	Requirement	
	Acceptable makes	
	Material of construction	
	MS Cover for expansion joints	
7	Metalic/RUBBER EXPANSION JOINT/DISMANTLING JOINTS	
8	SUPPLY AND FIXING OF ROLLER BEARINGS	
9	SURGE PROTECTION DEVICES	
	Surge analysis	
	Technical specifications	
10	FLOW MEASUREMENT DEVICES	
	Electro megnatic full bore type flow meter	
11	PIPE, VALVES, FITTINGS & AUXILIARY SYSTEMS	
	Codes & standards	

	Scope	
	Design construction & erection	
	Piping(General)	
	Design of piping system	
	Painting and	

SL. NO.	PARTICULARS	PAGE NO.
1	SLUICE VALVES	
2	BUTTERFLY VALVES	
3	AIR VALVES	
4	DUEL PLATE CHECK VALVES	
5	PUMP CONTROL VALVES	
6	M.S EXPANSION JOINT	
7	Metalic/RUBBER EXPANSION JOINT/DISMANTLING JOINTS	
8	SUPPLY AND FIXING OF ROLLER BEARINGS	
9	SURGE PROTECTION DEVICES	
10	FLOW MEASUREMENT DEVICES	
11	PIPE, VALVES, FITTINGS & AUXILIARY SYSTEMS	

APPURTENANCES AND MISCELLANEOUS ITEMS

1. SLUICE VALVES

1.1 CONSTRUCTIONAL FEATURES

The valves shall be resilient seated, bubble-tight, straight and pocket less body passage, inside stem screw and electrostatic epoxy powder (EP-P) coated INSIDE AND OUTSIDE. The face to face dimensions shall conform to provisions of IS 14846/EN 558-1, Basic series F4/BS 5163. All tests shall be carried out as per these standards.

Valves shall be of non-rising spindle type except for the bypass valves. The spindles shall be of such lengths that when the valves are closed the bottom ends of the spindles engage fully in the spindle nuts. The spindle collars of thrust plates shall be concentric and machined, suitable for the specified test pressure. The thickness and bearing of the nut shoulders shall be adequate to resist operating thrusts. Spindles shall be greased and supplied with a cap top. Valve shafts shall be a one-piece unit extending completely through the valve disc, or of the 'stub shaft' type, which comprise two separate shafts inserted into the valve disc hub.

Valves of 400 mm and above shall be provided with thrust bearing arrangement/Gear Arrangement for ease of operation.

Valve of diameter 400 mm and above shall be provided with enclosed gear arrangement for ease of operation. The operation gear of all valves shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 200 N.

Valves spindles and hand wheels shall be positioned to give good access for operational personnel. Hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

Valves shall have two position marked at the shut end of the scale, first one corresponding to the position of the gate tangential to the bore of the seating and the second position below the first, corresponding to the position of the gate as it sits on the seating after moving a further distance equal to the depth of the seating.

The valves shall be so designed that the gates may be removed without removing the bodies from the connecting pipe work. The gate guides shall be cast integrally with the valve bodies and be of adequate strength and of sufficient length to guide the gates throughout their full length of travel. In the fully open positions, the gates shall be fully withdrawn well clear of the stream and the spindles shall not protrude into the bores of the valves.

All Sluice valves shall be open end tested.

The Contractor shall provide test certificates for materials, strength and leakage in accordance with BS 5163 / IS 750/International reputed Standards.

1.2 MATERIALS OF CONSTRUCTION

Item	Material of Construction
Body, Dome	Spheroidal Graphite Iron IS 1865 Gr 400/12 or Gr500/7 Ductile Iron DIN 1693-GGG40 / GGG50
Wedge	Spheroidal Graphite Iron IS 1865 Gr 400/12 or Gr500/7 Ductile Iron DIN 1693-GGG40 / GGG50 Rubber Vulcanized with EPDM/

Spindle / Stem	SS: IS 6603 04 Cr17 Ni 12 M0 2 / AISI 316/SS 420
Bonnet Gasket	EPDM
Internal Fasteners	Stainless steel SS316
Nuts, bolts & washers for pipe flanges	High tensile steel Hot dip galvanized
Coating	Internal and external with powder or liquid food grade Fusion Bonded Epoxy(FBE) coating with minimum dry film thickness Of 250 microns Or Thermoplastic-Powder Coating Internal/External min 250 microns

2. BUTTERFLY VALVES

2.1 CONSTRUCTIONAL FEATURES

The valves shall be with integral body seat and bubble tight shut-off type, suitable for ON-OFF operation of wafer type short body with flanges.

Butterfly valves shall be of Concentric Design and Vulcanized type generally as per EN 593, BS 5155 and IS 13095 or any equivalent international standards approved by the end user. Underground Valves on transmission mains which are used for only isolation purposes shall be provided with stainless steel extension spindle / telescopic arrangement so that valves can be operated from ground level.

Butterfly valves shall be suitable for mounting in any position. The valve shall be free from induced vibrations

Butterfly valves shall be suitable for bi-directional pressure testing with dead-tight shut off even after long period of operation. The valves shall be of double flanged wafer Short type.

The valve body seat shall be of Vulcanized Rubber design. When the valve is fully closed, the seal shall seat firmly. All fasteners shall be set flush so as to offer the least resistance possible to the flow through the valve.

The shaft shall be stainless steel with Bronze or equivalent seal with self-lubricating bearings. Valve shafts shall be a one-piece unit extending completely through the valve disc, or of the "stub shaft" type, which comprises two separate shafts inserted into the valve disc hubs.

All valve spindles and hand wheels shall be positioned to give good access for operational personnel. Valve of diameter 400 mm and above shall be provided with enclosed gear arrangement for ease of operation. The gear box shall be of worm and worm wheel design type, totally enclosed, grease filled and weather proof. The operation with gearing shall be such that they can be opened and closed by one man against an unbalanced head of 1.15 times the specified rating. Valve and gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 200 N. The valve disc shall have a 90 degree turn.

The disc shall be designed to withstand the maximum pressure differential across the valve in either direction of flow. The disc shall be contoured to ensure the lowest possible resistance to flow and shall be suitable for throttling operation.

It should be possible to open the valve with upstream pipe fully filled and downstream pipe empty. The shaft shall be designed to withstand the maximum torque that will be imposed by the operator. It shall be secured to the discs by tapered stainless steel cotter pins.

Valves shall be provided with a continuous mechanical position indicator to show the position of the disc, mounted on the driven shaft end.

Rigid adjustable stop mechanism shall be provided within the gear box or elsewhere on the valve to prevent movement of the disc beyond the fully open or closed position (i.e. set points).

Valves shall be capable of closing against the maximum flow that can occur in practice. The breakaway torque under maximum differential head conditions shall be within the manufacturer's limits.

All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

2.2 FEATURES OF CONSTRUCTION

The requirement shall be as follow: -

Table 'A'

S.N.	Particulars	Required specifications
(A) General requirements		
•	Conforming to	BS 5155 Generally or IS : 13095/EN 593/API 609
•	Fluid handled	Clear Water
•	Rating	(PN 1.0,1.6,2.0 and 2.5) As per design pressure / surge analysis at the point of installation
1	Temperature of fluid	4 to 45 degree Celsius
(B) Service		
1.	Tight shut off	Yes
(C) Modes of operation		
1	Direction of rotation of hand wheel	Clock-wise for closing
2	Orientation of hand wheel w.r. to Pipeline	Perpendicular/Horizontal
(D) Type of construction		
1.	Flanged or Wafer	Double flanged/Wafer series

2.	Face to face dimension	As per BS 5155 or IS : 13095 or AWWA C 504 or EN 593/API 609
3.	Whether lifting lugs and mounting feet are required	Yes
4.	Valve installation	Horizontal
(E) Any other Information		

S.N.	Particulars	Required specifications
	(i) Limit stops should be provided in open and closed position with protection against excessive operating force with mechanical position indicator Locking arrangements should be provided for the valve disc to facilitate removal Of gear box.	
(G) Tests to be carried out		As per BS 5155 or IS : 13095/API 609

2.3 MATERIAL OF CONSTRUCTION

S.No.	Item	Material of construction
(1)	Body and Flanges	Spheroid Graphite Iron IS 1865 Gr 400/12 Ductile Iron DIN 1693/GGG 40/GGG 50
(2)	Disc	Spheroid Graphite Iron IS 1865 Gr 400/12 Ductile Iron DIN 1693/GGG 40/GGG 50
(3)	Shaft	Stainless steel IS :6603 -1972 Grade 316 or AISI 410 or BS 970 Grade 431 S29 Or AISI 420
(4)	Disc Seal Ring	EPDM/Ductile Iron GGG 40/50
(5)	Disc Seal Retaining Ring	MS & HDPE
(6)	Body Seat	Stainless steel AISI 316/ Nickel weld overlay micro finished/ integral micro finished seat with valve body/Vulcanized EPDM Minimum +60 Shore
(7)	Shaft Bearing	Bronze with EPDM 'O' ring seal
(8)	Internal Fasteners	Stainless steel SS 316
(9)	Nuts, bolts & washers for pipe flanges	Stainless steel SS 316/Galvanized Steel
(10)	Coating	Internal and external with powder or liquid food grade Fusion Bonded Epoxy coating with minimum dry film thickness of 250 microns.

2.4 ACTUATORS OPERATED VALVES

- i. Actuators will be with Limit and Torque switches for either end of travel for control and interlocking purpose.
- ii. The characteristics of the actuators to be located on the valves are indicated in the actuators specification.
- iii. Should the actuator be located on the control column, all connecting accessories shall be supplied (extensions, joints, articulations etc.).
- iv. The valves 350 Nb and above shall also be provided with hand wheel drive arrangement suitable for manual operation. Manual operation of valve shall be through worm and gear arrangement having totally enclosed gearing with hand wheel diameter and gear ratio designed to meet the required operating torque. It shall be designed to hold the valve disk in intermediate position between full open and full closed position without creeping or fluttering. Adjustable stops shall be provided to prevent 'OVOT travel' in either direction.
- v. Limit and torque switches shall be enclosed in water tight enclosures along with suitable space heaters.

2.4.1 MATERIALS / DESIGN DETAILS "

Materials, design and other specific requirements of various categories of BF valves shall be as indicated below .

SI. No.	Description	Requirement.
a)	Design	As per IS 13095/ BS 5155
b)	Type	Double flanged
c)	Material	
	i) Body and Disc	Cast steel grade ASTM-A 276 74 d Gr. WCB or SG Iron as per IS 1865 gr.500/7
	ii) Shaft	Stainless steel AISI: 431
	iii) Body Seat	Monel 60 integral
	iv) Disc Seat	EPDM
	v) Bearing	PTFE LINED ST.ST.
	vi) Testing	AWWA-C-504/IS
	vii) Other Requirement	Tight shut off

2.4.2 SPECIFIC PERFORMANCE GUARANTEE

For the rubber seated valves, the contractor shall guarantee that in the closed position and with a disc differential pressure as specified the valves shall be water tight.

The contractor shall guarantee that the operating mechanism shall open and close the valve under the specified maximum differential pressure within the time specified.

The valve shall be suitable for frequent operation during initial commissioning operation after a long period of inactivity.

2.4.2 MARKING

The mark stated by the Employer in the Material Request shall be printed on the body, of all valves and relevant accessories (control columns and relevant connecting elements to the valve, counter flanges, valves for the auxiliary control if separately supplied, etc.).

The face of each hand wheel shall be clearly marked "Open" and "Shut" with arrows indicating the direction of rotation to which they refer. Each hand wheel shall also be fitted with a circular name plate indicating the service for which the valve is intended and valve tag number. The name plates shall be engraved in black lettering. Each spare part shall be individually marked with metal plates suitably punched for an easy identification.

2.4.3 TESTING AND INSPECTION

All valves shall be checked for correctness in respect of flange details as specified. The valves shall be tested as per the requirement of AW WA C-504 (latest version) IS. Proof of design-tested valve shall not be supplied for the project.

For cast construction: Body and Disc shall be subjected to MPI/LPI and shaft shall be subjected to UT and LPI. .

For Fabricated Construction: All Butt welds having thickness 20mm and above shall be subjected to Radiography and, stress relieving. Only qualified welders shall be used for the purpose of carrying out welding. Shaft shall be subjected to UT and LPI.

2.4.4 SITE TEST

The valves shall be tested at site for opening and closing time, valve operation etc. The valve should operate without any flutter, noise, and vibration.

A.ELECTRIC MOTOR ACTUATORS FOR BUTTER FLY VALVES

2.2.5 DESIGN REQUIREMENTS

Electric actuators shall essentially consist of electric motors, limit switches, hand wheel and gear trains, mechanical position indicators, internal wiring and terminal block.

The electrical actuator assembly inclusive of drive motor and unit switches compartment shall conform to IP 55 degree of protection. Actuators shall be sized so as to open / close the valve at the rated speed against the design differential pressure at 90% of the nominal voltage. Lost motion hammer blow feature shall be provided for seating / unseating the valve when the operating torque exceeds 11 kg/m. Operators shall be designed to be self locking (i.e. maintains the stem position) upon loss of electric power supply. Motors shall be installed on the operator prior to shipment to the valve manufacturer. Actuators shall be provided with lifting lugs for handling it along with the bonnet. Actuator assembly shall have all metal gear trains. Operators shall be flange mounted on the valve bonnet. Welding of

operators onto bonnets is not permitted. All actuators shall be as per the approved vendor list or as approved by the employer.

2.4.6 OPERATING SPEED

All actuators shall have operating speeds as per the manufacturer's standard. However, this shall meet .operating requirement of the system. Actuator operating times (opening and closing) shall be furnished with actuator details.

2.4.7 SERVICE CONDITIONS

The actuator shall be suitable for operation in a hot, humid and tropical atmosphere. Unless otherwise stated in the equipment specification, the ambient air temperature shall be taken as 50 dg. C, relative humidity 100% and mean sea level less than 1000 meters.

2.4.8 RATING

The actuator shall be designed for operation on a 415 V + 10%, 3-Phase 50 Hz + 5% solidly grounded system. The combined voltage & frequency variation shall be +/-10%. The control circuit voltage shall be 240/110 V A.C. or 220V D.C.

The actuator shall be rated for three successive open-close operation of the valve or 15 minutes, whichever is longer.

The normal torque rating of each drive unit shall have adequate margin and at least equal to theoretical brake torque required to drive the equipment under full load, including all losses in speed reducers and power transmission.

The drive shall take into account valve operating speeds and differential and static pressure required for the service. The contractor shall select operating speeds and design pressure to satisfy requirements of the equipment furnished and acceptable to the Employer. Motor actuator assemblies shall have all metal gear trains. Fiber gears are not acceptable.

2.4.9 PERFORMANCE

The actuator shall open and close the valve completely and make lead-tight valve close, without jamming.

The actuator shall attain full speed operation before valve load is encountered and impart an unseating blow to start the valve in motion (hammer blow effect).

The actuator shall operate the valve stem at standard stem speed and shall function against design differential pressure across the valve seat.

The motor reduction gearing shall be sufficient to lock the shaft when the motor is de energized and prevent drift from torque switch spring pressure.

The entire mechanism shall withstand any shock resulting from closing with improper setting of limit switches or from lodging of foreign matter under the valve seat.

2.4.10 SPECIFIC REQUIREMENT

Construction

The actuator shall essentially comprise of the drive motor, torque/limit switches, gear train, clutch, hand wheel, position indicator I transmitter, space heater and internal wiring. The actuator enclosure shall be totally enclosed,. dust tight, whether proof suitable for outdoor use without necessity of any canopy. All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.

The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficult.

Motor Drive

The drive motor shall be three phase, 415V, squirrel cage, induction machine with class B insulation and IP-55 enclosure, totally enclosed and self ventilated and designed for high torque low inertia and reversing service suitable for operation at 50 deg. C ambient temperature

The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current

All motors shall have TEFC enclosures with space heaters to maintain the internal temperature above dew point when the motor is idle. Space heaters shall be rated for 240V AC.

The motors shall be capable of operating the valve against the maximum load on the valve disc. with drive bearings in dry and dirty condition.

Each motor shall be provided with two direct temperature sensing thermostats to prevent thermal overload.

All motors shall have O-ring seals to provide complete environmental protection when the motor is idle.

Earthing terminals shall be provided on either side of the motor.

Double shielded grease prelubricated, regreasable, antifriction bearings having a minimum life rating of 1,00,000 hours shall be furnished.

2.4.11 Limit switch

a. Position Limit Switches

Each actuator shall have rotary drum position limit switches, two (2) for open and two (2) for close position, each with adjustable setting between fully open and fully close positions. Each rotary drum position limit switch shall have two normally closed (NC) and two normally open (NO) independent contacts. The adjusting 'mechanism for the limit switches shall be easily accessible.

b. Torque limit switches

Each actuator shall have two torque limit switches with suitable arrangement to limit the opening I closing thrust. The torque switch, actuated by the torque' clutch when the valve

is restricted during opening / closing shall stop the motor thereby protecting the motor from overloading torque. The torque switches shall be set as near as possible to the pull out torque of the motor without damaging the valve of the operation.

Each torque switch shall have two normally open (NO) and two normally close (NC) independent contacts

The torque limit switch adjusting mechanism shall be easily accessible.

Limit switches along with all necessary electrical wiring shall be housed in a weather proof NEMA-3 enclosure and shall have gasketed cover and space heater to maintain the temperature above dew point.

Each torque / position limit switch shall have 2 NO + 2 NC potential free contacts. Contacts shall be rated to make and carry continuously 10 A at 110 V ~C and 0.5A (inductive) 220 V DC.

Manual operation.

All actuators shall have mechanically independent manual drive arrangement with hand wheel and motor declutching mechanism. The manual drive shall be provided with clutch and gearing as required to limit hand wheel effort to 25 kgt maximum along with suitable latch and locking arrangement to keep the hand wheel in engaged position using manual operation.

The hand wheel shall disengage automatically during motor operation.

2.4.12 Position indicator / Transmitter

All actuators shall have one (1) built-in local position indicator for 0.-10.0. % travel. All actuators shall be provided with mechanical 3-point dial position indicators. Rising steam valve shall

additionally have visual position indication through plastic stem covers.

Where required, valves shall be provided with continuous remote position indicators of the potentiometric type. The available voltage sources for the potentiometric position transducers are 220V DC and 240 V AC. The transducer shall be suitable for established 4-20 mA current signal. The associate wiring for the transducers shall be housed in the limit switch compartment.

Space Heater

A space heater shall be included in the limit switch compartment suitable for 240. V AC, 50. Hz supply 220. V DC.

Wiring

All electrical devices shall be wired up to and terminated in a terminal box. The internal wiring shall be of sufficient size for the power rating involved but no case less than 1.5mm copper. All wiring shall be identified at both ends with ferrules. Internal wiring diagram shall be neatly pasted on the rear side of the terminal box cover

Motor power, heater and all control wiring shall be wired at shop to suitably rated master terminal blocks located within the limit switch compartment. All internal wiring shall be of

650/1100 V grade flexible standard copper conductor cables with tropical fungicidal treatment and the insulation shall be flame resistant

The limit switch terminals should be capable of terminating two nos. 2.5 mm copper cable

Terminal boxes shall be provided with removable undrilled gland plates to terminate following sizes of cable.

9.1 1 no. - 14 core 2.5² (Cu)

1 no. . .,10 cores - do –

1 no. - 2 pair

1 no. - 10 pair

1 no. - Power cable

Terminal Box

Actuator terminal box shall be suitable to receive and terminate the following cables:

- a. 1 No. power cable details of this shall be intimated later.
- b. 3 Nos. 19 C x 2.5 copper conductor PVC insulated unarmoured control cable Actuator terminal box shall be provided with a removable front cover plate and an undrilled detachable gland plate

2.4.13 DATA TO BE FURNISHED

Motor data sheet for each type of actuator shall be furnished along with internal wiring diagram, suggested control schematic and torque I limit switch contact development.

2.5 B. ELECTRO HYDRAULIC ACTUATORS

2.5.1 DESIGN CRITERIA

Each electro-hydraulic actuator shall be provided with its own power pack. Each actuator shall consist of a double acting cylinder, control cabinet and accessories to cater for following operational requirements.

In the closed position the valve shall be held closed by a substantial counter weight or by any other mechanical device.

Start-up sequence of pump shall initiate powered opening of butterfly valve hydraulic actuator. The actuator shall be adequately sized to open or close the valve against an unbalance. Pressure equal to pump shut-off pressure in either direction within the time period as specified. The necessary limit switches shall be provided on the valves so that at a pre-determined position, the pump circuit breaker shall be closed to start the pump.

Valve shall remain open during normal running of the pump. No disc flutter shall take place in the position nor shall there be any creep in this fully open position.

A limit switch be provided (set at about 3 deg from open position) to sense the creeping. Switch shall start the oil pump and return the valve to the fully open position.

When the valve is fully open and electric supply in the valve control system fails the butterfly valve shall remain open while the CW pump continues to deliver water. Normal operational shut down shall enable valve to close at a slow closing rate, which shall be adjustable between 30 to 60 seconds.

In case of any fault causing pump motor trip, the corresponding butterfly valve shall start closing at a fast rate initially and thereafter at a slow rate. The emergency closing facilities shall be duplicated each with its own solenoid valve in the hydraulic circuit.

Provision for local manual operation shall be made.

The lower part to the cylinder shall have a fixed orifice especially designed to achieve a minimum valve closing time in case of failure of oil pipeline.

A locking device shall be provided so that the valve can be maintained in open/shut position during maintenance and inspection.

The hydraulic controls for each valve shall be housed in independent cabinet located on an operating floor near the valve. This shall consist of pumping unit, oil tank, and accumulator of adequate - capacity to hold the valve disc at any position and to prevent any surge including disc flutter during valve travel and to fully open position. Accumulator will also have enough capacity for 2 strokes of operation without external electric AC power. The hydraulic power pack will consist of necessary pressure switches, pressure gauges, flow regulators, solenoid valves; transformers, rectifiers etc. for DC power supply for solenoid valves contactors, relays, fuses, indicating lamps, push buttons etc. for control of solenoid valves and pumping units; throttle valve, filters, non-return valves etc. arranged in a logical circuit to meet operation requirement

All oil pipelines *I* flexible hoses interconnecting the control cabinet to the valve shall be in bidders scope

The electrical controls for the valve such as relays, contactors and fuses shall be housed in the common panel (local) for CW pumps or in a separate panel.

Each butterfly valve shall have four limit switches, each capable of being set of at any point between full open to full close position to meet desired functions. In addition, one more extra limit switch to be set at an intermediate position shall be provided, each limit switch shall have 2 NO. and 2N C contacts. Limit switch enclosure shall conform to NEMA 4 x standard

2.5.2 SUBMITTALS

The contractor shall submit with his offer full details of valve operating mechanism and hydraulic diagram with description.

2.5.3 TESTS AND INSPECTION

The Contractor shall furnish type test certificates from a recognized test house certifying evaluation of accuracy, reliability and repeatability.

Each valve actuator assembly shall be given a complete operation test at the value manufacturer's shop to demonstrate that each operator is functional and all limit switches have been properly set.

Tests shall be also done for speed of travel, torque rating and calibration.

When practicable, each valve assembly shall be shop tested to open and close against the maximum differential pressure.

All the components of actuators shall be subject to tests at the works of Manufacturer as per relevant Material Specifications and Manufacturer's established practices, to ensure reliability. Details of the same shall be furnished to the Employer

Functional test on accumulators, Oil Pumps and completely assembled unit of Actuators shall be carried out as per approved procedure and Data Sheet.

Contractor Must Conduct Proof of Design Test on the Actuators as per A\NWA-C-504

3. AIR VALVE

3.1 GENERAL

The valves shall be as per the scope of work. The valves shall be capable of exhausting air from pipe work automatically when been filled. Air being released at a sufficiently higher rate to prevent the restriction of the Inflow rate. Similarly the valve shall be capable of ventilating pipe work automatically when being emptied. The air inflow rate being sufficiently high to prevent the development of a vacuum in pipeline. The valve shall automatically released air accumulating in pipeline work during normal working condition.

Air valves with a large orifice for ventilation for exhaust of air of the pipeline and small orifice for release of air under working pressure. The valve shall be suitable for maximum working pressure in the system. All air valves shall be provided with isolating valve and flanged end connection.

Air valves shall be designed to prevent premature closure prior to all air having been discharged from the line. The orifice shall be positively sealed in the close position but float (Ball) shall only be raised by the liquid and not by mixture of air and liquid. The sealing shall be design to prevent the floats striking after long period in the close position.

The aperture of valves must be properly designed for which the contractor shall submit design calculations for necessary approvals before the procurement of valves.

All branched outlets, including air valve or Tees will be provided with one ½”BSP coupling duly plugged for measurement of pressure in due course.

Air valves shall thus be designed to automatically operate so that they will;

- i. Positively open under internal pressure less than atmospheric pressure to admit air in bulk during pipeline draining operation;
- ii. Exhaust air in bulk and positively close as water, under low head, fills the body of the valve during filling operation;
- iii. Not blow shut under high velocity air discharge; and
- iv. Exhaust accumulated air under pressure while the pipe is flowing full of water.

The Contractor shall verify with the supplier of the valve that the valves have the capacity to sustain the pipeline test pressures prior to testing.

3.2 Specifications:

Air valve should be Single Chamber

Body should be made of HDPE & MS orequivalent Float should made with Polypropylene/Stainless Steel

Rolling Seal should be made with EPDM Gaskets and seals made of EPDM

Valve should be Epoxy coating both inside and outside
Flange Drilled as per DIN/ISO/BS/EN 1092

3.3. 3 Material of Construction

(i) Body (80 – 200 mm)	:	MS
(ii) Air & Vacuum Float	:	Polypropylene/Stainless Steel EPD
(iii) Rolling Seal	:	M
(iv) Automatic Float cover	:	Acetal EPD
(v) O-Ring	:	M
(vi) Automatic Float	:	Polypropylene/Stainless Steel
(vii) Discharge Outlet	:	Polypropylene
(viii) Bolts and Nuts	:	Galvanized Steel
(ix) Body (50 mm)	:	Polypropylene

All flanges will be drilled as per I.S. 1538/ISO/DIN/BS.

removal of the complete air valve in the event of maintenance.

4. DUEL PLATE CHECK VALVE

Duel plate check valves are used to prevent the back flow at pump discharge. Duel disc check valves should match with the following specifications

4.1 Specifications:

The Dual Plate Check Valve should be suitable for one way acting

The Dual Plate Check Valve should able to operate horizontally and vertically.

The Dual Plate Check Valve of PN 16 Should be able to activate against Very Low Pressure of 0.1 bar and also for the high pressure upto 16 Bar.

The Dual Plate Check Valve Seal should be Vulcanized EPDM for complete Drip Tight sealing.

The Dual Plate Check Valve should be compact in design and easy for assembling.

The Dual Plate Check Valve should be Epoxy coated.

4.2 Material of Construction

Body	:	Cast Iron GG 25 Ductile Iron GGG 50 Nickel
Disc	:	Plated
Spring	:	Stainless Steel
Washer	:	Polyethylene
Shaft	:	Stainless Steel
Locking Screw	:	Steel
Limit Shaft	:	Stainless Steel
		EPD
Bonnet Gasket	:	M

5. PUMP CONTROL VALVE

5.1 SPECIFICATION OF PUMP CONTROL VALVES

The Pump Control Valve shall open fully or shut off in response to electric signals. It shall isolate the pump from the system during pump starting and stopping, to prevent pipeline surges during Pump ON/OFF.

Valve Should be with Rapid-action piston for Fast Opening/Closing action to facilitate stable and accurate control.

Valve Should have High Kv factor e.g. 4" valve should have KV value of 475 m³/hr,

Valve should have Low head loss at high flow rates,

Valve should be strong, lightweight and corrosion proof surfaces, which resist cavitation damage, thus increasing service life and reducing operation & maintenance cost.

Valve should have Linear flow, Low turbulence to minimize cavitation, and allow high flow velocities with low noise and vibration.

Valve should have "Soft closure" feature to prevent water hammer.

Multi-Valve modular configuration Full redundancy enabled. Individual valves can be possible to separately removed for maintenance or replacement which reduces downtime and maintenance costs & allows maintenance work to be done without halting water flow.

5.2 MATERIAL OF CONSTRUCTION :

Valve Body, : Reinforced fiber glass nylon or Polypropylene

Pistons, Bushing, Front and Rear Cups : Reinforced fiber glass nylon or Polypropylene

Main seal : NBR, VITON or EPDM rubber,

O-rings : NBR or EPDM rubber

Inlets, outlets : Stainless steel/ Reinforced fiberglass nylon

Clamps, bolts : Stainless steel

Multi-Valve manifolds : Spheroid iron with polyester or epoxy coating

Pressure Rating : **PN 16**

Inspection and Testing of all equipment will be done as per the approved Quality Assurance Plan from Engineer in Chief.

6. M.S Expansion joints

6.1 Requirement

Expansion joints are necessary on the MS pipeline laid above ground to accommodate expansion and contraction of the MS line due to temperature variations, so that the expansion or contraction is not cumulative over several lengths. These joints permit linear movement of the pipe relative to the packing provided in the joint. Fabricated steel Bellow-type expansion joints, as per the EJMA standards, shall be provided and installed at the locations shown on longitudinal section of the pipeline.

Normally, on plain ground, the centre to centre distance of the expansion joints shall not be more than 300m. When the length of above ground pipeline is less than 300 m but more than 100 m, one expansion joint at the centre shall be provided. The pipe line shall be anchored firmly with concrete anchor blocks between two expansion joints, so that the expansion or contraction between two anchor blocks is accommodated by the expansion joint provided between the blocks. Supports / saddles shall be placed on each side of the expansion joint at about one meter distance from the centre of the joint to avoid unequal deflection of the pipe on either side of the joint.

The item covers providing and packing, transportation to work site and fixing wherever required on the pipeline with hydraulic testing along with the pipeline section.

6.2 Acceptable makes

Acceptable makes for the Bellow-type expansion joints shall be as per the approved vendor list. All the expansion joints shall have the same make. Contractor should not place order with any other manufacturer for the above said item till has been recommended in writing by employer for the makes listed above.

6.3 MATERIAL OF CONSTRUCTION

BELLOWS MATERIAL	SA 240 GR. 304
CENTRE SPOOL / WELDENDS	IS 2062 GR. B
INTERNAL SLEEVE	SA 240 GR. 304
LIMIT RODS / NUTS & CHECK NUTS	IS 1367
FLANGES	IS 2062 (AS PER IS 1538/IS 6392)

6.4 MS cover for expansion joints

6.5 Requirement

Circular MS covers shall be fabricated and fixed on the expansion joint for protecting the joint from possible damages. The item covers the cost of plates and material required, nut bolts, all taxes and duties, providing and applying two coats of epoxy paint in addition to one primer coat, transportation and fixing charges etc complete

7. Manufacture, supply. and installation of MS dismantling joint

Bellow type Dismantling joint shall be provided for each online sluice valves, butterfly valve and washout valve to facilitate removal of the valve for repairs whenever required.

The joints shall be fabricated as per EJMA standard .The item covers cost of Bellow type Dismantling joint, including all taxes and duties and cost of coating, packing, transportation, cost of jointing including required material such as nut bolts, rubber packing, labour cost etc complete with hydraulic testing to required pressure.

7.1 Material of Construction

BELLOWS MATERIAL	SA 240 GR. 304
CENTRE SPOOL / WELDENDS	IS 2062 GR. B
INTERNAL SLEEVE	SA 240 GR. 304
LIMIT RODS / NUTS & CHECK NUTS	IS 1367
FLANGES	IS 2062 (AS PER IS 1538/IS 6392)

7.2 Acceptable makes

Acceptable makes for the Bellow-type Dismantling joints shall be as per the approved vendor list. All the dismantling joints shall have the same make. Contractor should not place order with any other manufacturer for the above said item till has been recommended in writing by employer for the makes listed above.

8. Supply and fixing of roller bearings

1. Requirement

Steel roller bearings shall be provided and fixed on the bearing plates fixed on concrete pedestals for above ground pipeline, as shown on drawing. The bearing boxes shall be firmly fixed to the bearing plate. Number of bearings and rollers, size of rollers etc shall depend on the pressure and thrust on the pipeline and shall be as directed by the Engineer-in-Charge in charge.

2. METALIC / RUBBER EXPANSION JOINTS / DISMENTALING JOINTS

Metalic / Rubber expansion joints shall be provided between the discharge head outlet and valve in delivery line each pump for easy assembling and dismantling of the pipe work. The

metallic /rubber expansion joint shall with stand the internal test pressure and vacuum as specified in Schedule – design shall ensure that –

1. When assembled and under dynamic load the rigid bolts together withstand pull, equal to twice the duty head and no torque or pull is extending on the discharge head mounting fasteners.
2. During assembling or dismantling, the sliding flange can slide adequately to enable to detach discharge head and piping from each other.
3. The seal ring that joint shall be designed to withstand test pressure mentioned in Schedule 'B' without any leakage.

3. DESIGN AND CONSTRUCTION

Design of the expansion joints shall be restrained type with minimum three (3) tie rods.

BODY

Expansion bellow shall be manufactured from natural or synthetic rubber, with integral flanges at both ends. Split retaining rings of adequate design shall be supplied for severally holding the expansion joint with connecting pipe flanges.

CARCASS

Fabrics of high strength synthetic fibers shall be used in suitable number of pipes to hold the shape of the below at the working condition. All fabric pipe shall be impregnated with rubber or synthetic components to permit flexibility before them.

Copper coated steel wire or solid endless rings embedded in the carcass shall be coated with suitable material to protect the carcass from outside sewage and fluid corrosion.

Protective hypal on coatings shall be applied at the exterior.

4. CONTROL ROD ASSEMBLY

Each expansion joint shall be supplied with control rod assembly to prevent excessive elongation or contraction of the below. Control rod assembly will consist of long bolts, nuts and lock nuts, spherical washer connecting plates (guest plates) for fixing the assembly with mating flanges.

Control Rod assembly shall allow transverse and rotation movements under limiting axial conditions of the Expansion Joints.

Design of control rod assembly shall take care of the maximum axial thrust across the Bellow, calculated on the bases of maximum fluid internal pressure and internal diameter of the each.

Expansion joints shall be provided with flanges drilled to suit the Pumps delivery flange.

5. INSPECTION AND TESTING

Tests at hop shall include but not be limited to the following

- a. Material test as per specification requirement.
- b. Vacuum test.
- c. Hydro- test

6. HYDRAULIC PRESSURE TEST AND LEAKAGE TEST

All expansion bellows shall be subjected to internal hydrostatic pressure test of equivalent to 1.5 times the shut off head of pumps and the following condition.

1. Free position of the bellow for five (5) minutes.
2. With permitted (design) elongation and lateral deflection for Two(2) minutes and
3. With design contraction and lateral deflection for two (2) minutes.

After the hydro test is over, the bellow shall be dimensionally inspected to check deformation, if any.

During the test, the control assembly shall be suitably adjusted to obtain the test condition of the Bellow.

All tests shall be carried out in presence of the Engineer or his representative.

7. CLEANING, PROTECTION AND PAINTING

Before installation, all expansion joints shall be properly cleaned, as necessary. All exposed finished metal surfaces shall be greased to prevent dust.

8. DIS MANTLING JOINT

Item Design, Manufacture, Supply & Erection of Dismantling Joints of various diameter including hoisting lowering in position fixing in true plumb & level etc. including tie rods hardware gaskets & other necessary material for making joints including all taxes, central state & local conveyance to site, loading, unloading safe storage till erection etc. complete.

General: The item providing & fixing in position dismantling joint of various dia on the pipes. The design work man ship shall be to the specifications of Engineer & shall comply with one or more of the standards, regulations & codes issued by Bureau of Indian standard / B.S.

Item to Include: The Unit includes:

- Manufacturing of Dismantling joints, providing gasket, tie rods, nut, bolts & studs.
- Quality control
- Conveyance to site.
- Storage till erection
- Erection with all jointing material and labour

- Successful commissioning.
- All taxes central, state and local and any other incidental expenses.

Design to approved before manufacturing:

Before manufacturing the contractor shall submit to the Engineer-in-charge, the detailed drawing with relevant IS. The contractor shall not manufacture joints without written approval of Engineer-in-charge to the design.

Material of construction & Design data:

	i. Name of Fluid		Raw River Water	
ii.	Working Pressure	←	As per IS CODE provision	→

iii. Material of Construction

Inner shell	←	MS as per IS 2062 Gr. B.	→
Outer Sheet	←	MS as per IS 2062 Gr. B.	→
Pressure flange	←	MS as per IS 2062 Gr. B.	→
Nuts bolts tie bar	← →	CS IS 1367 Gr. B.(Galvanized)	studs
Gasket	←	Rubber	
'O' Ring	←	Neoprene (50 shore hardness)	→

iv. Governing standard

Flanges ← IR 1318
Fabrication ← IS 3589

- V. Testing** ← As per IS CODE provision
Test Certificate ← Hydraulic Test Certificate &

Material Test Certificate

Before the joints are actually fixed, they shall be cleaned, greased & it should be seen that all the parts are perfectly in working conditions.

9. Dismantling joints shall be suitable for flange bolting individual to flanges of BFV & NRV. Flange made segments & welded shall be stress relieved after welding.

Flange & machined surfaces shall be protected from corrosion during shipment and Subsequent storage by casting rust pan, preventative or equivalent which is easily removable with petroleum.

9. SURGE PROTECTION DEVICES

Surge Analysis

The contractor shall undertake surge analyses to determine the extent of surge pressures or other adverse hydraulic conditions that may occur during the operation of rising mains.

The contractor shall undertake the following tasks as an integral part of the surge analysis for each system:

1. Construct a mathematical model of the system using internationally recognized transient simulation computer software. The network model should be as detailed as possible incorporating high and low elevation points along the pipeline and detailed piping manifold in pump station area.
2. List all the steady state scenarios under which the system will operate;
3. List, with reasons, the most adverse surge conditions under which the system will operate;
4. Determine maximum and minimum surge pressures along the system that can occur due to system operation with and without cavitation conditions. The case with cavitation conditions must capture high and low surge pressures by simultaneously limiting low pressures to vapor pressure at all nodes considered in the mathematical model.
5. Add surge protection system to the network model and determine the maximum and minimum surge pressures for the most adverse surge conditions. The network model used for studying the effectiveness of surge protection system should also include all air venting valves, though they are not normally considered as part of the surge protection system.
6. Verify the adequacy of the surge protection system for other important operating scenarios such as new pipe roughness condition, power failure during single pump operation, and pump start up conditions.
7. The surge simulations must be carried out for at least 10 times $2L/c$ value where L is the total length (m) of the pipeline and c is the average celerity (wave speed) in m/s. Results presented should indicate the total simulation time, e.g., pressure variation graph w.r.t. time at some specific locations along the pipeline.
8. Computational time should be at a minimum of 0.005 seconds to capture all the pressure spikes arising from air valve slam conditions, NRV Slam Conditions and any other rapidly varying slam pressures. The report generated by the surge analysis software should be attached to demonstrate the use of all small computational time steps.
9. Surge Protection System should be suitable for the Thickness of Pipeline used for the Project. Thickness of the pipeline must be capable of withstanding both highest and lowest negative pressures in accordance with the appropriate Indian or AWWA standards.
10. Prepare a Surge Analysis Report providing full details of tasks (1) to (6), including sufficient data sheets, figures, and analysis output etc. from the transient simulation computer software to allow the vetting authority to undertake a detailed review of the Surge Analysis Report.

The Report should be Vetted by Competent Authority as decided by employer and if they suggests additional simulations and/or changes to the protection methods, the contractor shall incorporate all the necessary changes as agreed mutually by client and contractor and resubmit the report.

Surge protection system should comprise of bladder vessels only or along with any or all of the following equipments depending on the recommendation of surge analysis to prevent the positive and negative surges in the pipeline.

Surge protection system comprises of bladder vessel and surge suppression valve must be in working condition for projects in india.

Surge monitoring system comprises of data logger, pressure transmitter to be supplied to enable to study the surge effect.

TECHNICAL SPECIFICATIONS OF SURGE PROTECTION EQUIPMENT

Supplying erecting commissioning of Three Stage Surge Suppression Valve OPERATION :

The Valve should be able to take high air intake capacity and Discharge the Air in Controlled Way by predesigned Small Orifice to allow the rejoining of columns slowly.

SPECIFICATION :

- **Air Intake:** The Valves should offer very high air intake capacity with nominal orifice size for ex. 6" valve should have a large orifice of 6" along with better aerodynamic design to reduce the obstruction of air flow through the valve.
- **Sealing:** The models should be equipped with a two stage sealing, a soft EPDM seal and Bronze seat. As float approaches the orifice it meets first the rubber seal and as pressure increases the seal is pushed and the float seats on the Bronze seat. This ensures low minimum sealing pressure of 2 meters and long life maintenance and leakage free operation.
- **Float design:** Floats should be made of polycarbonate, and should be tested for 100 bar bursting pressure for all pressure ratings of the valves. The float design should offers long term maintenance free operation and resistance against drowning effect of float against orifice. The float design and the air valve body design should offer better protection against pre-mature closing of the valve. The spherical hollow design of the float will offer less resistance which leads to high flow capacities and also avoids accumulation of debris.
- **Air discharge and surge suppression:** The Surge Suppression Disc should be used in Surge Suppression Air Valve The following parameters are emphasized for the purpose of simulation:
 1. **Air Intake Orifice:** Both the models offer nominal size of orifice for ex. 6" valve has a large orifice of 6" offering very high intake capacity due to less frictional losses.
 2. **Air Outlet Orifice(Surge Suppression orifice):** Manufacturer should develop standard Surge Suppression orifice sizes for each size for Customization of specific requirement as per the hydraulic analysis.
- **Switching pressure:** This denotes differential pressure required to switch from large orifice to Surge Suppression orifice during air release. **The Valve Should have Surge Suppression Disc operating from a differential pressure less than 2 KPA (20cm) of water column.**

Technical Specification for ARI surge suppression High Flow Combination Air Release Valve Material of Construction

Body &	MS & HDPE AS PER IS CODE
• Cover	
Float	
• (Kinetic) :	Polycarbonate
Float	
• (Automatic) :	Foamed Polypropylene

- Nozzle Seat : Bronze ASTM B-62 B-271
- Nozzle Seal : Rubber E.P.D.M.
- Seal (Automatic) : EPDM
- O-Ring : Buna-N
Ductile Iron ASTM A 536 / EN 1563
- Screen Cover : 1563
- Screen : Stainless Steel SAE 304
- Bolt and Nut : Galvanized Steel
- Working Pressure : AS PER IS CODE

10. FLOW MEASUREMENT DEVICES:

10.1 Scope :

Electromagnetic Flow Meter of appropriate size shall be installed at the end of the manifold/s to measure the quantity of water discharged in to the Rising mains

10.2 Electromagnetic Full Bore Type Flow Meter

Full bore electromagnetic flow meter shall consist of flow sensor (i.e. flow tube), flow transmitter and flow indicator and integrator and any other item required to complete the system. To avoid the effects of disturbances in the velocity profile, a straight and uninterrupted run, upstream as well as downstream from the location of the flow meter shall be provided, as required by the flow meter manufacturer and in line with the applicable standards. Contractor shall finalize the exact location of flow meter in consultation with Representative of Employer.

Flow measurement shall not be affected by physical properties of water viz., temperature, pressure turbidity etc., within given limits. Contractor shall provide compensating Electronic circuits, if required.

A lockable enclosure shall be provided for the flow transmitter cum computing unit, if required.

Flow meters shall be suitable for the water turbidity at site during various seasons. Flow tube shall be rugged in construction and shall be suitable for continuous operation. Flow tube shall have waterproof construction and shall be suitable for installation on underground /above ground pipe lines.

The flow computer and transmitter shall be a single unit suitable for panel mounting. It shall accept inputs from flow tube, process the signals and shall provide an output proportional to the flow rate. The distance between transmitter and flow tube shall be maximum 250 m. Taper pieces required for installation of flow meter shall not exceed an angle of 8° in order to avoid disturbance in flow profile.

a) General :

- (i) Accuracy of flow measurement during FAT $\pm 0.5\%$ of measured value
Overall accuracy of flow measurement
- (ii) loop. $\pm 1.0\%$ of measured flow

b) Flow tube

- (i) Application : The water pumping mains
- (ii) Type : In line full bore electromagnetic
- (iii) Size of flow tube : As approved by the Employer.
- (iv) Process connection : Flanges as per BS 4504
- (v) Weather Protection Class : IP 68 as per IS 13947
- (vi) Surge protection devices (SPD)
between flow tube and flow transmitter: Required for protection from lightning surges
- (vii) Material of Construction :
Electrodes : SS 316, self cleaning pipe
SS 316, fully welded
Coil Housing : construction.
/S.S flow tube with carbon steel coil housing
Flanges : Carbon steel
SS
Grounding ring: 316
- (viii) Flow tube Lining : EPDM/Neoprene/PTFE.

c) Flow Transmitter Unit

- (i) Type : Microprocessor based with facility to configure theranges.
- (ii) Type of display : 4 digit backlit LCD/ LCD, for flow rate
In
m³/hr. 8digit backlit LCD/ LCD for
totalized
flow in ML
Flow rate -m³ / hr or LPS as desired by
employer
Totalized flow – ML
- (iii) Units of display : From flow tube
- (iv) Input : 4-20 mA DC (isolated) proportional to
flow rate
- (v) Output :
- (vi) Power Supply : 230 VAC
- (vii) Zero and Span Adjustment : Required
- (viii) Weather Protection Class : IP 68 as per IS 13947
- (ix) Battery backup for totalized flow
Type Online

Capacity 2.5 mVA

Backup Time 8 hours.

(xi) Facility for on line diagnosis: Required

10.3 Calibration:

The Electromagnetic flow meter shall be wet calibrated for the full flow range specified as per BS EN 29104 (Methods of evaluation of electromagnetic flow meters). The calibration method shall be either gravimetric method as per ISO 4185 (Measurement of fluid flow in closed conduits – weighing method) or volumetric method as per ISO 8316 (Calibration by Volumetric Method). The 'test bed' shall be accredited by appropriate National / International certifying authority. The Contractor shall produce accreditation certificates for

the test facility and calibration certificate for the flow meter for the review by representative of the Employer. The Contractor shall also demonstrate complete wet calibration on the test bed in the flow meter laboratory. The flow meter shall be acceptable if the accuracy and repeatability is equal to or better than those specified.

10.4 Flow Indicator and Integrator

Flow indicator and integrators shall be modular in design. It shall consist of two separate dedicated displays for flow rate indication and total flow indication. It shall accept 4-20 mA DC isolated input. The flow integration shall be carried out in the Programmable Logic Controller (PLC). The flow indicator cum flow integrator shall provide 4-20 mA retransmission output proportional to flow rate.

Sl. No.	Details	Description
1	Type	Microprocessor based
2	Mounting	Front facia of Control Panel
3	Display	Digital, seven segment back lit LCD / LED display
4	Digit Height	14 mm or Higher
5	No. of Digits for Flow indicator Flow integrator	4 Digits 6 Digits
6	Input	4-20 mA DC (Isolated) from flow transmitter through analogue signal multiplier (Refer Note 2)
7	Zero and span adjustment	Required
8	Manual Reset Facility for flow integrator	Required (shall be password protected)
9	Engineering units: - Flow rate indicator	Cum/hr

	- Flow integrator	ML
10	Battery backup for integrator	Required
11	Retransmitted output	4-20 mA proportional to flow rate
12	Alarm outputs	1 NO + 1 NC for high and low alarms (adjustable)
13	Communication port	RS-485 (With Mod bus protocol) for interfacing with PLC
14	Weather Protection	Class IP-52 of IS 13947 Part I
15	Accuracy	$\pm 0.25\%$ of span or better.

Notes:

1. Digital flow indicator and flow integrator shall be a combined unit.
2. Facility shall be available in the analog signal multipliers and in the flow indicator and integrator for providing excitation voltage for the flow transmitter in case of 2-wire flow transmitters.

10.5 Acceptable makes for Electromagnetic Flow meters

Acceptable makes for the Electromagnetic Flow meters shall be as per the approved vendor list. All the Electromagnetic Flow meters shall have the same make. Contractor should not place order with any other manufacturer for the above said item till it has been recommended in writing by employer for the makes listed above.

10.6 Installation

The installation of the Electromagnetic Flow meters shall be done at the locations decided by the Engineer-in-Charge. The job covers supply of the Electromagnetic Flow meters at work site with cost of all the required material and all types of taxes and duties, cost of packing, loading, transportation, unloading, stacking and installation at the specified location with cost of all jointing materials such as nuts and bolts, EPDM rubber gaskets etc. The job also covers field hydraulic testing of the Electromagnetic Flow meters after installation for the specified test pressure for the respective pipeline section.

11. PIPE, VALVES, FITTINGS OF AUXILLARY SYSTEM**11.1 CODE& STANDARDS**

The design, manufacture, shops testing, erection testing and commissioning of piping and valves shall conform to the latest revisions of applicable Indian standards.

11.2 SCOPE

The equipment & material to be supplied for the Pumping station under this section shall include but not be limited to the following.

Pipes, bends elbows, tees, branches laterals, crosses, reducing unions, couplings, cap, expansion joints, flanges, blank flanges, saddles, shoes, sampling connections etc. necessary for making a reliable piping system.

Gaskets, ring joint, bracing rings, jointing material etc. as required.
Instrument tapping connection, stub and thermo wells.

Supply and machining work of flanges, pipe spools and matching pipes to conned flow measuring orifice nozzles etc., pressure accumulators as necessary.

Valve to start stop and regulate flow.

Strainers

Anchor block (for buried/ over ground piping), support brackets, clamps, supports etc. for the piping

Bolts, nuts, fasteners as required for interconnecting piping, valves and fitting as well as for terminal point.

Secondary steel for pipe supports and embedded steel. Also pipe supports and necessary embedment required to be embedded in concrete for under ground/above ground pipe.

Painting anti-corrosive coatings, etc. inside and outside of pipes as necessary.

All embedded parts required for all tanks, water-retaining structures made of RCC including puddle pipes shall be supplied by the contractor.

11.3 DESIGN, CONSTRUCTION AND ERECTION Piping (General)

11.4 Design of Piping Systems

For water, air and other services where steel pipes are used, joints of this size range shall be screwed/flanged type;

All unlined steel pipes 65 NB and above (other than .CI pipes and air service pipes) shall be jointed by butt welding.

All rubber lined pipes shall have flanged joints. Miter bends shall not be used on RL piping. Only forged fittings shall be used.

Steel pipe flanges shall be generally slip on or raised face type. Welded neck flanges shall be used when flange follows immediately after a butt-welding or where it is required with respect to service conditions. When weld neck or socket weld flanges are used, their bore must be made the same as that of the pipe being welded to Socket welded or threaded flanges may be used, with the appropriate piping system for connection of pipe to the flanged equipment

All the piping flanges and counter flanges shall conform to ANSI B 16.5 CI. 150.

For easy handling & removal of equipments, valves etc. and for maintenance purpose, break up flanges for 65 'NB and above sizes and suitable type of compression flexible coupling for flanged joints of 50 NB and below size shall be

provided. The overgrown piping, wherever routed inside building, shall have a clear head room of minimum 2.1 meter from operating floor.

Buried piping shall be generally installed so that the top of pipe is **1.0 meter below** the ground level unless otherwise specifically mentioned.

Complete supporting system for the pipe line shall be designed, fabricated and supplied by the Bidder. Inside the building, the overhead portion of the pipe line may be supported from the building structures. No support shall be taken from the brick wall. Outdoor, pipes other than buried pipes shall run on steel trestles. Crossing of the road shall be on a pipe bridge with a clear height to at least 6.1 meters over the road surface. All the steel structures for the pipe bridge, and the supporting posts /trestles along with all necessary hangers clamps, connecting steel, fixing bolts, nuts etc., shall be supplied and erected by the Bidder.

Miter bends will not be accepted for steel pipes of 250 NB and below. For sizes 300 and above, the miter bends shall conform to BS: 534.

For rubber lined pipe, lining should be applied in two (2) layers, giving a total thickness not less than 3 mm.

11.5 Painting and application procedures shall be as follows:

- a) Surface to be painted shall be thoroughly cleaned of loose mill scale, rust etc, by wire brushing.
- b) For over ground exposed steel pipes, two coats of red oxide primer (zinc chromate). primer shall be applied on the cleaned surface. There after minimum two (2) coats of synthetic enamel paint of approved colour shall be applied on the same to total dry film thickness of not less than 200 microns.
- c) The protective coating of buried pipe shall consist of coal tar primer 2 coats and 2 wraps of coal tar enamel and glass fiber inner wrap followed by glass fiber or coal tar impregnated kraft paper outer wrap. Min. thickness for each layer of application shall be as per IS: 10221, and the total thickness of the completed coating shall not be less than 3.2 mm.

11.6 VALVES AND STRAINERS

Valves will be used to start/stop & control flow.

All valves shall be suitable for service conditions i.e. flow temperature and pressure under which they are required.

Valves in Clarified/ Filtered water application

Either Butterfly type or sluice/ gate valves shall be used for isolation purposes. Sluice/gate valve shall conform to IS: 780 & IS: 2906 of rating PN 1.6 (min). Stem, body, seat ring and wedge facing ring shall be of stainless steel construction. Other parts shall be as per IS:780. Flanges shall be designed as per ANSI B 16.5 Cl. 150. to meet with the piping flanges. Valves shall be of outside screw and rising stem type. Sluice/Gate valves shall be provided with the following accessories in addition to the standard items.

- a) Hand wheel
- b) Manual Gear reduction unit operator for valves 200 NB and above.
- c) Bypass valves for valves of sizes 350 NB and above.
- d) Draining arrangement wherever required.
- e) Arrow indicating flow direction
- f) Position indicator

Sluice/ Gate Valves shall be provided with back seating bush to facilitate gland renewal during full open condition.

Butterfly valves shall be of double flanged or lugged wafer type of low leakage rate confirming to AWWA-C-504 class 150 or BS: 5155 Class 150.

The various components of butterfly valves shall be of the following:

i)	Body	:	Cast Iron - ASTM A 48 Cl. 40; BS: 1452 Gr. 220 SG Iron - BS : 2789
		:	Cast Steel - ASTM A 216 GR. WCB; 8S:1504 Eq. Gr.
ii)	Disc	:	Cast Iron - ASTM A 48 Cl. 40; BS:1452, Gr. 220 SG Iron - 8S 2789.
		:	Cast Steel- ASTM A216 Gr. WCB; 8S:1504 Eq. Gr.
iii)	Shaft	:	ASTM A 296 Gr. CF8M/AISI 316 : AISI 420: BS 970 Gr. 316; BS 970 Gr. 420
iv)	Seat rings	:	Nitrile rubber, EPDM (Ethylene propylene rubber), Hypalon

Butterfly valves shall be fitted with sleeve type bearing such as PTEF. Valves of 350 NB and above shall be provided with one or two thrust bearings to hold the disc securely in the of valve seat without hydraulic or external axial shaft loads. Sleeve and other bearings fitted into the valves body shall be of self lubricated materials that do not have any affect on the fluid handled and other components of the valves.

All the butterfly valves shall be provided with Hand wheel or level as per the requirements. For larger sizes i.e. 150 NB and above hand wheel shall be provided. For level/wrench operated valves, means shall be provided for positively holding the disc in not less than three intermediate positions. Manually operated valves shall be provided with reduction gear unit for valves of size 200NB and above. Valve provided with motorized pneumatic actuator shall be with a hand wheel for manual operation. All the valves shall be equipped with adjustable mechanical stop-limiting devices to prevent over travel of the valve disc in the pen and closed positions. The

valve operators (Hand wheel Gear reduction unit motor actuator etc. shall be designed as per relevant International Standard.

All the butterfly valves shall be provided with an indicator to show the position of the disc. Flanges shall conform to ANSI B 16.5 CI. Conforming to the following technical specifications.

a) Ball Valves

- | | | |
|-------------------------------|-----------------|--|
| | | BS:5351 Class |
| i) | Design Standard | : 150 |
| ii) | Type | : Welded/Flanged ends; Fullbore; Shlit |
| iii) | Body & Seat | supported construction |
| iv). Material of Construction | | |
| | Body | : Carbon Steel/ Cast Iron |
| | Ball | : Stainless steel ANSI 420 |
| | Seat ring | : PTFE |
| | Stem | : Stainless steel AISI 420 |
| | Seats | : Nitrile rubber; PTFE. |

v) Valves shall be designed to be directly operable by a wrench/Handlever.

vi) Suitable stops be provided for both the fully open & close condition.

vii) All the valves shall be provided with an indicator for showing the position of the spindle.

b) Globe Valve

- | | | |
|-----|-----------------|---|
| i) | Design Standard | : IS:778 Class-I |
| ii) | Type | : Straight, rising stem, with outside Screw |

iii) Material of construction

1. Body, Bonnet, stuffing Box &: Leaded Tin

- | | | |
|----|-----------------------------------|-------------------------------|
| | Bronze conforming seat rings/Disc | IS:318 Gr. |
| 2. | Stem | : Stainless Steel, AISI - 316 |
| 3. | Disc | : 15:318 Gr. 2/AISI-316 |

Back seat shall be provided on the stem or on the disc.

- Renewable disc assembly shall consist of disc holder, disc, disc guide, Check nut and disc retaining nut with washer.
- Disc of globe valve may be provided with renewable rubber seating ring.

b) Handy wheels shall be marked with the word: 'OPEN' or 'SHUT' with arrow to indicate direction of opening or closing.

The valves shall conform to the following requirements:

i)	Design Standard	:	IS 780/ IS : 2906 rating PN 1.0 or Equipment
ii)	Type	:	Double Flanged or wafer body, outside screw and rising stem type
iii)	Material Construction	:	
1	Body	:	Cast Iron: 15:210 Gr. FG. 260
1	Stem	:	Stainless Steel AISI 420
1	Disc	:	Cast Iron 15:210 Gr. FG 260

The valves shall conform to the following specifications.

i)	Design	:	IS: 5312, BS: 1868, BS: 5153 or Eqvt.
ii)	Type	:	Swing check Type and Flanged ends.
iii)	Material of Construction (For non corrosive application)		
a)	Body & Cover Hinge disk/ door	:	Cast iron IS: 210 Gr. FG 260/or Cast Iron BS: 1452 Gr. 220 or Eqvt.
b)	Hinge Pin and Door/Disc. Pin	:	Cast steel ASTM A 216 Gr. WCB
c)	Disc facing ring	:	Stainless steel
d)	Body Seated ring	:	Stainless steel
e)	Bearing Bushes	:	Leaded Tin Bronze: IS: 318 Gr. 2
f)	Bolts	:	Carbon Steel

Flanges shall conform to ANSI B 16.5 CI . 150 to match with the piping flanges as specified elsewhere.

Body shall be permanently marked with an "arrow" Indicating the direction of motion of the fluid for all the check valves.

Check valves for clarified/ filtered water may be offered in Gun metal construction & with threaded ends for sizes 50 NB and below conforming to 15:778 or Equipment.

11.7 Strainers

a) Basket Strainers

- b) Basket strainers of simple design shall have the following materials of construction of raw/ clarified/ filtered water.

Body : Fabricated mild steel: IS:226 (Tested quality) Wire shall be stainless steel (AISI:316 18 BWG 30 mesh suitable reinforced. Reinforcement material shall also be of stainless steel construction.

Drain plug / Nuts: Gun metal;

- c) Inside of basket body shall be protected with one coat of red lead primer and minimum three coats of chlorinated rubber paints to a Total thickness of 200 microns.
- d) Suitable Vent and drain valves shall be provided for the strainers.
- e) Screen (strainer) flow area shall be at least four times pipe sectional area. Flow area in any portion of Basket strainer assembly shall not be less than the pipe cross sectional area.
- f) Pressure drop in clean condition shall not be more than 1.0 MWC.
- g) Basket Strainer shall be provided with lifting lugs and suitable mounting arrangement.
- h) For OM water service, body shall be rubber lined to minimum 4.5 mm thickness (soft rubber of shore Hardness 85 $\pm 5^\circ$ A).

11.8 Y - Type Strainer

- a) Y-Type strainer for water application shall be constructed of following

materials:

Body : Cast Iron 15:210 Gr: FG 260

: Wires, of stainless steel AISI - 316. 18 BWG 30 mesh

Strainers suitably

reinforced. Reinforcement material shall also be of stainless steel construction.

Drain Plug/Nuts : Gun metal (threaded construction).

- b) Y-Type strainers shall also conform to CI. 4.9.01 (b), (d), (e), and (t).

- c) Body of the Y -type strainers for alkali, and dematerialized water shall be of

Cast Iron (IS: 210. Gr. FG 260) and lined with soft or hard rubber to a thickness of 3 mm.

- d) For acid services, apart from the rubber lined body material, the screen material, shall be polypropylene or HDPE wire cloth of suitable mesh and thickness.

11.9 TEST FOR PIPING, VALVES & FITTINGS

a) Piping & Fittings

- i. Pipe shall be hydraulically tested as per relevant standards
- ii. Pipe which are to be of internal bead removed quality and subjected to pressure test after bead removal but before rubber lining.
- iii. All rubber lining is to be subjected to the following test as per IS: 4682 Part -I
 - a) Adhesion test b) Bleeding Test c) Thickness of lining d) Shore hardness e) Spark test 5 KV/mm of lining f) Ageing test on the samples of rubber sheets shall be one as per ASTM – D 471, part 37 before lining g) visual inspection.

Valves / Gages/ Strainers

All the valves shall be hydraulically tested for the body and test leak test as per relevant standard. For rubber lined valves, body shall be subject to

hydro test before rubber lining.

Back seat leakage test shall be done wherever applicable.

Seat Air leakage test at 1 kg/cm² shall be carried out wherever applicable as per relevant standards.

- iv. Elastomers wherever coated or lined for the valves shall be tested for the corrosion resistance against the medium for which those are selected as per relevant Standard and the test certificates shall be furnished for the Owner's approval.
- v. Rubber lining on valves/ Gates Strainers shall be checked in accordance with IS:4682 Part-I including all tests as indicated above for piping & fittings.
- vi. Strainer shall be hydraulically tested for its strength. The pressure drop across the strainer assembly shall be verified at design flow for clean condition for each type and size. If already conducted for each size! type, test certificates may be produced of Owner's review and approval.

11.10 TEST AT SITE

- a) All piping, valves, Gates, resin traps, strainers and other fittings after erection at site shall be tested to hydraulic test pressure of two times the operating pressure or 1.5 times the maximum allowable pressure whichever is higher for a period of one hour.
- b) All valves (Manual/ Automatic) shall be operated throughout 100% of the travel manually and as well as from control panel and these should function without any trouble whatsoever.

HYDROCYCLONE FILTER**2.10.1 SPECIFICATIONS****IS NUMBER: IS 14743:1999**

S NO.	TECHNICAL DATA	
1	NOMINAL SIZE (INCHES)	As per design requirement
	NOMINAL OPERATING PRESSURE	1.0 TO 6.0 KG/CM ²
	RANGE OF FLOW RATES	As per design requirement
	CAPACITY OF COLLECTION CHAMBER	As per design requirement
2	MATERIAL OF CONSTRUCTION	
	BODY INCLUDING COLLECTION CHAMBER	MS
	WALL THICKNESS (mm)	MINIMUM 3MM
3	COATING FOR BODY AND COLLECTION CHAMBER	
	TYPE	POWDER COATING
	COATING THICKNESS (MICRONS)	MINIMUM 70 MICRONS OF PURE POLYESTER ELECTROSTATIC POWDER COATING
4	MAXIMUM OPERATING PRESSURE	10.0 kg/cm ²
5	CLEAN PRESSURE DROP	0.2 TO 0.5 kg/cm ² AT NOMINAL FLOW RATE
6	SAFE MAXIMUM PRESSURE DROP	0.5 KG/CM ²

2.10.2 ADDITIONAL SPECIFICATIONS/REQUIREMENTS:

1. The capacity of filter selected should be more than 20% of the system flow.
2. The tank shall have dish ends
3. Powder coated with 70 to 80 micron thick deep blue colored pure polyester from both inside and outside surface for protection against corrosion and weather effects.
4. Hydro dynamically designed to create maximum centrifugal action to separate particles heavier than water.
5. Removes fine sand and silt particles of size higher than 75 microns and specific gravity more than 2.65
6. Special protection plate is provided at the bottom of the cone to avoid wear due to strong vortex.
7. Large volume of dirt collection chamber increases flushing interval.
8. Dirt can be easily flushed out through dirt collection chamber.
9. Maximum operating pressure 10 kg/cm²

5.0 FOOT VALVE**CONSTRUCTION FEATURES**

- Foot valve shall top end flanged type.
- All the dimensions of the valve shall be in accordance of IS-10805.
- The flanges and their dimensions of drilling shall be in accordance with IS – 1538.

- Size of foot valve shall be equal to the size of suction pipe line.
- The opening in the strainer may be in form of hole or slot or combination of both.
- The design of foot valve shall be such that the coefficient of friction shall not exceed the value given in table 2 of IS-10805.
- All coating shall be carried out outside after satisfactory testing of valves. Two coats of black Japan confirming to Type B of IS-341 shall be applied.
- Performance tests of valves shall be carried out as per IS-10805.

MATERIALS OF CONSTRUCTION

Housing, Seat and strainer	CI to IS Gr FG 200
Disc and disc plate	CI to IS Gr FG 200
Disc flap	Leather

SECTION VIII

ERECTION, TESTING, TRIAL RUN, COMMISSIONING AND TESTS AFTER COMPLETION

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SECTION VIII: ERECTION, TESTING, TRIAL RUN, COMMISSIONING AND TESTS AFTER COMPLETION**8.0 ERECTION GENERAL**

The Contractor's staff shall include adequate and competent erection engineers with proven, suitable, previous experience on similar Contracts to supervise the erection of the Works and sufficient skilled, semi-skilled and unskilled labor to ensure completion of Works in time. The Contractor shall not remove any representative, erector or skilled labor from the Site without prior approval of the Employer's Representative.

The Contractor shall ensure that no installation or erection work shall commence until full and unconditionally approved working drawings, signed and stamped by the Employer's Representative are available at Site.

The Contractor's erection staff shall arrive on the Site on dates to be agreed by the Employer's Representative. Before they proceed to the Site, however, the Contractor shall first satisfy himself, as necessary, that sufficient Plant/s***** of his supply has arrived on Site so that there will be no delay on this account.

The Contractor's representative responsible for erection shall be an erection engineer who is conversant with the erection and commissioning of the complete Works. If there are more than one erector, one of them will be in charge and the Contractor shall inform the Employer's Representative in writing which erector is designated as his representative and is in charge. Erection engineer is to report to Engineer in charge.

The Contractor shall be responsible for setting up and erecting the Plant/s***** to the line and levels of reference and of the positions, levels dimensions and alignment, appliances and labor in connection therewith. The checking of setting out of any line or level by Employer's Representative shall not in any way relieve the Contractor of his responsibility for the correctness thereof.

Erection of Plant/s shall be phased in such a manner so as not to obstruct the work being done by other contractors or operating staff who may be present at the time. Before commencing any erection work, the Contractor shall check the dimension of structures where the various items of Plant/ss are to be installed and shall bring any deviations from the required position, lines or dimensions to the notice of the Employer's Representative. Plant/s shall be erected in a neat and workmanlike manner on the foundations and at the locations shown on the approved drawings. Unless otherwise directed by the Employer's Representative, the Contractor shall adhere strictly to the aforesaid approved drawings. If any damage is caused by the Contractor during the course of erection to new or existing Plant/s or buildings or any part thereof, the Contractor shall, at no additional cost to the Employer, make good, repair or replace the damage, promptly and effectively as directed by the Employer's Representative and to the Employer's Representative satisfaction.

The Contractor shall align all equipment and holding down bolts and shall inform the Employer's Representative before proceeding with grouting-in the items concerned. The Contractor shall ensure that all equipment is securely held and remains in correct alignment before, during and after grouting-in.

The approval by the Employer's Representative of the Contractor's proposals for rigging and hoisting any items of the Plant/s into their final positions shall not relieve the Contractor from his responsibility for damage to completed structures, parts or members thereof or other installed equipment. He shall at his own cost make good, repair or replace any damaged or injured items, whether structural, electrical, architectural, or of any other description, promptly and effectively to the satisfaction of the Employer's Representative.

No Plant/s, equipment or other loads shall be moved across the floors of structures without first covering the floors with timber of sufficient size so that applied loads will be uniformly transferred to floor beams and girders. If it is required to reduce bending stresses and deflection, the beams and girders shall be provided with temporary supports.

During erection of the Plant/s the Employer's Representative will inspect the installation from time to time in the presence of the Contractor's Site representative to establish conformity with the requirements of the Specification. Any deviations and deficiencies found or evidence of unsatisfactory workmanship shall be corrected as instructed by the Employer's Representative.

8.1 LEVELLING AND GROUTING OF MACHINERY

Contractor shall undertake, sufficiently in advance, chipping of any unevenness of concrete on foundations, anchor bolt pockets, cutouts etc., to achieve uniform level of reference for erection. All concrete surfaces receiving grout shall be chipped as required to ensure better bonding with the grouting.

Contractor shall undertake the inspection of all components to be erected sufficiently in advance to check their soundness and conformity to drawings and the inspection records shall be signed by the Employer's Representative as approval for undertaking the installation of the components. Any damage, shortfalls etc. shall be made good to the satisfaction of the Employer's Representative.

All grout for equipment shall be carried out using non-shrinkable continuous grout materials with suitable framework of at least 12mm thickness. Surfaces to receive the grout shall be chipped and roughened and laitance shall be removed by wire brush or blast of air. Concrete surface shall be blown off by compressed air before commencing grouting. Grouting shall be done in one continuous operation from one side such that grout flows in a single wave until grout reaches all confined spaces with no air pockets and air from all confined spaces is expelled. A hydrostatic head of 150 mm shall be maintained during grouting operations. All grouting shall be carried out in the presence of the Employer's Representative. All lines and levels shall be checked after grout is set. Blockouts shall be closed using cement concrete of the same grade as that of the parent structure.

8.2 RECORDS, PROCEDURES AND REPORTS

The Contractor shall maintain records pertaining to the quality of installation / erection work and inspection, testing, compliance with all technical requirements in respect of all his works as described in the previous paragraphs. The reporting formats shall be in the approved formats. The Contractor shall submit such records to the Employer's Representative after the completion of any particular work before submitting the bill of supply / progress of work. Such report shall comprise shop inspection reports, shop testing reports, material test reports, based on which dispatch clearances are provided, and all the quality control reports of welding, erection and alignment records.

All the above mentioned records shall be submitted in the final form duly countersigned by the Employer's Representative attesting conformity to specifications and his approval of installation, and duly incorporating all the additions, alternations, and information as required by the Employer's Representative, on the basis of preliminary reports giving the progress of the work. Such records notwithstanding, any records submitted earlier with bill of supply / progress, etc., shall be duly bound and submitted to the Employer's Representative in six copies by the Contractor on his notification of the mechanical completion of erection.

8.3 GENERAL PREPARATIONS BEFORE COMPLETION OF THE PLANT/S

The documents listed in Sub-clauses 8.3.1, 8.3.2, 8.3.3 and 8.3.4 should be completed in accordance with the Contract schedule before completion of erection. The Employer's Representative and the Contractor shall preserve and control these documents in a safe and appropriate place on Site in order that both parties' personnel can make use of them at any time.

8.3.1 Technical Documents:

- Operation and Maintenance manual
- Design documents including the Contractor's design data, drawings and Specifications.
- Tools and test equipment list
- Spare parts list
- Lubricant list

8.3.2 Procedures:

- Mechanical testing procedure
- Electrical testing procedure
- Instrumentation testing procedure

- Detailed pre-commissioning and commissioning procedures
- Detailed Performance Test procedure

8.3.3 General and Coordination Documents:

- Detailed organization charts for pre-commissioning and commissioning showing lines of authorities and responsibility, and functions of all key personnel
- Job description of the members of the team
- Scheduled dates of assignment of each member to pre-commissioning and commissioning organization.
- Detailed schedule showing the time sequence which the Contractor anticipates to follow for the various steps in completion of erection, pre-commissioning and commissioning of each unit and equipment.
- Regulations for safety, hygiene and discipline
- Practical organization of the relationship (meetings, reports, etc.) between the Contractor and the Employer's Representative at the phases of pre-commissioning and commissioning.
- Emergency communication route.

8.3.4 Manpower:

Required manpower shall be provided as agreed between the Contractor and the Employer's Representative in a Manpower Mobilization Plan, which shall include the number and qualifications of the operator and maintenance personnel to be furnished by the Employer's Representative for the Plant/s.

8.4 COMPLETION OF ERECTION

The completion of Plant/s under erection by the Contractor shall be deemed to occur if all the units of the Plant/s are structurally and mechanically complete and will include, among other such responsibilities, the following:

- Plant/s in the Scope of the Contract has been erected, installed and grouted as per specifications.
- Installation checks are completed and approved by the Employer's Representative.
- Erected Plant/ss are totally ready for commissioning checks.

At the stage of completion of erection, the Contractor shall ensure that all the physical, aesthetic and workmanship aspects are totally complete and the Plant/s is fit and sound to undergo tests on completion and subsequent pre-commissioning checks.

Upon achieving the completion as described above, the Contractor shall, after having given 21 days advance notice of the expected date for carrying out the inspection, notify the Employer's Representative by a written notice intimating completion of erection and notify the Employer's Representative for inspection. The Employer's Representative shall proceed with the inspection of such units within 24 hours of such a notice.

The Employer's Representative shall certify completion when there are no defaults in the Works or provide the Contractor with a list of deficiencies for rectification, hereinafter referred as the "Punch List". The Contractor shall complete the rectification work within a jointly agreed period before pre-commissioning activities and obtain the Employer's Representative's acceptance or approval before proceeding with the same.

The Employer's Representative may inform the Contractor that the works are accepted with the Punch List (items which do not hamper operability, safety or maintainability) and allow the Contractors to proceed with the pre-commissioning checks when the Contractor under-takes to complete such outstanding works within an agreed time prior to or during the defects liability period. Taking over shall be based on rectification of all deficiencies which are to be completed before acceptance, as advised by the Punch List.

The erection period indicated by the Contractor would be deemed to cover all the activities up to Completion as stipulated in previous paragraphs, notice of completion by the Contractor, inspection by the

Employer's Representative for Completion, and Contractor's rectification of all deficiencies as noticed by the deficiency/Punch List, and acceptance by the Employer's Representative of such rectification's, prior to Tests on Completion.

Minor defects, which in the opinion of Employer's Representative do not hamper operability or maintainability, will not be taken into account for deciding Mechanical Completion. Such defects shall be rectified concurrent to commissioning checks before Tests on Completion. However, the Employer's Representative's decision in this regard is final.

The commissioning period as notified by the Contractor shall include all periods of pre-commissioning, trial runs and tests on completion.

It is in the Contractor's interest to offer the section/units/systems, progressively under Identified milestones within overall erection period, duly completed for rectification of any deficiencies pointed out by the Employer's Representative and to achieve mechanical completion before undertaking the tests on Completion within the specified erection period. The Employer's Representative also reserves the right to withhold the cost as estimated to be equivalent to the rectification of deficiencies pointed out to the Contractor until such a time as the deficiencies are rectified by the Contractor to the satisfaction of the Employer's Representative.

8.5 PRE-COMMISSIONING

After the completion of erection, pre-commissioning activities listed below shall be carried out to make the Plant/s ready for commissioning. All instruments, materials and provisions necessary for conducting site tests shall be provided by the Contractor at his own cost.

Upon completion of erection of each piece of equipment, facility or discrete part of the Plant/s, mechanical checks and tests shall be carried out according to the Contractor's checklist. The mechanical checks and tests shall be to establish that:

- The Plant/s is erected in accordance with the Contractor's construction drawings, pipe work drawings, instrument diagrams, etc., issued for the Plant/s;
- Materials are installed and mechanically function in accordance with the Contract; and
- Applicable codes as listed in the Contract are followed for materials and workmanship.

Items such as painting, thermal insulation and final clean up which do not materially affect the operation or safety of the Plant/s will be excluded. All these items shall be listed and completed after pre-commissioning or commissioning at the discretion of the Contractor, but before acceptance.

The Contractor shall prepare and maintain at Site test forms and records, which shall include:

- Description of type of test or check;
- Date and times of test or check;
- Identification of equipment and facilities;
- Test pressure, test data and results, including remarks, if any; and
- Signature of the Contractor's personnel attesting to data recorded; if any. The Contractor's construction forces thereof shall carry out checks, tests and records.

Wherever the Employer's Representative's witnessing or attesting of the check or test is required, the Employer's Representative's personnel shall attend such check and test. For this purpose, the Contractor shall keep the Employer's Representative informed of a day-to-day test plan schedule. The test plan schedule may be revised from time to time to reflect the actual progress of the work and test.

Any items found incomplete or requiring repair or adjustment shall be marked as such on the test records and reported by the Contractor to the Employer's Representative and the Contractor's personnel in charge of the relevant construction area.

Checking procedures shall be repeated until all the items on the checklist are cleared.

A complete set of test records shall be handed over to the Employer's Representative on completion.

The tests on the different mechanical and electrical equipment shall include but not be limited to:

8.5.1 Pumps, Piping and Valves

- Leakage tests shall be carried out on all erected pipe work, pumps and valves immediately after erection and where possible before being built in.
- Operating tests shall be conducted on valves.
- The pumps shall be tested for mechanical performance. The vibration and noise levels shall be checked to be within the specified limits.
- Pump performance tests shall be conducted for all raw water and clear water pump sets with initial duty impellers. Each pump shall be tested at a time
- To check and verify efficiency of each pump and vibration of pump.

8.5.2 Pump Motors

- Condition of winding insulation be tested and insulation values shall be restored to required level by suitable heating arrangements locally.

8.5.3 Instrumentation Testing Requirements

(a) Tests on Cables

- i. Check details are in accordance with the specification
- ii. Check for physical damage
- iii. Megger test between each core and armour / sheath
- iv. Continuity check
- v. Connections

(b) Continuity of Signal/Control/Power Supply Cables

After laying of the field signal/control/power supply cables and prior to connection up to the control panels/instruments, the following procedures shall be adopted:

- i. The signal/control/power supply cables shall be disconnected from each termination point in turn when the wires shall be 'rung-through' for identification and tagged.
- ii. The signal/control/power supply cables shall be reconnected to the termination points and again 'rung-through'.

(c) Loop Test

After testing and calibration of individual instruments forming the various loops, simulated functional test of the whole loop shall be performed before pre-commissioning. The procedure for conducting these tests shall be decided by the Employer's Representative and results shall be recorded. During loop test, it is the Contractor's responsibility to ensure that the calibration of instruments is intact and in order and if any instrument is found defective in calibration, he shall recalibrate the same without any extra cost. After the loop test is over, he shall connect back all the terminations and connections removed for loop test.

(d) Tests on Electrical Installation

- i. Check all closing, tripping, supervision and interlocking of control devices.
- ii. Check operation of all alarm circuits.

(e) Test on Complete Control System

- i. On completion, the functioning of the complete control system shall be tested to demonstrate its correct operation in accordance with the Specification.
- ii. For control system testing, the Contractor may provide temporary means to simulate operating conditions, but the system will not be finally accepted until correct operation has been demonstrated to the satisfaction of the Employer's Representative when all the Plant/s is operating.
- iii. The system shall be shown to operate correctly whatever the selection of duty and standby equipments may be.

- iv. Conditions to be tested shall include:
 - Normal automatic operation
 - Normal manual operation
 - Emergency manual operation

(f) System Validation

- i. The services of factory trained and field experienced instrumentation engineer(s) shall be provided to validate each system and verify that it is operational and performing its intended function within system tolerance. System tolerance is defined as the root-mean square sum of the system component published specified accuracy from input to output.
- ii. Each system shall be validated by simulating inputs at the first element in loop (i.e. sensor) of 10 %, 50 % and 90 % of span, or on/off and verifying loop output devices (i.e. indicator, alarm etc. except controllers).
- iii. During system validation, provisional settings shall be made on levels, pressure, alarms etc.
- iv. Correct operation of controllers shall be verified by observing that the final control element moves in the proper direction to correct the process variable as compared to the set point. All logic sequences shall be verified to operate in accordance with the specifications.
- v. All defects and malfunctions disclosed by tests shall be corrected immediately. New parts and materials shall be used as required and approved and tests shall be repeated.
- vi. A report certifying completion of validation of each instrument system indicating calculated system tolerances, verification that the system meets these tolerances and any provisional settings made to devices shall be provided. The report shall be made in the format required by the Employer's Representative and shall be certified by the Employer's Representative when he approves it.

(g) Final Operational Testing and Acceptance.

- i. Upon completion of instrument calibration and system validation, all systems shall be tested under process conditions.
- ii. The testing shall include, but not limited to all specified operational modes, taking process variables to their limits (simulated or process) to verify all alarms, failures, interlocks and operational interlocks between systems and/or mechanical equipment.
- iii. Any defects or malfunctions shall be immediately corrected using approved methods and materials and the tests shall then be repeated.
- iv. Upon completion of final operational testing, a report shall be submitted, indicating that the total control system provided meets all the functional requirements specified herein. This report shall be made in the format required by the Employer's Representative. The Employer's Representative shall certify this report when he approves it and it shall constitute final acceptance of the control system.

8.6 ELECTRICAL

The commissioning engineer may verify any commissioning tests / completion checks to satisfy himself that the Plant/s is fit and sound.

The commissioning tests / completion checks to be carried out shall include, but not be limited to, those described in subsequent paragraphs, as applicable to the individual equipment / system.

8.6.1 Commissioning Tests / Completion Checks

Preliminary Checks

In general, the following checks shall be carried out on all the equipment/systems, as applicable.

- a) Name plate details according to approved drawings / specifications
- b) Any physical damage or defect and cleanliness

- c) Tightness of all bolts, clamps and connections
- d) Oil leakages and oil level
- e) Condition of accessories and their completeness
- f) Clearances
- g) Earthing connections
- h) Correctness of installation with respect to approved drawings / specifications
- i) Lubrication of moving parts
- j) Alignment
- k) Correctness and condition of connections

General tests

a) **Commissioning Tests of Motor**

- Insulation resistance test of motor windings and cables. (PI for MV motors only)
- Continuity check for power and control cables.
- Winding resistance measurement in case of motors rated 55 kW and above.
- Control, interlock and protection schemes.
- Operation and setting of timer, in case of Star Delta starters.
- Phase sequence and rotation.
- No load trial run for observation of vibrations, noise and temperature of bearings etc.
- On load operation, starting and running load current (also observe vibrations, noise and temperature of bearing and winding).
- Relay setting as per relay co-ordination chart
- Simulation check of motor control circuit by local/ remote closing and tripping

b) **Commissioning Tests of Transformer:**

- i) Test oil for dielectric strength, tan delta, acidity, resistivity and dissolved gases, Insulation resistance test of windings.
- ii) Capacitance and tan delta test of condenser type bushings, before assembly.
- iii) Test the transformer for the following:
 - Voltage / turns ratio at all the taps.
 - Winding resistance at all the taps.
 - Short circuit impedance (at low voltage)
 - Magnetic balance.
 - Core loss at normal tap at low voltage.
 - IR and PI.
- iv) Vector group test.
- v) Phase sequence test.
- vi) Test the current transformers for following:
 - Continuity test.
 - Polarity test.
 - Insulation resistance test.
 - Magnetization characteristics.
 - Measurement of secondary winding resistance.
- vii) Line connection as per phasing diagram.
- viii) Winding resistance.
- ix) Insulation resistance of control wiring.

- x) Buchholz relay operation (for alarm and trip).
 - xi) OLTC control indicating and alarm circuit.
 - xii) Operation test of all protective devices (electrical and mechanical) and interlocks.
 - xiii) Calibration of temperature indicators (oil and winding) and temperature relays.
- c) Commissioning Tests of Switchboard:**
- i) Checks on relays.
 - ii) Insulation resistance test
 - iii) High voltage test
 - iv) Millivolt drop test for busbar joints
 - v) Checks on motors/ simulation check.
 - vi) Setting of relays, other alarms, tripping devices and interlocks as per scheme.
 - vii) Phase angle checks, measurement of magnitude and phase angle of current transformer secondary currents and potential transformer secondary voltage.
 - viii) Functional checking of all power and control circuits e.g. closing, tripping, control, interlock, supervision and alarm circuits including proper functioning of the component equipment.
- d) Commissioning Checks of Relay:**
- i) Check operating characteristics over the entire range by secondary injection.
 - ii) Check minimum pick up voltage.
 - iii) Check operation of electrical / mechanical targets.
 - iv) Relay settings.
- e) Commissioning Checks of Meter:**
- i) Check calibration.
 - ii) Megger all insulated portions.
 - iii) Check CT and VT connection with particular reference to their polarities for relevant meters.
- f) Commissioning Test of Circuit Breaker:**
- i) Check control wiring for correctness of connections, continuity and IR values.
 - ii) Manual operation of breaker.
 - iii) Power closing / operating manually and electrically.
 - iv) Breaker tripping and closing time.
 - v) Trip free and anti pumping operation.
 - vi) IR Values, resistance and minimum pick up voltage.
 - vii) Contact resistance.
 - viii) Simultaneous closing and mechanical interlocks provided.
 - ix) Check electrical and mechanical interlocks provided.
 - x) Checks on spring charging motor, correct operation of limit switch and time of charging,
 - xi) Checks on CTs.
 - xii) High voltage test,
 - xiii) All functional tests.
- g) Commissioning Tests of Voltage Transformer:**
- i) Insulation resistance test.
 - ii) Polarity test.
 - iii) Ratio test on all cores.
 - iv) Line connections as per connection diagram.

- v) Open delta test with low voltage, wherever required.
- h) Commissioning Tests on Current Transformer:**
 - i) Megger between windings, winding terminals and body.
 - ii) Polarity test.
 - iii) Ratio identification checking of all ratios on all cores by primary injection of current.
 - iv) Magnetization characteristics, secondary winding resistance.
 - v) Capacitance and tan delta test.
 - vi) Dielectric test of oil (wherever applicable).
- i) Commissioning Checks of Cable:**
 - i) Megger test between each core and armour / sheet.
 - ii) Continuity check.
 - iii) Connections.
 - iv) High voltage test for cables above 3.3kV.
- j) Commissioning Checks for Battery:**
 - i) Specific gravity test.
 - ii) Cell voltage test.
 - iii) Capacity test.
 - iv) Initial charging/ discharging cycle.
- k) Commissioning Checks of Battery Charger:**
 - i) Functional check of auxiliary devices, such as alarms, indicating lamps etc. and operational checks.
 - ii) Insulation test of all circuits.
 - iii) Measurement of voltage regulation and efficiency.
 - iv) No load current and voltage (AC) and voltage and current (both AC and DC) at different points.
 - v) Voltage at tap cell (While boost Charging)
- l) Commissioning Checks of Capacitor:**
 - i) Measurement of capacitance
 - ii) Capacitor loss tangent measurement (for above 1000V)
- m) Commissioning Checks of Neutral Grounding Resistor:**
 - i) High voltage test
 - ii) Ohmic value test
- n) Lighting System**

Commissioning tests stipulated in applicable standards and code of practice covering all lighting system equipment
- o) Earthing System**

Continuity of all conductors and joints shall be checked. The Employer's Representative may ask for earth continuity tests, earth resistance measurements and other tests, which in his opinion are necessary to prove that the system is in accordance with design, specification, code of practice and electricity rules. Earth grid resistance value should be not greater than one ohm.

8.7 INSTRUMENTATION AND CONTROL

- i) The list of tests to be carried for SAT along with test instruments to be used shall be furnished for review by the Employer's Representative.

- ii) The testing of all the equipment and accessories shall be carried out as per latest applicable Indian/International standards recommendations.
- iii) Prior to testing, all relevant documentation and sufficient briefing about the tests shall be given to Employer's Representative who would witness the testing.
- iv) After installation and commissioning, the Contractor shall demonstrate, by tests in the field, compliance of the values, functionalities, quality and reliability of the complete system and its components, both hardware and software, as specified and as per guarantees.
- v) Contractor shall be fully responsible for interfacing to the equipment of Others as indicated in the scope of works. It shall be Contractor's responsibility to ensure satisfactory functioning of the system in conjunction with related equipment like exchanges, data equipment and other communication equipment of the Employer's Representative. Problems relating to such interconnections shall be mutually resolved.
- vi) After tests as above, the complete system shall be on continuous uninterrupted service with all functionalities and interconnections without any failures or manual interventions for correction, modification, rectification or replacements in the Contractor's system.
- vii) Additional specific tests, if required, would be decided mutually.

SAT on local SCADA, UPS systems shall include the all tests covered under FAT documents except tests such heat run test and those tests which can not be conducted at site (such tests shall be approved by the Employer's Representative) in addition to integrated local SCADA, UPS systems testing at site with all field equipments/instruments

8.7.1 Site Calibration

Standard calibration procedures shall be used for calibrating all field instruments. All reference equipment, used for calibration, shall be certified from an authorized certifying agency, to be arranged by the Contractor at his own cost. At the time of calibration, standard calibration norms shall be adopted and the same will be documented for record purposes.

Calibration shall be performed in the presence of the Employer's Representative. The instrumentation shall be calibrated while being commissioned in order to verify that the high quality calibration carried out during FAT is not being disturbed (No undue adjustments shall be made for minor deviations). The Contractor will monitor and check the instrument calibration throughout the Operation and Maintenance period.

8.7.2 Instrumentation Installation and Pre-Commissioning Checks

- a) Check the exact location of the instrument with reference to the pipe and instrumentation diagram and/or the General Arrangement drawing.
- b) Check that tag plate with tag no. and description is provided for each instrument.
- c) Check the model No. and instrument type with reference to the technical specification requirements.
- d) Check all mounting and fixing arrangements and required accessories such as isolation valve, nuts and bolts, siphon etc.
- e) Check that the instrument installation is as per the installation drawing.
- f) Check the cable type, connections for power supply as well as signal cables.
- g) Check that cable shields for the instruments are properly terminated.
- h) For the flow meters, check that the flow rate and totalized flow reading on the various displays match.
- i) Check that the earthing is as per manufacturer's recommendation.
- j) Check that there are no leakages.
- k) For the level switches check that the level electrodes are connected to the correct level control units.

- l) For the temperature scanners, check that the communication port of temperature scanner is properly configured and interfaced with the PLC system. Also check that the alarm and trip signals for various channels of temperature scanner are properly configured.
- m) Check the loop continuity for every circuit. While this is being done, the power supply to the instrument shall be cut-off.
- n) Calibration checks of the instruments shall be carried out to ensure integrity with the manufacturer's factory test reports. (No undue adjustments shall be made for minor deviations)
- o) After switching on the instrument/system, it shall be monitored hourly and the data obtained shall be recorded and compared with the reference norms to ascertain whether any recalibration is required. If recalibration is required it shall be carried out using standard reference equipment/instruments at no extra cost.

8.7.3 Instrumentation Commissioning

- a) Each control loop and interlock shall be tested independently, in manual mode first and then in auto mode from the PLC and local SCADA system. The operation shall be checked for conformity with the approved logic in both modes. All pump control ON/OFF shall be checked in manual mode first.
- b) Annunciation system shall be checked as performance testing by simulating the condition and by passing in actual mode and then individual loop will be checked for annunciation system.
- c) All motorized valves shall be checked in manual mode first, from controls on the control panel, and feed-back from the field for valve on/off shall be checked on the panel.

8.7.4 Programmable Logic Control (PLC)

- a) The PLC system and software shall be loaded by the representative of the PLC manufacturer.
- b) Testing, commissioning and stabilization of the software shall be carried out by the authorized representative of the PLC manufacturer. The following checks shall be carried out:
 - All indicators and indicating controllers will be put in manual mode after independent checking.
 - Check that the PLC is properly configured and installed as per the approved drawings.
 - Check that the PLC wiring is as per approved drawing.
 - Check that the cables terminating in the PLC are properly dressed.
 - Check that the PLC is earthed as per manufacturer's recommendations.
 - Check that the PLC on-line battery is functioning properly.
 - Check that the PLC is correctly time synchronized with the local SCADA system
 - Check that the signals and events are getting correctly time stamped.
 - Check the PLC response when input signal is out of range.
 - Check that the correct ladder program is loaded in the PLC.
 - Check the PLC ladder program by simulating various normal and abnormal conditions.
 - Check that the data sheets and drawings are updated to reflect the as-built status.
 - All analogue inputs shall be connected to the PLC system first. All digital inputs shall be checked at terminals before connecting to the I/O card of PLC system. PLC system shall be installed and checked first, before connecting any control signals/cables. Software shall be loaded in the PLC first, before connecting I/O cards with signal cables. After complete checking of the system in manual mode, system shall be put in Auto mode.
- c) The PLC system manufacturer/supplier shall provide assistance/commissioning support at the time of commissioning, to be arranged and coordinated by the Contractor. Details regarding commissioning shall be provided prior to commissioning and any required modifications or changes shall be advised in advance.

8.7.5 Control Panel

- a) Check name plate details of every piece of associated equipment for conformity with the specifications.
- b) Check the tightness of all bolts, clamps, connecting terminals.
- c) Check for physical damage.
- d) Check cleanliness
- e) Check switch development
- f) Each wire shall be traced by continuity tests and it should be confirmed that wiring is as per the relevant drawings. All interconnections between panels/equipment shall be checked
- g) Megger test on all wires.
- h) Check on meters
- i) Check that the primary devices are set as per the system requirements.
- j) Checks on the control circuit for the functional requirements
- k) Check that the control panel front fascia layout is as per approved drawings.
- l) Check that the panel and all the panel equipment (viz. panel indicators, alarm annunciators, etc.) are connected to the proper earth.
- m) Check that spare cutouts on the control panel are blanked.
- n) Check that the panel indicator tag plates reflect the tag no. and the correct service description.
- o) Check whether the panel meters are fixed properly in their cutouts.
- p) Check that the instruments are identified inside the panel.
- q) Check that the panel meter instrument ranges are as per approved data sheets.
- r) Check that panel meters are provided with password protection facility.
- s) Check that the alarm inscription details are as per approved drawings.
- t) Check that the MCBs are identified by their function.
- u) Check that safety guards are provided for power supply terminals.
- v) Check the cables terminating in the control panel are properly dressed.
- w) Check that proper node addresses are given to the panel meters/ scanners connected on the communication bus.
- x) Check that the communication bus is terminated properly.
- y) Check working of alarm annunciator by simulating alarm conditions.
- z) Check that the panel meter readings match with other displays.
- aa) Check that the no. of decimal places and unit of measurement are same for all the displays.
- bb) Check that the data sheets and drawings are updated to reflect the as-built status.

8.7.6 Tests for Local SCADA

SAT on local SCADA systems shall include all the tests covered under FAT documents except tests which cannot be conducted at site (such tests shall be approved by the Employer's Representative) in addition to integrated local SCADA, communication system and UPS systems testing at site with all field equipment/instruments.

8.7.7 Tests for UPS

SAT on UPS systems shall include the all tests covered under FAT documents except tests which cannot be conducted at site (such tests shall be approved by the Employer's Representative) in addition to integrated local SCADA, UPS systems testing at site with all field equipments/instruments.

8.8 COMMISSIONING

After the completion of pre-commissioning activities the final checks and preparations necessary for start-up of the Plant/s shall be carried out. The Contractor shall submit to the Employer's Representative a written Notice of Mechanical Completion, which shall include:

1. Identity part of the Plant/s considered mechanically complete.
2. Copies of all relevant completed test reports.
3. Date on which the completion of the tests was achieved.
4. Check list.
5. Request for issuance of a Mechanical Completion Certificate in respect of that part.
6. Within fourteen (14) days from the date of receipt of the Contractor's written Notice, the Employer's Representative shall:
 - In the case of acceptance, issue a Mechanical Completion Certificate.
 - In the case of objection, submit a rejection statement setting forth remaining items to be completed or defects or deficiencies to be corrected before Mechanical Completion status can be accepted. When the Employer's Representative rejects the Contractor's Notice the Contractor shall take any necessary action to complete or correct the items marked and give the Employer's Representative a second Notice of Mechanical Completion.
7. After the issuance by the Employer's Representative of a Mechanical Completion Certificate, commissioning activities listed below shall be carried out to enable the start-up and operation of the Plant/s. Procedures are described as below:
 - A) Commissioning procedure shall be carried out in a methodical sequence as follows
 - Warming up
 - Start-up
 - Initial running
 - Operability adjustment
 - Stable operation
 - Final adjustment
8. At all stages of commissioning sequence, the Plant/s shall be operated at optimum Plant/s conditions. To ensure this, the Contractor may make minor adjustment to the conditions indicated in the Operation and Maintenance Manual as necessary.
9. The Contractor shall check the operating conditions of the Plant/s by constantly monitoring operating data.
10. The Contractor shall specify for each discrete part of the Plant/s the operational data to be recorded and the manner in which the data is to be taken.
11. The Employer's Representative on the forms to be mutually agreed shall record all the operating data. The Employer's Representative shall make a copy of the operating log and analytical data from initial operation through to the completion of Performance Test available to the Contractor for evaluation.
12. The Contractor shall carry out commissioning tests in the presence of the Employer's Representative. The evaluation of test results and decision passed by the Employer's Representative regarding the test results will be final and binding on the Contractor. Any additional tests or repetition of tests to establish satisfactory operation of any equipment shall be carried out by the Contractor, if so desired by the Employer's Representative, at no extra cost.
13. All checks and tests shall be as per the Manufacturer's drawing manuals, relevant codes of installation and as per commissioning checklists.
14. Among other commissioning tests, the following shall be carried out at site after completion of installation. Contractor shall ensure to use calibrated test equipment having valid calibration test

certificates from standard laboratories traceable to National Standards / International Standards.
All tests to be carried out in the presence of Employer's Representative.

8.8.1 Commissioning Tests

Following commissioning tests are to be carried out on all the equipment/systems, as applicable.

- Insulation resistance measurement of equipment, accessories, cabling/wiring etc.
- Dielectric tests on equipment, accessories, cabling/ wires etc.
- Phase sequence and polarity
- Voltage and current ratios
- Vector group
- Resistance measurement of winding, contacts etc.
- Continuity tests
- Calibration of indicators, meters, relays, etc.
- Control and interlock checks
- Settings of equipment and accessories
- Checking of accuracy/error
- Checking of operating characteristics, pick-up voltages and currents, etc.
- Operational and functional tests on equipment, accessories, control schemes, alarm/trip/indication circuits, etc.
- Measurement of guaranteed/approved design values including lighting levels, earth resistance measurement, etc.
- Complete commissioning checks of the system

8.9 SAFETY PROCEDURE AND PRACTICE

Following safety procedure and practice should be provided by the Contractor in the switchboard room/ substation as per latest edition of I.S. 5216.

- a) Rubber matting in front of HV, MV and LV switchboard and other panels in switchboard room
- b) Shock treatment chart in switchboard / electrical equipment room
- c) Caution/Danger Board on -
 - HV, MV and LV switchboard and other LV panels
 - Lighting distribution board
 - Transformer yard.
- d) Sand bucket in switchboard / electrical equipment room/ transformer yard
- e) Fire extinguisher in switchboard/ electrical equipment room
- f) One set of hand gloves in switchboard room
- g) First aid box in switchboard / electrical equipment room

8.9.1 Fire Safety

The requirement of hand appliance in switchboard room, electrical equipment room shall be as per the latest edition of Fire Protection Manual by Regional Tariff Committee.

8.9.2 Contractor's Licence

- The Contractor shall obtain the necessary Licence/ Authorization from the Licensing Board of the locality/ State for carrying out the installation work. The persons deputed by the Contractor should also hold valid permits issued/ recognized by the Licensing Board of the locality/ State in which the work is to be done.

- The electrical installation work shall be carried out by licensed electricians only and approved by appropriate authorities. It is the responsibility of Contractor to get approval of complete system from the appropriate authority.

8.10 PIPELINE WORKS

8.10.1 Test on Pipe Line

The sectional testing of MS/HDPE pipeline shall be done as per the provisions set out in the section 5 along with the laying of pipelines. The tested pipeline will be joined by gap pieces to complete the total physical completion of works. The maximum length for sectional testing in case of pipeline shall be as specified in section 5 except for cases where, according to the Employer's Representative, the criteria can not be met due to specific Site conditions.

The laid pipeline will be joined with respective manifold through valves. Just before the commissioning the complete transmission main will be checked for:

- (i) All the motorized valves in the system will be inspected for proper lubrication, manual and electrical operation.
- (ii) All air valves shall be inspected for proper fitting and operation of isolating valves.
- (iii) All flange joints/ expansion joints/ couplings will be checked for tightness of all bolts, clamps, etc.
- (iv) The entire transmission system shall be checked for proper soil cover/ backfilling/ thrust and anchor blocking, etc.
- (v) The structures will be checked for any constructional defects.
- (vi) The valve chambers and their surroundings will be checked for its cleanliness.
- (vii) The rectifiers, batteries, battery chargers will be checked for their functioning along with pipe to soil potentials (PSP) at every test lead point for proper soil potential. All stations to be monitored regularly during the commissioning and trial run period and data related to PSP, individual anode current, energy consumption, battery performance, etc., to be incorporated in the log-book.
- (viii) Surge protection system shall be checked for the proper functioning.

8.10.2 Leakage Test

The entire pipeline shall be subjected to a hydraulic test as follows, to the required test pressure as per IS: 5822.

If a drop in pressure occurs, the quantity of water added in order to reestablish the test pressure should be carefully measured. This should not exceed 0.1 liter/ mm of pipe diameter per kilometer of pipeline per 24 hours for each 30 m head of pressure applied.

All the joints, valves, fittings which are not tested during sectional testing shall be physically checked for leakages and leakages repaired if found.

The Contractor shall provide and maintain all requisite facilities, instruments, for the field testing of the material. All pipes, specials, valves and civil works shall be replaced by the Contractor free of cost if damaged during testing.

8.10.3 Surge Protection Test

The effectiveness of the surge protection system shall be checked as follows,

- Install pressure gauges at the pressure gauge points such as immediately after pumps, at summits, at valleys, at critical points, etc.
- Run all the pumps at a time at least for one hour and then shut off all the pumps at a time.
- Record the pressure gauge readings before and after shut off.
- Inspect working of the various equipment of the surge protection system.

The pressure gauge readings at any point should show the pressure increase less than as specified for design of surge protection system. Vacuum pressure of -3.0 m (minus three meters) is allowed in the system. No leakages should occur other than the places observed above in the leakage test. The surge

protection system shall work smoothly without any visual distress, failing which the Contractor shall take necessary measures to improve/correct /replace the surge protection system.

8.10.4 Hydraulic Tests

All equipment subject to water pressure including castings, pressure vessels, pumps, pipes, fittings, and valves, shall be hydraulically tested to the pressure specified or in accordance with the applicable standard. Hydraulic test facility shall be made available at the manufacturer's works.

Any of the hydraulically tested items shall be subject to the Employer's Representative inspector's random item proof re-test and notice of testing dates shall be submitted to the Employer's Representative.

8.10.5 Site Testing

The Contractor shall arrange for the full site testing of all items of equipment and shall include provision of:

- a) All skilled and qualified operating and test staff for the testing of all equipment;
- b) Provision and disposal of all services, lubricants, and fuels other than electricity;
- c) All measuring and testing instruments to demonstrate equipment operates to the fulfillment of the works test;

8.10.6 All Loading Weights for the Load Testing of all Lifting Equipment

The Contractor shall carry out all the tests to the satisfaction of the Employer's Representative.

The Contractor shall be responsible for coordinating the programme of site testing of all items and to ensure that all parties concerned are present during any tests to oblige their responsibilities.

8.10.7 Documentation

Set of documents shall be prepared and maintained by the Contractor and one set of the latest revised documents shall always be kept at site. The following documents shall be prepared by the Contractor:

- All latest approved L-sections and alignment drawings.
- All up-to-date as built drawings.
- Data sheets for instrument specification and selection
- List of electrical equipment along with data sheet/ literature
- Erection/ Instruction manual of electrical equipment
- Commissioning manual of electrical equipment
- Instrument Schedule
- Electrical cable schedule and inter-connection diagram
- Instrumentation schedule
- Instrumentation cable schedule
- Loop drawings for instruments in the field and control panel
- Instrument test and calibration report
- Instrument installation drawings
- As built drawings and G.A. Drawings for equipment and instrument installation

The Contractor shall keep on site two sets of the latest revised Operation, Maintenance and Calibration manuals for all field instruments and sub systems, annunciation system, data loggers, indicating controllers and PLC system etc.

8.11 TRIAL RUN OF THE SYSTEM

After execution of the works the Contractor shall make trial runs of the individual components. A continuous operation of the component for a period of 7 days to the satisfaction of the Employer's Representative will be deemed to demonstrate satisfactory completion of trial run for the individual component. The cost of electricity, and other consumables for operation and maintenance of the System

during the period of this trial run will be borne by the Contractor. The costs towards the Contractor's Representative and other operating personnel during the said period of trial run, along with cost of tools and spare parts, which are required for operation and maintenance of the plant and equipment during the trial run period shall also be borne by the Contractor and shall be included in Contract Price. In the event that the System or any of the facilities do not satisfactorily achieve the required performance standards during this period, the trial run period shall be extended until such time as the Contractor has satisfactorily rectified any deficiencies as may be necessary to satisfy the performance requirements, at the risk and cost of the Contractor.

8.12 SYSTEM COMMISSIONING

The Contractor shall be responsible for commissioning of the entire system under design and operating conditions or under conditions which the Engineer in Charge may define and which in no case shall exceed the design and operational conditions. The System commissioning shall commence after the work has been physically completed to the satisfaction of the Engineer in Charge. The design and operation conditions are as follows:

The timing of the system commissioning will depend upon the permissible operation period for the scheme. Contractor shall be responsible to plan his activities accordingly. The Contractor shall prepare the entire system for the execution of the tests complete with all required taps, branches with blank flanges, etc. All these provisions have to be of a durable nature so that the tests can be repeated even after several years. He has to provide all the equipment for the execution of the tests and for the measuring and recording of:

- a) Pressure at various points within the pump station and the pipeline
- b) Head losses across different valves and fittings
- c) Overall energy efficiency of the pumping system at the prescribed flow rates
- d) Quality of water delivered
- e) Loss of water in **main**

The Contractor may engage an institution for the execution of the required tests and their monitoring at his own cost. The institution has to be approved by the Engineer in Charge.

On completion of the Trial Run, commissioning of the System shall be done by the Contractor. The system shall be considered as fully achieved after the full system has run continuously for a period of 15 days without any breakdown to the satisfaction of Employer's Representative. If continuous run is not achieved fully to the satisfaction of Employer's Representative, the Contractor has to do the needful to achieve the same at his cost. All the costs thereof, including the cost of staff, maintenance, and any other consumables for operation and maintenance of the system during the period of commissioning except for the electricity consumed during the commissioning period shall be borne by the Contractor. The cost of the electricity will be borne by the Employer.

The operation of the system solely for the purpose of maintaining partial supply by or on behalf of the Department shall not be taken as evidence that any work has fulfilled the commissioning tests, or has been taken over unless the Engineer in Charge specifically states so in writing.

The necessary protocol must be maintained for record purposes, jointly with Engineer in Charge and/or the authorized Representative of the Department.

8.13 OPERATION MANUAL

Along with detailed operation manual for main Pump House and whole scheme a separate manuals submitted by the bidder at the time of handing over the system.

SECTION IX

QUALITY ASSURANCE AND QUALITY CONTROL

SECTION 9: QUALITY ASSURANCE AND QUALITY CONTROL

9.1 GENERAL OBLIGATIONS OF THE CONTRACTOR

- I. The Contractor shall establish staff, equip and operate a comprehensive quality assurance organization at the site during the full period of the Works. The principal responsibility and duty of this organization shall be to ensure that all work carried out and materials produced or supplied by the Contractor shall comply fully with the Specifications as well as with all relevant Indian or other standards.
- II.
 - a) The Contractor shall prepare a detailed quality control manual, organization plan and staffing programme. This manual shall list all internal quality control procedures to be undertaken by the Contractor, given details of laboratories (listing their equipment and testing procedures), reporting procedures, Quality control training programmes for his staff. Sampling procedure, frequency of testing, preservation of samples, list of external Quality control labs having accreditation where the samples can be sent to counter check, tolerance.
 - b) The Contractor shall prepare detailed Quality assurance and control procedures with detailed procedure for control charts, statistical analysis & online reporting system. The bidder shall design such systems & provide hardware & software's for day to day reporting of the programmed & frequency of testing.
- III. **Within 60 days of issue of the order to Commence, the Contractor will submit to the Engineer-in-charge, for review and approval, a detailed and updated Quality control manual and programme, which will take into account all comments made by the Engineer-in-charge.**
- IV. At all times, the Contractor's quality control and other site personnel will co-operate with and inform fully the Engineer-in-charge in all matters relating to the work in progress and testing of materials etc., and will reply promptly to any requests by the Engineer-in-charge and his site supervision personnel for additional information and data.
- V. The Engineer-in-charge may establish and operate his own site laboratories for materials testing, and contractor will be required to provide at no cost to Water resources Department samples for testing in these laboratories. The contractor shall be required send samples to outside labs also for third party certification at the cost of contractor as per the instruction of Engineer-in-charge.
- VI. Supervision and testing which may be carried out by the Engineer-in-charge no way relieves the Contractor of his full responsibility for the quality of the works and for compliance with the requirements of these specifications.

9.2 CONTROL OF THE PROGRESS OF WORK

- I. Close progress control, and the preparation of corresponding progress reports, shall be an important part of the Contractor's quality control responsibilities. The Contractor must at all times provide the Engineer-in-charge with up to date information on the progress of work and must without delay bring to the attention of the Engineer-in-charge all delays or occurrences which could lead to delay or additional costs.
- II. The Contractor shall submit detailed monthly progress reports to the Engineer-in-charge, in which the contractual programme for the works is updated and information is given on the quantitative completion of civil works (in the form of tables indicating the quantities of completed works).
- III. The monthly progress reports shall give full details of any delays to work in progress or planned, delays in transport to/from the site, together with detailed proposals for overcoming or preventing delays, and for regaining any lost time.
- IV. The Contractor shall at any time, at the request of the Engineer-in-charge, submit detailed reports on particular matters relating to the execution and progress to the works, if such reports are required in order to assess the quality or progress of specific activities or works.

9.3 CONTRACTOR'S QUALITY CONTROL STAFF

- I. The Contractor shall assign one experienced engineer to site as full – time quality control officer, responsible with complying with all requirement of this Section.
- II. The experience and qualification of this engineer shall be given in the contractor's tender and shall be subject to the approval of the Engineer-in-charge.
The positions, and the qualification and duties, of the contractor's quality control staff shall be indicated in the quality control organization plan and manual respectively, and shall likewise be subject approval by the Engineer-in-charge.

9.4 CONTRACTOR'S LABORATORIES

- a) The Contractor shall establish, equip and operate fully furnished laboratories for the mix design and testing of the principal construction materials at site.
- b) The numbers of samples to be tested, and the timing of testing, shall be as specified in relevant IS Codes, or upto satisfaction of the Engineer-in-charge.
- c) The staff of the Contractor's laboratory shall have proven experience in similar previous work and their qualification shall be subject to approval by the Engineer-in-charge.
- d) Complete records shall be kept of all laboratory tests carried out and shall be available at any time to the Engineer-in-charge on request.
- e) The Engineer-in-charge shall be permitted at any time and without notice to observe tests being carried out in any of the Contractor's laboratories, to inspect equipment or to study results.

9.5 SITE LABORATORIES

Due to the nature of the work, the material for preparing concrete and the concrete itself must be of very high quality and the reliability of all material must be ascertained at the commencement of the work. A well – equipped laboratory shall be established on site and shall be equipped maintained and managed by the Contractor and he shall keep a full time well – experienced laboratory Engineer-in-charge thereof. The Personnel's working with the testing of the concrete shall be well trained for their task. Furthermore, the facilities of the laboratory and the assistance of its personnel's shall be available to the Owner for his independent testing well before the Commencement of the Concreting of any Permanent works structures , related pre-construction and others requisite tests shall have been performed. These tests shall be carried out by the Contractor & put up for the approval of the owner.

All testing of concrete material and other works shall be carried out in accordance with the appropriate “ Bureau of Indian Standard “ or “British Standard Institution “ or “ American Society for Testing Materials (ASTM) Standard Specifications and Methods “ , except when otherwise agree with the owner. The laboratory equipment shall be calibrated and checked periodically to the approval of the owner.

In addition to equipments required for the stipulated BS or ASTM tests, the following equipment to the approval of the Engineer-in-charge shall be provided and installed in the laboratory by the contractor.

LIST OF EQUIPMENT FOR CEMENT AND CONCRETE TESTING

TEST	EQUIPMENT
A. CEMENT	Flame Photometer
a. Chemical	
i) Alkalies	
ii) Minor, major oxides by	

Calorimetry	
iii) Chloride	Hot plate, Balance (Acc. 0.0002 g) Muffle
iv) General	Furnace (up to 1200 c). Platinum Crucibles",
	conductivity Bridge, pH Meter, physical balance
	(Cap. 150 g)
b. Physical	
i) Fineness	Blaine Apparatus, stop watch.
ii) Soundness Le- Chatelier	Le-Chatelier Moulds, hot water bath Autoclave
iii) Consistency and setting time	
iv) Heat of Hydration	
v) General	
B. AGGREGATES & Vicat Apparatus, moulds, setting time needles and plunger compression testing machine (50 tonnes).	
CONCRETE	
a) General	vibrating machine, moulds 50 sq.cm. Area,
i) Crushing value	calorimeter thermometer, flow table, stop watch,
ii) Impact value	timer temperature controlled oven, humidity
iii) Abrasion value	chamber incubator, physical balance (ACC 0.001g), balance (cap. 5 kg ACC 1 g), set of standard sieves lid and receiver
vi) Alkali Aggregate Reactivity	
vii) Flakiness & Elongation indices	
viii) Unit weight	
Containers	
ix) Sampling (Sand)	
viii) Specific Gravity and	Electric Driver, hot plates, set of standard sieves
Absorption	lid and receiver, balance 10 kg (ACC 1g), 100 kg (ACC 0.001 kg), 200 kg (ACC 0.5 kg) scop, Enamel trays, balance, shovels, compression testing machine (200 tonnes), crusher and ball mill prevailing rigs 2,25,50,100 tones. Crushing apparatus Aggregate impact test machine Apparatus for measuring flakiness Minimum Capacity of Measures.

TEST	EQUIPMENT	
C. CONCRETE	Max. C.A.	Size of Capacity of
		Measure dm³
a. Fresh Concrete		

i. Vibration	2.50	6
ii. Temperature	37.50	11
measurement		
iii. Mix proportions	50.00	14
	75.00	28
Cylindrical strength test		
b. Workability Tests:		
i. Slump Test	114.00	71
ii. Compaction factor test	152.00	99
c. Hardened concrete	Refer sample Divider	
i) Compression, tension Pycnometer		
bending & Brinell	Internal Vibrator, table vibrator	
hardness tests.	constituents, Slump cone Apparatus	
	Compaction Factor apparatus, Universal Testing	
	Machines with accessories (Cap. 100 tonnes),	
	Concrete workability meter, Capping moulds	
	Laboratory concrete mixer, Reluctance meter.	
d. Special Tests	Optical microscope, grinding and polishing	
i) Microscopy	equipment, ultrasonic pulse velocity, rebound	
ii) Non-Destructive	hammer core drilling machine, RCC cutting	
iii) Core Testing	machine, thermal conductivity apparatus.	

TESTS TO BE PERFORMED ON MATERIALS

MATERIAL	TEST	CODE
Cement	a) Chemical	IS:4032-1985
i)	Sio ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , Cao, MgO, SO ₂ , Insoluble residue & Loss on ignition	
ii)	Alkalies & Chlorides	
iii)	Free Lime	
b)	Physical	IS:4031-1988
i)	Specific gravity	
ii)	Fineness	
iii)	Soundness	
iv)	Compressive strength	
v)	Drying shrinkage	
Water	Chemicals	
i)	Cl, SO ₄ , Organic & Inorganic Solids, pH, IS:3025-1987 Alkalinity / Acidity	
ii)	Setting time of mortar	
iii)	Relative strength of concrete	IS:1199-1959
Fine Aggregate	i) Sieve Analysis & Fineness Modulus	IS:383, IS:2386
ii)	Test for organic impurities silt & clay (Part I & IV)	
iii)	Decantation test for silt	IS:2386 (Part II)
iv)	Specific gravity	IS:2386 (Part III)
v)	Unit weight and bulkage	IS:2386 (Part III)
IS:2386 (Part III)		
Coarse	i) Sieve Analysis	IS:2386-1963
Aggregates	ii) Flakiness index	
iii)	Elongation Index	PART - I
iv)	Deleterious materials	
v)	Specific gravity	PART-II
vi)	Bulk Density	
vii)	Moisture content	PART-III
viii)	Absorption value	
	Mechanical tests	PART-IV
ix)	Aggregate crushing value	
x)	Impact Value	PART - V
xi)	Abrasion Value	
xii)	Potential reactivity of aggregate	
xiii)	Petro-graphic examination	PART-VI
xiv)	Alkali Aggregate reactivity test	PART-VII
Concrete	a) Fresh Concrete	
i)	Air Contents	
ii)	Vibration	
iii)	Temperature measurement	
iv)	Mix proportions	

v)	Water cement ratio	
vi)	Yield	
b)	Workability test	
i)	Slump Test	Usual procedure
ii)	Compaction Factor test	IS:CED2(CESS) ASTM
C 597-83		
c)	Hardened Concrete	BS: 4408
i)	Compressive strength	IS : 516-1959
ii)	MDT Tests	IS : CED 2 (3890)
d)	Special Test	
i)	Microscopy	
ii)	Non-destructive	
iii)	Core Testing	
Admixtures	i) Bleeding	IS:9103-1999
	ii) Relative Strength	IS:516-1959
	iii) Setting Time	IS:8142-1974
	iv) Relative water content	IS:9103-1999
	v) Relative length change	IS:1199-1959

Any other equipment not included here but directed by the Engineer in charge necessary for testing and quality control shall be provided by the Contractor.

9.6 MATERIALS DELIVERED TO SITE

- The contractor's quality control staff shall keep full records of all materials delivered to site for use in the works, and of all tests made on such materials either prior to or following delivery to site.
- These records shall be available at all times to the Engineer-in-charge, together with any factory testing certificates.

9.7 Materials, Plant and Equipment

9.7.1 PRE-DISPATCH INSPECTIONS AND TESTS

The contractor shall submit a Quality Assurance Programme (QAP) for each item for approval of Engineer-in-Charge. Actual manufacturing shall start only after approval of QAP.

It is proposed to get the equipment and material listed in the table below, inspected prior to dispatch for work site through third party/project consultants/departmental engineer(s).

S. No.	Equipment/Material
1.	Pumps
2.	All other Electric control panels for HV/MV/ LV distribution, Capacitor panel etc.
3.	Capacitors, Transformers etc.
4.	Instrumentation
5.	Pipes

The Contractor shall notify Engineer-in-Charge at least 2 weeks in advance for carrying out the Pre-Dispatch inspection, and tests before the dispatch of materials. Failure to Pre-Dispatch inspection/tests, the contractor shall be liable for all costs incurred against such dispatches. No material scheduled or notified for pre-dispatch shall be accepted until inspection/ have been successfully carried at manufacturers or other selected premises and the inspection report has been approved by Engineer-in-Charge and he has given consent for dispatch of material.

In addition to the pre-dispatch inspections, the Engineer-in-Charge may ask for additional certificates from manufacturer to satisfy with the quality of material used and for the compliance to respective standards.

For all materials and equipments not listed above, the contractor shall produce manufacturers test certificates for material, performance, efficiencies, workmanship and standard compliance etc. as directed by the Engineer-in-Charge, to satisfy with the quality of the material to be received.

The Engineer-in-Charge may also ask for Pre-Dispatch inspections for any other item(s) not shown in the list of items requiring pre-dispatch inspection, for which the contractor shall make necessary arrangements, without any additional costs to the Department.

9.7.2 INSPECTION AND TESTING OF PUMPS

The performance and hydraulic tests of the pumps shall be made with their respective motors. The tests mentioned in the technical specifications shall be ensured.

9.7.3 INSPECTION OF MOTORS

Motors shall be subject to full performance tests, (including Power factor) which may be witnessed by the authorised person / agency of the department at the Motor manufacturer's works.. Type test certificates that shall include the following shall be provided for all motors:

- i. Motor testing shall be carried out in accordance with the requirements of IS 325.
- ii. Acceptance Tests - Full load test to determine efficiency, power factor and slip shall be conducted on all the motors. No negative tolerance shall be permitted on the tested motor efficiency
- iii. All type test certificates conducted on similar motors

9.7.4 INSPECTION OF HV/LV DISTRIBUTION PANEL, CAPACITOR PANEL AND OTHER PANELS

All routine tests on all panels.

All type test certificate conducted on similar panels to be forwarded.

9.7.5 PROTECTION AND CONTROL CIRCUITS

Based on the completeness of the circuits in the final manufactured form within the manufacturer's works, the following tests shall be carried out:

- a. Primary injection tests to ensure correct operation of the current operated protection relays and direct acting coils over their full range of settings.
- b. Balanced earth fault stability tests by primary current injection. Care must be taken to reproduce accurately the burdens of interconnecting cables. A further test to ensure correct polarity must be made after assembly.
With differential pilot wire schemes it may not be possible to apply primary injection testing. In this case the circuits shall be proved by secondary injection. Current transformer characteristics and calculations associated with the above tests shall be available for inspection by the Engineer.
- c. Tests on auxiliary relays e.g. Buchholz auxiliary, at normal operating voltage by operation of associated remote relays.
- d. Correct operation of control circuits at normal operating voltage by operating voltage by operation of local control switches, and simulation of operation from remote control positions.

9.7.6 MANUFACTURE'S CERTIFICATIONS

In addition to the items listed below, the Department may ask for relevant certificates of the manufacturer for any item supplied in the contract.

9.7.7 CABLES

All cables supplied under the Contract shall be subject to routine tests in accordance with the relevant Indian ISS. Cables will not be accepted on Site for installation until certificates giving proof of compliance with the Specification and details of tests results have been received and approved by the Engineer-in-Charge. A certificate shall be applicable to each drum. The tests to be carried out on every drum at manufacturer's premises shall include:

- a. High voltage AC insulation pressure test between cores, each core to earth metallic sheath or armour as applicable;
- b. Insulation resistance test;
- c. Core continuity and identification;
- d. Conductor resistance test.

9.7.8 ELECTRICAL EQUIPMENTS

Tests to ensure the compliance to respective standards shall be provided for the MCB's, relays, fuses port insulator and other electrical equipments.

I. Electrical Measuring Instruments and Meters

Tests shall be undertaken in accordance with the relevant ISO/IS to ensure accurate operation of all meters such as Ammeters, Voltmeters, Frequency Meters, Power Factor Meters, kW, kWh & kVAR meters and multi functional meters.

9.7.9 PIPES

All type of pipes shall be tested in accordance to relevant ISO/IS to ensure quality during entire service life.

9.8 SAFETY

The Contractor's obligation with regard to site safety are detailed in Section 1.6 of these specifications.

9.9 TRAINING OF OWNER'S STAFF

The contractor must allow for providing quality control training to Owner's personnel during the construction period for a total of five (5) man/woman months (each trainee for a period on site of approximately one month), the suitable accommodation with lodging & transportation will be provided by the contractor .

1. PROJECT COMPLETION

Based upon completion manuals prepared under 'Planning , Design and Engineering Services" , the Contractor (or consortium of contractors) shall carry out completion related activities of the project :

- a) Final inspection of civil structures upon completion
- b) Reservoir impoundments at specified rates, surveillance during impound and remedial action, if any
- c) Dry and wet testing of gates and other hydro-mechanical equipment
- d) completion of the project as a whole

The Contractor shall fully involve the owner's site team during above process so that the team is fully trained with functioning of different components and equipments of the project.

Full documentation of completion activities shall be maintained and same shall be submitted to the owner as a complete report.

SECTION X

GENERAL SPECIFICATIONS FOR INSTRUMENTATION, AUTOMATION AND CONTROL SYSTEM

1 GENERAL SPECIFICATIONS FOR INSTRUMENTATION, AUTOMATION AND CONTROL SYSTEM

1.1 General

This section of specifications defines the requirements of Instrumentation and Control system to be installed at Raw Water Pump House and entire scheme. For selection of field instruments and control system or anything related to instrumentation, the Contractor shall follow the specifications contained herein.

Irrespective of the detailed specifications of the respective items detailed elsewhere, the Contractor shall be required to provide all equipment, accessories, cabling, earthing, providing necessary transducers/sensors, system hardware/software, programming logic etc. to achieve the functional requirements described in the Bid Document. The civil and electromechanical work associated with installation of the instrumentation equipment shall be in the Contractor's scope.

1.2 Preamble

The control systems for the Raw Water Pumping Station, and other network shall be based on the use of Programmable Logic Controllers (PLCs) and Remote Terminal Units (RTUs). The various modes of controls shall be Auto, Semi- automatic and Manual. Remote operation facilities shall be provided for operating the equipment from the central SCADA system.. This Master SCADA system is provided for central monitoring and for remote operations of the Raw Water Pump House, along with entire scheme in the Raw Water Pump House. The Secondary SCADA system, PLCs and RTU's shall be capable of interfacing / networking with this master SCADA system.

In the event of failure of the automatic controls or by operator choice it shall be possible to revert to semi-automatic or manual operation of each item of Plant independent of the PLC functions.

The field instruments shall also form an integral part of the control system.

1.3 Reference Standards

Unless otherwise approved, instrumentation shall comply with relevant quality standards test procedures and codes of practice collectively referred to as Reference Standards including those listed below in accordance with the requirements detailed elsewhere in this specification.

BS 89-2:1990, EN 60051-2:1989, IEC 60051-2:1984	Direct acting indicating analogue electrical measuring instruments and their accessories.
BS 1042 (Various)	Measurement of fluid flow in closed conduits.
BS 1646-1:1979, ISO 3511/I-1977	Symbolic representation for process measurement control functions and instrumentation. Basic requirements
BS EN 837-1:1998	Pressure gauges. Bourdon tube pressure gauges. Dimensions, metrology, requirements and testing
BS EN 60751:1996, IEC 60751:1983	Industrial platinum resistance thermometer sensors
BS 3680 (Various)	Measurement of liquid flow in open channels.
BS 3693:1992	Recommendations for design of scales and indexes on analogue indicating instruments
BS EN 60770-1:1999, IEC 60770-1:1999	Transmitters for use in industrial-process control systems. Methods for performance evaluation
BS 4675-2:1978, ISO 2954-1975	Mechanical vibration in rotating machinery. Requirements for instruments for measuring vibration severity
BS EN 60584-1:1996, IEC 60584-1:1995	Thermocouples. Reference tables

BS 5308 (Various)	Instrumentation cables
BS EN 60529:1992	Specification for degrees of protection provided by enclosures (IP code)
BS ISO 11631:1998	Measurement of fluid flow. Methods of specifying flow meter performance
BS 5863-1:1984, IEC 60381-1:1982	Analogue signals for process control systems. Specification for direct current signals
BS 5863-2:1980, IEC 60381-2:1978	Analogue signals for process control systems. Specification for direct voltage signals
BS EN 60654-1:1993, IEC 60654-1:1993	Industrial-process measurement and control equipment. Operating conditions. Climatic conditions
BS 6739:1986	Code of practice for instrumentation in process control systems: installation design and practice
BS EN 60073:2002	Basic and safety principles for man-machine interface, marking and identification. Coding principles for indicators and actuators
BS 1553 (Various)	Specification for graphical symbols for general engineering
ISA-5.1-1984 - (R1992)	Instrumentation Symbols and Identification
ISA-5.4-1991	Instrument Loop Diagrams
ANSI/ISA-7.0.01-1996	Quality Standard for Instrument Air
ANSI/ISA-18.1-1979 - (R1992)	Annunciator Sequences and Specifications
ISA-26-1968	Dynamic Response Testing of Process Control Instrumentation
ISA-37.1-1975 - (R1982)	Electrical Transducer Nomenclature and Terminology
ISA-37.3-1982 - (R1995)	Specifications and Tests for Strain Gage Pressure Transducers
ANSI/ISA-50.00.01-1975 (R2002)	Compatibility of Analog Signals for Electronic Industrial Process Instruments
ANSI/ISA-51.1-1979 - (R1993)	Process Instrumentation Terminology
ISO 9000 and 09004	Quality Systems
IEEE 60587	Power Supply Surge Protection
IEC 61131-3	Programming Languages for Programmable Controllers.
IEC 61158-2	Communication Protocols
ISO 9075 (BS 6964)	Structured Query Language (SQL)
BS 5515	Documentation of Computer Based Systems
BS 7165	Recommendation for Achievement of Quality in Software
BS EN 50081	Electromagnetic Compatibility
ISO 3511	Process measurement control functions - instrumentation symbolic representation.
ISO-OSI	7 Layer Communication Model
IEEE 472-1974	Surge protection.
IEC-61850	Sub-station automation protocol
IEC-8705101	Modbus Protocol Conversion

1.4 Statement of Compliance

The Contractor shall provide a list of the reference standards used and shall provide a compliance/non-compliance statement during the Bid submission and FDS submission once the contract has been awarded. Failure to do so will be treated as a non-responsive bid.

All standards which the Contractor intends to use but which are not part of the above Standards or other listed Reference Standards, shall be submitted to the Engineer for consent before any design against that standard proceeds.

1.4.1 Design Requirements for Instrumentation, Control, Automation and SCADA Systems

The instrumentation, control, automation SCADA installations shall fully comply with design standards, regulations and the material and workmanship requirements of the Specification.

The electrical plant installations associated instrumentation control and automation systems shall also comply with and be tested in accordance with the latest edition of BS 7671 or equivalent Indian standards.

All equipment and materials incorporated in the system shall be selected, designed and rated to operate under the defined performance duties and specified site conditions and to maintain a high level of operational reliability.

The instrumentation control and monitoring system equipment and materials shall have an operational life of not less than 15 years, unless otherwise approved by the Engineer.

1.4.2 General Design Requirements

- a) Instrumentation and Control system shall be designed, manufactured, installed and tested by an experienced system integrator to ensure high standards of operational reliability. Instruments mounted in field and on panels shall be suitable for continuous operation. All electronic components shall be adequately rated and circuits shall be designed so that change of component characteristics shall not affect plant operation.
- b) All I&C equipment shall be new, of proven design, reputed make, and shall be suitable for continuous operation. Unless otherwise specified, all instruments shall be tropicalized. The outdoor equipment shall be designed to withstand tropical rain and temperature variation from 0 to + 50° C. wherever necessary, space heaters, dust and waterproof cabinets shall be provided. Instruments offered shall be complete with all the necessary mounting accessories. *The control equipment installed inside the control room should be designed to work at 35° C and the instruments in sheltered place outside the control room at 45° C.*

1.4.3 Installation Requirements

- a) The locally mounted instruments shall be installed on appropriate rigid supports, having minimum vibrations. The instruments shall be installed away from hot objects.
- b) The instruments shall be protected against physical damage or liquid splashing by providing metallic/ fibre glass enclosures or canopies.
- c) All transmitters / transducers shall be installed nearest to the sensing point and at a place convenient to get access for maintenance.
- d) The field instruments i.e. the instruments mounted outside the control panel shall be mounted at a convenient height of approximately 1.5 m above grade platform.
- e) While installing the instrument, provision shall be made to carry out in-situ calibration Isolation valves and drain valves shall be provided to the field instruments wherever required.
- f) Instrumentation cables shall be separately laid, away from electrical cables. The instrumentation cables from the field mounted instruments shall be terminated on the control panel without any joints.
- g) Double compression glands shall be used for glanding the cable in field instruments and instrument control panel.
- h) Metallic tag number plate shall be provided for each instrument.

1.4.4 Instrument Power Supply Cables and Instrumentation Signal Cables

Cables shall be capable of satisfactorily withstanding without damage, transportation to site, installation at site, and operation under normal and short circuit conditions of the various systems to which the respective cables are connected when operating under the climatic conditions prevailing at the site as indicated in this specification.

Cable joints in instrument signals and power supply cables shall not be permitted.

Cables shall be capable of satisfactory performance when laid on trays, in trenches, conduits, ducts and when directly buried in the ground.

Cables shall be capable of operating satisfactorily under a power supply system voltage variation of $\pm 15\%$, a frequency variation of $\pm 5.0\%$.

1.4.5 Laying Of Cables

A distance of minimum 300mm shall be maintained between the cables carrying low voltage AC and DC signals and a distance of minimum 600mm shall be maintained between HT cables and signal cables. In outdoor areas, the cables shall be directly buried. Each instrumentation and power supply cable shall be terminated to individual panel/terminal box. Identification of each cable shall be by proper ferrules at each junction as per cable schedule to be prepared by Contractor.

Cables shall be laid in accordance with layout drawings and cable schedule which shall be prepared by Contractor and submitted for approval.

All cable routes shall be carefully measured and cables cut to the required lengths, leaving sufficient amount for the final connection of the cable to the terminals on either end. Various cable lengths cut from the cable reels shall be carefully selected to prevent undue wastage of cables. A loop of 1 meter shall be left near each field instrument before terminating the cable. Cables shall be complete uncut lengths from one termination to the other.

All cables shall be identified close to their termination point by cable numbers as per cable interconnection schedules. Identification tags shall be securely fastened to the cables at both the ends.

1.5 Programmable Logic Controllers

1.5.1 Codes and Standards

The design material, construction features, manufacture, inspection and testing of Programmable Logic Controllers (PLC) shall comply with all currently applicable statutes, regulations and safety codes. The PLC shall comply with the latest applicable standards and codes. If any such standards are not applicable then the same shall comply with the available recommendations of professional institutes like NEMA, IEC, ANSI, ISA, IEEE, DIN and VDE.

1.5.2 Design and Construction Requirements

PLC shall be provided as a Hot-Standby configuration to perform combinational and sequential logic functions, status monitoring and reporting functions with counter and timer facilities.

PLC Panel interrogation power supply should be fully redundant.

PLC shall comprise of necessary processors, input/output (I/O) modules, communication interface modules and man-machine interface (MMI) required to perform the desired functions.

Each PLC shall have memory protected built in historical archiving/data logging of system alarms & events and process variables. Data logger shall be able to log data based on time or an event. PLC shall have enough memory allocated to allow 200,000 time and data stamped discrete and /or analog values to be archived. The historical archive shall allow the oldest data to roll off the system as memory is used keeping the 200,000 most current data points available. Process point time stamping frequency shall be selectable within the configuration software. It shall be possible for the archived data to be exported in CSV format allowing use with standard spreadsheet and data software applications

PLC shall have the following attributes as a Hot-Standby configuration.

- carry out sequential logic implementation for operations of plant;
- carry out computation and interfacing for data acquisition, data storage and retrieval;

- it shall accept downloaded program from a programmer;
- it shall have different functional modules to perform the desired functions;
- it shall scan the inputs in time cycles and update the status of its outputs.

1.5.3 Redundant processors

The master station shall be provided with two identical central processors configured such that they operate in Hot-Standby mode.

Redundant system with hot back up redundancy feature should be built in the CPU. Software engineered hot backup systems are not acceptable. CPU should have the memory expansion capability up to 7 MB. Both the CPU's should have separate backplane and associated hardware for redundancy.

CPU system should have built in WEB server

SCADA connectivity with the CPU will be on dual Ethernet network (10/100 Mbps with open Modbus TCP/IP protocol). On the event of hardware failure in primary system the standby system will provide dual connectivity with the SCADA.

Redundancy of switch for SCADA (industrial grade managed switch) connectivity is to be provided.

Failure to do adhere to the above will be treated as a non-responsive bid and lead to technical disqualification. Contractor should take note on the importance of this obligation.

The system shall be designed and implemented such that when the Main processor fails, the Standby one shall automatically take over. The changeover shall be seamless, smooth and without any time delay and shall not cause any disruption to the overall distributed control system and to the ongoing processes.

The PLC system shall be expandable (OPC compatible) and shall be modular in construction, so as to capable of future expansion without hardware modifications. External OPC servers will not be considered.

- The system hardware, application software and database shall be sized to accommodate a total of 50% increase in signal capacity and up to 100% increase in an individual zone.
- Sufficient plug in modules shall be provided and wired to terminals ready to accept future signals of up to 10 % for each IO card
- Each IO card shall be able to accept at least two more I/O cards without requiring replacement of, or additions to, the original equipment.

PLC s shall be microprocessor based. PLC s shall use standard known protocols and structures for communication outside the system. In case of system failure or power supply failure the outputs shall attain a predetermined fail safe condition (this shall normally be 'off').

The PLC used shall have a proven record in the type of application concerned and in the prevailing environmental conditions. PLC shall be of an approved type from a major international manufacturer. Refer Vendor list. The PLC shall be furnished with a dual redundant microprocessor. The PLC shall be open systems standard for all elements of communications and programming and shall be designed for ease of use and minimum configuration.

Application logic programs shall be fully compliant with all five logic development methods detailed in IEC 63331-3. The PLC shall be powered by two independent sources provided by the UPS system and all internal operating supplies shall be derived from the UPS. The power supplies, I/O, CPU and communication modules and battery backup rates shall be monitored by the PLC and shall be available by report.

During the times of the battery discharge, the PLC shall initiate an orderly self shutdown and automatically restart on the main power restoration without the need for reloading or initiation of any kind. The PLC shall comply with the specification specified elsewhere in this specification.

Each PLC shall have built in web server capability allowing system information to be stored in a format that allows for easy access and viewing with standard Windows™ based browser. Each unit shall be furnished with built in O & M data associated with its

specific site including; as a minimum, basic system information, panel layouts, wiring diagrams, material lists w/part numbers, and operational summary. This information shall be accessible locally or remotely.

1.5.4 Central Processing Units

The central processing units (CPU) shall be a high performance processor with modular configuration suitable for real time process applications

The following features shall be provided on a minimum

Communication between CPU and peripherals shall be by an I/O bus. The individual device, interfaces shall be capable of being plugged into the I/O bus.

On resumption of power following a power failure the PLC shall automatically restart its controlling function.

CPU shall have a real time clock capability to accept a time synchronization pulse and adjust its internal clock with the pulse.

CPU shall have extensive self diagnostic facilities and watch dog timers to identify faults at card levels

1.5.5 Memory Unit

Memory unit shall comprise of highly reliable memory chips which are industry standard, proven design with fast random access and suitable for operation in process environments. Main memory shall be modular and facility shall be provided for the upgrading and expansion of memory to meet future demands.

Not less than 50 % spare program memory and data memory space shall be provided.

System initialisation and application software shall be stored in EEPROM or EPROM.

Operating data shall be stored in a RAM fitted with an internal battery backup. The battery backup provided shall support the memory on loss of power for at least one month. The battery life shall be at least 2 years.

15.6 I/O Modules

Standard rack mounted plug in I/O modules shall be provided. I/O Modules should be of the same series as the PLC CPU. Deviation from this would be treated as a non responsive bid and lead to technical disqualification. Contractor should take note on the importance of this obligation. Field wiring shall be terminated in screwed terminal blocks and interconnected to the processor I/O system with prefabricated cables and plug in card type connectors. The I/O modules shall be hot swappable.

20% extra modules of installed capacity for each type of module shall be provided as spare. Provision shall be made for future expansion of additional 20% extra I/O modules of the installed capacity. RIO's to have dual redundancy on network level connected to both the CPU. Even on the failure of one CPU backplane the other system should be available on dual network at RIO level. All the RIO rack should have redundant power supply modules for the backplane.

All I/O module should be rack mounted type.

I/O modules shall be as follows:

- inputs shall be upto isolated.;
- filters shall be provided for noise rejection;
- output status shall be indicated by an LED;
- all outputs shall be fuse protected and have fuse failure indication the fuses may be mounted externally from the output module;
- all the modules shall be of addressable type.

Ethernet I/O modules shall be connected to the PLC by on board Ethernet 10/100 Based connection port. Ethernet I/O modules shall support multiple communications including TCP/IP and Modbus ASCII and RTU allowing connection to any device supporting these protocols over standard Ethernet backplane

1.5.7 Analogue Input Modules

They shall consist of an input isolation unit, signal conditioning unit and an analogue to digital converter (ADC). In addition, the following features shall be provided.

- cross talk attenuation
- provision for monitoring of the ADC for overflow detection

- gain amplifier with high common mode rejection ratio
- accuracy for analogue signals shall be 0.5%

1.5.8 Analogue Output Modules

They shall consist of signal conditioning unit and a digital to analogue converter (DAC). In addition, the following features shall be provided.

- 16 bits resolution minimum
- provision for monitoring of the DAC for overflow detection
- accuracy for analogue signals shall be 0.5%

1.5.9 Digital Input Modules

The following design features shall be provided.

- contact bounce protection;
- choice of type of contacts.

1.5.10 Digital Output Modules

The digital output module shall provide contact closure output by driving relays. The features to be provided are as follows:

- contact bounce protection shall be provided
- relay output shall be provided to operate pump motors and motorised valve actuators
- fail safe position in case of output module failure and fault indication

PLC's provided under this specification shall be capable of performing the necessary logic to control the system as previously defined. These capabilities shall include, but not be limited to the following:

- | | |
|---------------------------------|-----------------------------------|
| 1. Discrete input/output | 10. Latch/unlatch relays |
| 2. Analog input | 11. Counters |
| 3. Analog output | 12. Comparators |
| 4. Timers | 13. FBD logic |
| 5. Pump Controller | 14. Flow Totalization/Integration |
| 6. Pump Alternation | 15. Intrusion Detection |
| 7. Mathematical Function Blocks | 16. Time of Day Control w/Lockout |
| 8. Stage Blocks | 17. Ramp Blocks |
| 9. Trending | 18. Data Logging |

1.5.11 PLC Programming

Where ever possible PLC programming shall be carried out using FBD, based on the approval of the employers representative. The logic shall be prepared using .proprietary programming software and shall be comprehensively annotated with subroutine and rung comments to assist further development and maintenance.

The system shall support a simple programming of the application software complying with IEC 63331-3.

The system shall support a structured, modular programming. At least the following standard operations shall be applicable:

- (1) Logic functions (such as AND/OR/AND NOT etc.);
- (2) Timer functions (externally adjustable);
- (3) Counter functions;
- (4) Skip functions;
- (5) Comparison functions;
- (6) Limit value functions;
- (7) Arithmetic functions;
- (8) Physical unit functions;
- (9) Closed-loop functions such as P/PI/PID/etc.

The Contractor shall submit the logic diagrams for review. The Contractor shall include the as-built logic in the final submission.

1.5.12 Programming Unit

The programming unit shall be of the portable type, industrial model designed to be used during commissioning on site. A functional keyboard which supports different type of programming methods shall be included, as well as a CRT or TFT display.

- At least the following functions shall be included on a minimum:

- On-line programming
- Off-line programming
- Flexible corrections during input
- Full screen editing functions
- Absolute and symbolic programming
- Input of comments and title blocks for complete documentation
- Complete application software documentation functions. Printouts of application software logic functions shall preferably be in Ladder logic diagrams.
- Load and transfer functions

The computer shall be provided complete with proprietary PLC programming and SCADA software complete with plant mimics and documentation software. Communications cables required to interact with the PLC, (Eg: Modbus Cable) would be supplied by the contractor. The software shall provide facilities for:

- carrying out program revision management;
- insertion of comprehensive program subroutine and rung comments;
- search and find and search and replace 'contacts' and 'coils';
- simulation functions and testing of the program by changing the status of contacts and monitoring the outputs;
- preparation of coil and contact list and their locations and memory maps;
- make system backup copies while the system is online;
- upload and down load programs to the PLC on line;
- carry out on line maintenance and fault finding on the PLC.

1.6 Technical Particulars for PLC

1.	Functions	As per the control logic and input/output list
2.	Expandability	50% of installed capacity
3.	Interposing relays	(i) Shall be provided for all the digital outputs (DO) including spare DO and for digital inputs wherever required.
4.	Optical isolation for all digital inputs and outputs and galvanic isolation for analog inputs	(ii) Required
5.	Mounting	Inside the control panels with viewing glass on the door
6.	CPU and power supply module redundancy	Required (In hot standby mode)
7.	Processor	
	Diagnostic function performance	Required
	Minimum 32 bit performance with floating point capability	Required
	Memory module	To store programs, standard software to perform logic functions and diagnostic functions
8.	Inputs and Outputs	Refer I/O schedule
9.	System Loading	Max. 60% under worst loading Conditions
10.	Power supply to sensor / transmitters	Required
11.	Type of input	Binary, analog and pulsed as required.
12.	Outputs	Binary signals (Relay outputs for driving MCC Starter coils, driving motorized valves etc.); analog and pulsed as required.
13.	Spare I/O	20% of each type, wired to terminal block
14.	Accessories	Laptop computer for programming along with all necessary adapter, laptop carrying kit, cables, connectors and accessories)

		Proprietary PLC programming and documentation software along with all cables and connectors for loading on laptop computer and on local PC based SCADA system
15.	Interface (Hardware and Software) to Local SCADA system	Required
16.	Communication port to be provided for interface to Local SCADA system	RS 232/ RS 485 (with suitable converters as applicable)
17.	Communication port for interfacing with temperature scanners (for pumping stations)	Required
18.	Communication port for interfacing with Multifunction meters/ Motor Protection Relays	Required
19.	Communication port for interfacing with flow indicator totalisers	Required

1.6.1 Default Values

Every operator selectable parameter shall be provided with a default value held in EPROM or EEPROM in the relevant PLC.

The default value shall be used if no other value has been entered through the local SCADA system or if the value entered through the local SCADA system has been lost. The default values shall be made available for interrogation by the local SCADA system at all times.

Sensible and logical default values shall be inserted prior to the start of system tests. The default values at the time of handing over the plant shall be those found operationally suitable during commissioning.

The PLCs shall make available for interrogation by the local SCADA for bits corresponding to the following PLC faults:

- failure of PLC as indicated by the PLC watchdog relay;
- failure of each I/O card;
- failure of communication link
- status of 24 V DC power supply for I&C system.

1.6.2 Software

The on line real time operating system supplied shall be proven for similar application and shall be able to support all the equipment/peripherals.

PLC programming shall be carried using latest available industrial standard formats for logic. The PLC programming shall be prepared using the PLC manufacturers recommended windows based PLC coding and documentation software. The PLC code shall be structured in the manner of the best industry standard and have comprehensive subroutine and rung annotation. Ladder program will be preferred.

The PLC shall be commissioned using RAM memory storage modules which shall be replaced with an Erasable read only memory (EPROM) or electrically erasable read only memory (EEPROM) when testing is complete.

1.6.3 Operator Interface Unit (OIU)

- OIU shall be provided for the PLC system on the front facia of the control panel.
- The OIU shall consist of panel mounted industrial grade unit with Color LCD/LED screen and tactile key pad. It shall be environmentally protected and designed for plant room use with a 'wipe clean' finish.
- The OIU shall provide facilities to:
 - Display status of Plant in a graphical and tabular format (i.e. running, stopped, fault etc.)

- ii. Display analog values on the appropriate graphic screen (displays shall change color when in fault conditions or when data is suspect);
- iii. Annunciate alarms associated with the area of the plant concerned including details of the time the alarm occurred
- iv. Provide facilities for the operator to:
 - adjust process set points;
 - select process modes;
 - select number of running pumps;
 - provide all other facilities required for operation of the Plant;
 - acknowledge alarms;
 - view a journal of unacknowledged alarms;
 - view a journal of the alarms acknowledged and unacknowledged.
 - Display process set points;
 - Display a total running hours log of local transmission pump drives.
 - Provide real time and historic data
 - Any additional features required to assist in the effective and efficient operation of the plants.
 - Security systems shall be provided to prevent unauthorized adjustment of process set points.
- d) Graphic screens shall be provided as follows:
 - i. Main and subsystem menus;
 - ii. Pumping system overview (i.e. providing details of Nos. of pumps running, total flows, reservoir/ sump level, power supply status etc.)
 - iii. Transmission main local surge suppression equipment tabular status format screen;
 - iv. Screens to permit viewing and modifying of process set points
 - v. Tabular screen of pumping plant status and values
 - vi. Running hours log for pumping stations.
- e) The screens shall display data commensurate with their size and the area of and the number of Plant items covered. The Contractor, in addition to the specific screen requirements stated above shall be responsible for providing any additional screens to ensure comprehensive coverage of the Works.
- f) The software chosen shall have a comprehensive alarm handling capability with the ability to annunciate, acknowledge, sort and maintain a historic record of current and past alarms including details of when the alarm occurred, when it was acknowledged and when it returned to normal.

1.6.4 Tests for Programmable Logic Controller (PLC)

The following tests shall be carried out for the PLC

- i. Scanning rate check for analog signals
- ii. Scanning rate check for digital signals
- iii. PLC cycle time check
- iv. Processor redundancy check
- v. Power supply redundancy check
- vi. Power supply failure alarm check
- vii. Power supply failure alarm check
- viii. Card level failure detection check
- ix. Failsafe output check on failure of output module
- x. Sensor failure detection check
- xi. Status indication check for healthiness of each input/output channel and module
- xii. Status indication check for power supply for each module
- xiii. Isolation check for input/output module
- xiv. Input filtering check for noise level
- xv. Processor – battery back-up check
- xvi. Controller functioning check on under voltage and over voltage

- xvii. Ladder logic program check by simulation of inputs and outputs
- xviii. Functional check of programming units.

1.7 Remote Terminal Unit

1.7.1 RTU system design

RTU shall be designed in accordance with this specification. The RTU shall be of proven design and suited for water supply and distribution SCADA applications.

In general the RTU design should aim to minimize power consumption and heat generation. It should be designed to work in remote installation by being of robust physical construction with immunity to electrical noise.

The RTU shall be assembled from modular units, for example, power supply module, CPU and communications module, communication interface modules and modules for input/ output purposes. I/O and serial cards shall be able to bear ranged in the RTU rack in any order.

Modules shall be inter connected via a suitably robust plug and socket method. It shall not be necessary to unscrew individual wires/ cables, both internal RTU wiring and I/O wiring, to replace faulty modules. The failure of one module will not affect the performance of any other module.

A marshalling terminal area shall be incorporated with each RTU to provide terminations for field cables. This area can be located in the RTU cubicle itself for an RTU replacement but for new locations there should be a separate marshalling cubicle. The RTU and marshalling cubicles shall normally be bolted together to form a 2-baycubicle suite. A separation plate may be located between the cubicles.

The RTU and the cubicles shall be designed to accommodate the actual number of input/outputs and IEDs at the specific substation, plus spare capacity.

1.7.2 RTU spare capacity

The spare capacity, which includes equipped, wired and cubicle capacity, shall be supplied as described below. The supplier shall detail the steps required to activate the spare capacity.

1.7.3 Equipped capacity

Equipped capacity shall include all electronic cards and output terminals. To activate this capacity, an input/output connection shall be made to the designated field terminals in the marshaling cubicle. This additional capacity is generally provided to cover the initial substation design and commissioning. It includes rounding up the quantities specified to the modulus of the number of points per card. Unless this is otherwise specified, the initial equipped spare capacity shall be not less than 20% for each type of input and output used. Unless specified, any I/O lists or quantities given for a particular RTU shall not include spare capacity. Therefore these quantities will need to be increased by 20% to meet spare capacity requirements.

1.7.4 Wired capacity

Wired capacity means that a cards lot is provided. To activate this capacity, in addition to connection of the field input, an additional input card or output card is required to be supplied and fitted, and wiring arranged from the I/O card to the terminals in the marshalling cubicle; the wiring is usually done by a preformed cable. This capacity is specifically provided to cater for some future known requirement, which may be 4-5 years away. Unless otherwise specified, this additional capacity shall be zero.

1.7.5 Cubicle capacity

Cubicle capacity is a requirement to provide adequate cubicle space capacity, such that additional card files and terminations could be retro-fitted at some stage in the future. This is to cater for expansions possibly 8-10 years or more away. Unless otherwise specified, this additional capacity shall be zero.

1.7.6 RTU I/O structure

The RTU I/O quantities shall be developed in accordance with requirements.

1.7.7 Performance requirements

1.7.7.1 Environmental conditions

The RTU shall be designed and supplied suitable for indoor equipment conditions. For

RTUs installed indoors, the ambient temperature range is -5° to $+55^{\circ}\text{C}$. RTUs installed in a cubicle in the field (outdoors) are required to work successfully in an ambient temperature range of -10°C to $+65^{\circ}\text{C}$.

Heat dissipation calculations shall be provided to demonstrate the RTU's ability to comply with the temperature ratings of the equipment in the range specified.

1.7.7.2 Maintainability

It is a requirement that all RTUs require no outline or planned maintenance. Therefore, no fans or moving parts shall be used in the RTU to avoid any need for maintenance. To ensure this requirement is met the RTU should be constructed to resist the entry of dust.

A single technician shall be able to remove and replace for repair purposes, without special tools and test equipment, all equipment involved in the operation of an RTU. Restoration of equipment to full operational use shall be possible within 15 minutes (nominally) of repairs being completed.

It should not be necessary to dismantle (remove multiple pieces of) the RTU in order to replace a module.

1.7.7.3 Reliability

The equipment will normally remain in continuous service to provide SCADA facilities. Failure can result in the interruption of the water supply to Sri Ganganagar city and a high level of reliability is therefore required.

The supplier shall provide the predicted meantime to failure and the meantime to repair of the equipment. Where insufficient historical data is available, the supplier shall state the methods used to determine the reliability performance.

Predicted availability of equipment supplied should exceed the following:

System Function	System Availability
Control and monitoring of any one control valve.	99.99%
Monitoring of any one single alarm (High Pressure)	99.99%
Monitoring of any one analogue input (Flow meter value)	99.99%

For the purposes of these calculations:

- the availability of any interconnecting communication equipment or system supplied by others shall be assumed to be 100%
- an assumption of an average 2 hours for maintenance personnel to travel to site shall be made. Repair time shall be added to this travel time.

1.7.7.4 Service life

The equipment shall be capable of complying with this standard, including performing its intended purpose, for a minimum of 20 years from the date of supply.

The supplier shall indicate the following:

- The date at which the product was released for sale.
- The anticipated date at which the product will be withdrawn from sale, but support will continue to be supplied.
- The anticipated date that product support will be withdrawn, i.e. spares will no longer be available and technical support is no longer provided.

1.7.7.5 Interchangeability

RTU parts shall be interchangeable individually, and as a whole RTU. Any such change or replacement shall not reduce the capability of the equipment to conform to the requirements of this specification.

1.7.7.6 RTU power supply

The power supply to run the RTU shall be the responsibility of the contractor. However, at some locations, a general purpose 240 VAC supply will be available to power the RTU. At these sites, the RTU is required to function for a period of at least 10 hours in case of AC supply failure. A combination battery charger and battery shall be provided by the supplier for this purpose. The RTU and its communication equipment are the only equipment to be powered from this source at these locations.

The batteries provided by the supplier shall be 12 VDC. Batteries shall be of the sealed

AGM (absorbed glass mat) or gel type lead acid, and shall be supplied in a separate wall mounted cubicle, with venting to atmosphere of approximately 10cm square.

The supplier is required to provide design calculations to demonstrate the battery capacity to be supplied. The calculation of the required battery capacity shall include a margin to ensure system integrity. This margin shall include a design allowance of 20% minimum, a temperature correction and an ageing factor for at least 4 years obtained from the battery manufacturer. The battery shall be suitable to be recharged from its design end-of-discharge voltage to full charge in 5 hours.

1.7.7.6.1 General

In all cases, galvanic isolation shall be provided on each power supply of the RTU that connects to the power supply source. Power supply isolation shall conform to applicable standards.

1.7.7.6.2 RTU CPU

The RTU shall be micro processor based. Once power is supplied to the unit, it shall be designed to operate without manual intervention; additionally, it shall auto restart and be able to communicate with the master station without reporting spurious state changes on power resumption after a power failure. Suitable, reliable indicators such as LEDs shall be provided for personnel to readily ascertain the status of the RTU.

The processor shall monitor the health of the RTU with built in diagnostics, which are capable of remote interrogation including diagnostics for memory and bus errors, buffer over flows, local software routine health, communication ports status, input/output card health. Diagnostics shall also be supplied that shall permit complete testing of the RTU with a portable computer. Diagnostic checking of the communication ports shall be provided to permit checking by a portable computer.

Power supply and battery low volts or failure conditions shall be monitored.

The RTU shall possess memory to permit storage of a minimum of 2000 events (input changes) locally for subsequent transmission to the SCADA master station and these events shall not be lost on buffer overflow; an indication shall be provided of this latter condition. Events will be retained in the buffer until they are correctly read by the master station. As a minimum, separate buffers shall be provided for digital and analogue events. To enable fault finding to occur, there shall be a separate event list to record internal RTU events such as health, time synchronisation and any internal errors. This shall permit storage of upto 2000 events.

When memory is provided for the purposes of local control or communications routines, spare capacity shall be provided equal to the amount utilised.

The RTU shall have a real time clock, with a resolution of 1 m sec. It shall have the capability of time stamping events. The RTU clock shall be synchronized by the master station using DNP 3 protocol every 5 minutes. In the event that this does not occur, the RTU clock shall drift no more than 1 second in 24 hours.

Within the RTU, events shall be reported to an accuracy of +/- 1 m sec.

The RTU shall be capable of programming in a high level language to implement local control and logic routines. It shall also be capable of being programmed using at least two IEC 1131-3 programming languages.

1.7.7.6.3 Communication ports

The minimum requirement for communications is as follows:

- The RTU shall be equipped and configured to communicate via dual 10 Base FL Ethernet ports,
- RS-232 serial port
- RS-485.
- RS-232/RS-485 port

Isolation of all communications circuits shall conform to IEC 60870.2.1 Table 18 Class VW3. Galvanic isolation shall be provided for any port that is not based on a fiber interface.

The RTU must reply on whichever port it is scanned.

The SCADA Master Stations interface with the RTUs utilizing ISDN/GPRS modem.

1.7.7.7 RTU Input/ Output modules

This section relates to direct wired input/output equipment.

1.7.7.7.1 Digital inputs

Digital inputs shall comprise both active & passive types. Where passive inputs are nominated, the power shall originate at the input module. Active inputs shall be powered from external equipment. Both the active and passive inputs shall normally have identical voltage ratings & types.

Digital input signals shall conform to applicable standards, and galvanic isolation shall be provided.

Each input shall be provided with individual 'anti-bounce' signal conditioning and noise filtering such that a value can be varied to adjust the sensitivity of the input from 0-30 ms. This ensures compatibility with older equipment with contacts that do not make solid contact initially.

Each input shall be able to detect a minimum change, from High to Lower, Low to High, of 4ms. The threshold voltage shall be set such that an input will not change from Low to High unless the input voltage is atleast 35% of the nominal battery voltage and it will not change from High to Low unless the input voltage is less than 65% of the nominal battery voltage.

Each group of inputs shall be protected by fuses (or equivalent). Fuse monitoring in groups shall be provided to detect whether fuses have failed, and alert the master station operator of this occurrence.

1.7.7.7.2 Digital outputs

Digital outputs shall comprise voltage free contacts rated for switching. Relays shall conform to IEC 60255-3 (formerly IEC 255-4).

Loads shall be typically:

240V AC 2 Amps

24V DC 1 Amp

Appropriate relays shall be selected for the specific type of load. The minimum contact wetting current shall be specified for the relays selected.

Digital output signals shall conform to applicable standards, and galvanic isolation shall be provided.

The preference is to use voltage free contacts for the digital outputs. This applies to all controls which therefore require 2 wires in the field cabling for each control.

1.7.7.7.3 Analogue inputs

Analogue input signals will conform to applicable standards, and galvanic isolation shall be provided.

Analogue inputs shall be bipolar, but normally configured to accept 4-20m ADC or ± 20 m ADC or ± 10 m ADC or ± 2 VDC using full resolution.

Each input shall be provided with individual software filtering.

The resistors used to convert the current loop to a voltage shall be precision resistors. The overall minimum accuracy of analogue measurement shall be 0.25% over the full scale and full temperature range. This includes resistors, ADC and software accuracy.

- Monitoring of all inputs, control of all outputs and testing of calculation logic.
- Monitoring of all inputs and logic at card level, logic level and DNP3 level.
- Display of communications statistics and eavesdropping of communications channels, including Ethernet, IP, DNP3, Mod bus and Conitel/Baker.
- Download & upload of RTU software, database configuration and calculations, upload the complete configuration from RTU to modify and then download to RTU.
- On-line help.
- Display current firmware, software and configuration running in the RTU
- Configuration and diagnostic software must run on both Windows 2000, XP, Windows 7 and 8.

The diagnostic and configuration utility software shall be provided on a CD/DVD that is compatible with the laptop PC. The current version number of such software shall be

provided. Any costs in upgrading to subsequent version numbers shall be included in the pricing.

1.7.7.8 RTU cubicle

Each RTU shall be supplied fully assembled, together with all ancillary equipment, including wiring terminals, mounting rails, wiring ducts & wiring, to form a complete system, subject only to connection of substation equipment to field terminals.

1.7.7.8.1 RTU marshalling cubicle

The RTU marshalling cubicle shall incorporate cable-marshalling terminals for all incoming field cables. Terminals shall normally be rail mounted vertically.

Terminals shall be provided for each core of all field cables. The individual cores of a field cable will be terminated in a row of adjacent terminals.

Adequate means of support for field cables shall be provided. This will typically be a section of cable ladder/tray/ducting to which the field cables can be tied for support. Normal field cable access shall be bottom entry into the marshalling cubicle.

Space shall be allocated between sections of terminals allocated to different cables to provide adequate space for labelling – a minimum label width of 9 mm shall be provided. Wiring looms shall be provided between each RTU I/O module in the RTU cubicle and the terminals in the RTU marshalling cubicle.

Where ducting is provided for locating cables, the duct size shall be large enough to hold all the cables permitting the duct lid to be fitted when cables are installed.

The design of the marshalling cubicle layout shall be to Engineer's approval.

1.7.7.9 Factory testing

The RTU shall be supplied defect free.

An Inspection & Test Plan shall be submitted for approval, prior to the commencement of any tests.

Factory testing of each RTU shall be conducted at the manufacturer's premises. Provision shall be made for witness testing of all equipment.

Each RTU shall be fully assembled and configured for factory testing, prior to dispatch.

Tests shall include, but not be limited to:

- Point to point wiring check
- Serial numbers of all cards and modules shall be listed in an Excel spreadsheet
- Confirmation of all digital inputs & outputs, from the field terminal through to the diagnostic laptop
- Verification of analogue values received (at least zero, half full scale, full scale values and negative full scale values for bipolar analogues) using a DC current or voltage signal generator measured from the field terminals to the diagnostic laptop
- Confirmation of control functions from the diagnostic laptop to the field terminals, including exercising the dummy circuit breaker, and the controls isolate switch
- Confirmation of effective communications between the RTU and other devices using the specified protocols
- All powered tests shall be carried out at the specified power supply rating of the RTU

Test results for each RTU showing tests undertaken, results and any corrective action taken shall be provided in an approved format.

Test results for each RTU showing tests undertaken, results and any corrective action taken shall be provided in an approved format.

1.7.7.10 Documentation associated with the RTU equipment

Documentation comprises the supplier's standard manuals and customised drawings for each RTU.

1.7.7.11 Manuals

The Supplier shall supply descriptive manuals for design, configuration, installation, commissioning and maintenance purposes.

1.7.7.12 Drawings

It is preferred that drawings of input/output circuits be provided in "proforma" form, such that they may be easily understood by field staff from a master set, rather than

having multiple sets of drawings. Separate spreadsheets may be provided to contain additional information.

Drawings as follows shall be submitted for the approval, for each RTU:

- Inspection & Test Plans
- Cubicle or gear plate General Arrangements showing RTU layout
- Dimensioned cubicle and/or gear plate drawings
- Bill of Material for each cubicle/gear plate set identifying all parts
- Power Distribution Schematic Diagrams for each RTU
- Schematic Diagrams for Inputs and Outputs for each RTU(preferably using pro forma principles)
- Calculations for RTU and I/O power consumption: An Excel spreadsheet shall be provided that calculates the maximum power consumption of the RTU. Inputs shall be the numbers and types of I/O and communications cards. The calculations shall compute the power at the primary voltage level into the RTU allowing for any power conversion efficiencies.

1.7.7.13 Spare parts

A set of recommended spare parts not less than 10% of installed quantity shall be detailed and supplied for each RTU. The set shall be sufficient to cover the complete range of RTUs supplied.

All spare parts shall be fully tested.

1.7.8 PC Based SCADA System

1.7.8.1 Supervisory Control and Data Acquisition System (SCADA)

The SCADA shall be a fully integrated microprocessor based control and data acquisition system to monitor, control, display, record and trend all assigned plant inputs and outputs. The SCADA shall be a fully dual redundant server microprocessor based computer system such that reliable and automatic plant control can be achieved. The main process monitoring and control shall be by means of VDU (monitor) based process operator workstations that shall be located in the central control room.

SCADA/HMI system shall be **Redundant server** system. The system shall be designed and implemented such that the failure of a central processor or HMI console does not inhibit continuous automatic control of the plant. In the event of such a failure, historical data shall be recoverable to a condition where a worst-case maximum of 15 minutes of historical data is lost.

Failure of a single outstation or communications to that outstation shall not affect control or operation of any other outstation, unless the failed outstation provides essential data to another outstation, in which case the non-failed outstations shall revert to a fail-safe mode.

An alarm shall be generated whenever a communications system failure occurs.

1.7.8.2 Hardware

The system shall support hardware and software interconnectivity to other networks generally in accordance with the **ISO Open System Interconnect 7 layer reference model**.

1.7.8.3 Computer

1. The computer hardware shall be of current technology at the time of installation, Standard PC technology with modern hardware, Windows operating system and data transmission over Industrial Ethernet must be used for the engineering workstations.
 - It must be possible to install more than one engineering station in a system.
 - The engineering system must be an open system that, for example, permits the importing of project data from Microsoft Excel or from CAD/CAE programs. It must be possible to import/export messages to/from Excel and Access for simple processing.
 - Removable memory media must also be provided for each workstation.
 - It must be possible to back up all database and configuration data both on removable media and on non-removable storage media without the system being offline.

- Provision of redundant storage media must be possible for the configuration database.
- The computer shall, as a minimum comprise of a personal computer (PC) type architecture, with IBM compatible Pentium IV based system or better, capable of running a multi-tasking real time operating system suitable for process control applications: The specs for computer hardware shown are indicative only. The contractor to select the appropriate hardware to suit the process requirements and data archiving.
 - a. Minimum clock speed shall be 2GHz
 - b. Hard disk drive: 500GB (Minimum)
- 2. All workstations, servers, communications equipment and peripherals shall be from reputed manufacturers, suitable for continuous operation and shall be the most currently available models at the time of construction, subject to approval. Adequate spare capacity shall be included to meet the specified requirements and future expansions.
- 3. Data Storage
 A historical data storage system with removable media for archive and backup will be provided.
 The data storage system shall store alarms and events, with the time of occurrence for one month and selected analogue signals connected to the system. All alarms and events shall be archived in a first in first out buffer, for a period of 40 days.
 A high speed back up device with removable media, such as streaming tape cartridge or optical disk, shall be provided for each, suitable for backing up the whole system on a weekly basis. Data selected for archive shall be written to removable media which shall be sized to support at least 40 days' worth of archive data.
 External portable hard disk alongwith at least one DVD write/rewrite/read with +R and -R capacity in addition to the historical data storage device in the Engineering Station should be provided.

1.7.9 Visual Display Unit (VDU)/Monitors

1. Visual Display Units (VDU's) shall be colour monitor screens, capable of displaying information in alphanumeric, bar histogram, graphical and mimic diagram formats. Monitors shall simultaneously display a minimum of 256 colours, non-interlaced, low radiation, flat screen with no discernible flicker. Display of characters shall be legible and stable on a shadow mask tube, having a resolution of not less than 1024 by 768 pixels and a refresh rate of not less than 70 Hz. The units shall include all the necessary picture controls to adjust the sharpness, contrast and position of the image. VDUs shall be flat screen, LED type, minimum requirements: brightness 250 cd/m², 500:1 contrast ratio, 1600 x 1200 pixels,
2. VDU's for SCC's shall be **32** inch.
3. VDU's for MCC shall be **60** inch. (Minimum)
4. VDU's shall be fitted with a power management system to reduce consumption upon detection of a stand-by signal from the PC.

Printers

Logging / Alarm / Report Printers – Continuous Feed:

1. Printers used for logging of system wide events and alarms shall comply with the following:-

a. print speed	:	160 characters per second
b. print quality	:	letter print with optional draft mode
c. paper feed	:	adjustable width tractor feed mechanism
d. paper width	:	18 to 38 cm fan fold
e. print pitch	:	10 or 12 cpi
f. print width	:	132 characters at 10 cpi
g. character set	:	Full ASCII
h. noise level	:	< 50 dBA.

Colour Printers

Laser Jet printers shall be used for the production of colour screen dumps and reports and shall have a sufficiently sized buffer memory such that system performance will not be degraded when the colour printer is operational and comply with the following:

- | | | |
|----------------|---|---|
| a. print speed | : | text, 80 characters per second |
| b. print speed | : | colour graphics, 2 minutes per full page (max.) |
| c. colours | : | compatible with VDU graphics |
| d. paper feed | : | A3 and A4 with auto sheet feeder mechanism and minimum 50 sheets per tray |
| e. paper width | : | A4/A3 |
| f. resolution | : | 600 DPI |
| g. RAM | : | min. 8 MB |

1.7.10 System Overview

The SCADA/HMI system shall follow the International Standards Organization (ISO), Open Systems Interconnect (OSI), reference model guidelines. All central system hardware and software devices shall be interconnected using a bus topology data highway. The communications protocol used shall generally meet the requirements of the ISO.

The system shall provide efficient and safe operation of the process plant by detecting alarm and error conditions, alerting the operator to these conditions both visually and audibly, monitoring all important system parameters and providing facilities for plant optimization. The system will allow operators, technicians and engineers to issue commands to change system parameters, start and stop equipment, provide configuration tools and operate diagnostic facilities from Operator Workstations (OW) and Engineers Terminal (ET), after successful log-on by security password.

The System shall perform all the necessary functions for the optimum monitoring, control and operation of the entire system.

For each abnormal condition, Plant failure, Plant unavailable or failure to respond to a command within a given period, the MMI shall provide the appropriate alarm. Printed and archived alarms shall be time and date stamped for occurrence and acceptance. Alarms, logs and reports shall be output to separate printers. Alarms shall be in red. The ability to generate alarms within the system software based upon digital and / or analogue events and set points shall be provided.

An alarm horn with silence button shall be provided to alert the operator of an alarm condition.

Specific alarm, monitoring and control input / output requirements shall be determined from the particular control specifications and the Project Drawings.

SCADA/HMI system should be housed in an air-conditioned environment.

1.7.11 SCADA Software Functions**1.7.11.1 General:**

1. The Contractor shall be responsible for supplying complete software packages to enable the equipment to operate as stated in this specification. Provision must be made for the adding of further software tasks as and when required. All software functions shall be user friendly, with instruction and messages to aid the operator. The Contractor shall make available all standard software functions, even if not specifically detailed in the specification.
2. The computers shall utilise a real time multi-tasking and networked operating system with a proven track record in real time control applications.
3. The Operating System shall be Windows XP, loaded with MS-Office latest licensed version suitable for interconnection with external networks in a Wide Area Network (WAN) configuration, where specified.
4. The Application Software shall provide communication with other industrial standard open networks. The Software shall support Object Linked Embedding for Process Control (OPC). External interfaces are not allowed for OPC.

The System shall support fully distributed 64 bit Client/Server architecture.

The System shall include Visual Basic for Applications (VBA) as a built-in programming language. Facility shall be available for building custom objects using VBA.

Object oriented graphics and tools to easily build reusable control strategies.

ODBC Application Program Interface (API) capable of collecting and writing secure real-time electronic records to one or more relational database.

The SCADA software & Hardware shall support OPC standards as both a client and a server for fast and reliable communications with a wide variety of hardware devices.

Provide Active-X controls with selection of third-party Active-X controls for ready-made solutions without VBA programming.

The SCADA software shall use SQL server as the integral database.

A standard software package, such as Crystal Report shall be provided to facilitate generation of free format, intuitive and presentation quality reports.

The Engineering Workstation shall be provided with simulation tools to support off-line testing of the control logics.

The Server shall provide the master clock for the SCADA time synchronization.

The system software shall be from the SCADA equipment manufacturer. Third party software is not acceptable.

It is a requirement that the system be supported by on line configuration and editing of all VDU mimic displays and database and to create new displays and additional database.

Operational mimics and other graphics shall be presented in an industry standard graphical user interface (GUI) format. A minimum of three active windows shall be displayable concurrently. Both text and graphics shall resize automatically to accommodate changes made to the size of a window. The system shall be designed to minimize the operator's use of the keyboard. All major functions shall be accessible on-screen through use of the mouse or track ball.

Operator system entry, for each area will be password coded with different levels of entry depending on the level of authority of the operator. Development and systems level entry passwords will be provided for engineering workstations. Each action taken by any operator at any level of entry, or at any operator terminal, shall be log file recorded and time and date stamped. Log in and out time and dates will be printed on the control room event logging printer.

VDU mimics will display dynamic colour details of flow rates and pressures, pump status, well levels, alarms, electrical power supplies and other general equipment status conditions. All requests and commands shall be via icons, whether menu linked or linked to equipment control actions. A permanent dynamic alarm banner shall be displayed at the bottom or top of each operator screen. Each control action will be routed through a series of confirmation routines. The reports shall be available for printing in graph or tabular format. Dynamic trend displays shall also be available for all analogue flow, level and pressure values. Custom, as well as preconfigured reports and trends shall be available to a higher level of entry. A colour, A4/A3 size, screen dump printer shall be provided for graph and trend prints.

An operator help utility shall be provided, offering help linked to the particular action being carried out by the operator at that time. At least one help screen per screen page shall be available. This facility shall be preconfigured with an option for updating by operators, via a password entry.

The Application Server software shall be configurable to provide for the monitoring and control of all points, loops, and systems through graphic display screens and hard copy reports. These shall include:

Parameter Displays for signal control

Control Loop Status Displays

Real Time and Historical Data Trend Displays

Event Displays and Log Reports

Alarm Displays and Log Reports

Equipment Diagnostic Displays and Reports.

The system shall provide on-line diagnostics that display the current status and operation of the local area network and its nodes. The diagnostic display shall include the LAN adapter status for the machine showing the display, as well as the current number of messages, errors and retries.

The system shall conform to and take advantage of industry standards. These shall include, but not be limited to:

- ODBC
- OLE
- ActiveX
- COM/DCOM
- DDE and Advance DDE
- C programming language
- Visual Basic
- Microsoft Windows XP or the most current Operating System
- TCP/IP
- OPC
- XML

It must be possible to integrate standard Windows applications such as Microsoft® Excel, Microsoft® Word and Microsoft® Access by means of the standard mechanisms OLE/ActiveX, ODBC/SQL. Any user programs (e.g. individual data management, analysis, process optimization) must work together with the control system via the integrated C programming interface and then utilize both the control system data and the control system functions.

The control system must be OPC-compatible in order to allow cross-vendor communication. The different OPC standards (DA, HDA and A&E) must be taken into consideration here. Current process data regarding this should be made available to other computers and applications. In this way, any computer that is connected to the network should be able to access all of the control system's data. The use of a standard database (Microsoft® SQL Server 2000) is required to store (write-protected) all of the list-oriented configuration data such as lists of variables and message texts as well as current process data such as messages, measured values and user data sets in order to be able to access the database via the opened programming interfaces C-API or OLE-DB. Work steps in the engineering phase should be automated and the configuration environment should be individually expandable through the integration of the standard tool Visual Basic for Applications (this simplifies the generation of mass data).

It is critical that the control system should offer the capability of homogeneously integrating other applications and application blocks into the user interface for process operation. Both the application windows and the OLE Custom Controls (32 bit OCX objects) or ActiveX Controls can be integrated into the control system application as if they were the control system's own objects. It should be possible to use the ANSI-C script language and Visual Basic Scripting for dynamizing graphical objects.

1.7.11.2 Display Facilities

The displays shall be user configurable, with the user being able to construct any desired symbol for display. Any display shall appear (excluding historical recall) within 1 seconds to 3 seconds of selection and the displayed data shall be updated from the database. Alarms shall typically appear within 3 seconds to 5 seconds of occurrence and within 1 second of being received into the central system database.

The Contractor shall configure all display pages as fully as possible. However, facility must be incorporated to permit easy construction and modification of the display pages, by using a standard library of shapes and symbols. The library shall be added to and modified by the user as required. The configuration shall be object orientated for ease of use.

The initial application software shall provide for the display pages listed below and any pages necessary for the system to function as a complete entity.

- Mimic displays.
- Graphic displays.
- Trend displays.
- Alarm summary tables with date and time.
- Event logs of past 72 hours with date and time.
- Tabular display of data.

Inset windows showing analogue trends may be mixed with mimic displays. In such a display the main mimic and inset trend shall all be live with automatic display updates. Indexing of information and menus shall be presented in the form of active windows on the screen, while the mimics etc. are still available for view.

No display or function shall effect the logging/monitoring of data. It shall be possible for the master station terminal and auxiliary terminals to perform simultaneously, different tasks within the display.

Multi-level real-time auditing, advising of energy optimization process and diagnosis of Plant process performance Software (Operational Data Management Software)

SCADA shall support and include a multi-level real-time auditing and advising of energy optimization process and Real-time process performance software. The key benefits of a performance auditing system would be a more efficient plant, improved reliability & safety, and increased profitability.

Objective of the software in conjunction with SCADA:

- Real-time process optimization resulting in energy savings /Cost savings
- Reduce Downtime Due to Unnecessary Process Shutdowns
- Reduce Process Information Overload on Operators & Engineers
- Maintain Better Quality Control of the Desired Process & Products
- Capture and Retain Process Knowledge Spread Across Plant Personnel

The optimization software shall support the following features on a minimum:

1. The real time process optimization software in conjunction with SCADA should comprise of a single source means for complete, multi-level real-time auditing and diagnosis of Plant process performance.
2. It should continuously audit plant operation to identify areas and assets (instrumentation, control loops, equipment, unit operations, etc.) that are not performing properly.
3. Process Sensor Data Validation and Reconciliation
The software in conjunction with SCADA should use method of minimal evidence diagnostic logic to validate process sensors and audit unit operations
4. Single & Multiple Fault Analysis
The optimization software in conjunction with SCADA should use method of minimal evidence diagnostic logic to identify either single or multiple process sensor and unit operation problems or abnormal process conditions
5. Statistical Process Control Capability
The optimization software in conjunction with SCADA should incorporate SPC functionality (Exponentially Weighted Moving Average.-EWMA) with alert capabilities for either continuous or batch processes and for performance equations
6. The optimization software in conjunction with SCADA should also provide timely information for improved reliability, process optimization, product quality improvement, cost reduction and critical business (financial, operations, etc.) process reporting & evaluation
7. All screens (advisory, reports, and charts) should be auto-generating from the point list to be audited. This will eliminate any additional interface programming costs during initial setup and continued maintenance of the system.
8. The optimization software in conjunction with SCADA should be designed in such a way to reduce cost, time, and resource commitment required to install and maintain these applications, allowing for a quick return on investment.

9. It should be compatible with Industry standard technology (XLM, OPC) to take the data from the plant/process to the desktop, making it available for use by ERP, PLM, PAM and other applications
10. It should also provide redundant soft sensors that could be used via manual set point control if for any reason the actual meters are reading incorrectly.
11. The optimization software in conjunction with SCADA software should operate either as a standalone system or run as a web service with advice and information screens as web clients capable of messaging to pagers, cell phones, etc. The flexibility should allow it to be directly incorporated into most common distributed control systems and ERP systems.
12. It should also be self-documenting. The entire configured process should be able to be cross referenced in an HTML report.
13. It should also be web-based. It also needs to be secured using standard NT security to make remote access to data and information both easy and secure.
14. The optimization software should take tools that are normally used offline by these groups, such as Excel, SQL, crystal reports and incorporates them into a comprehensive online auditing and advisory suite. These tools include advising, charting, executive summaries, reporting, key performance indicators, and soft sensor.

1.7.12 Monitoring and Alarms

1. The operator shall be able to monitor all of the information at the workstation. He shall be able to view active equipment information on a series of VDU based graphical and tabular displays.
2. In the event of an equipment alarm, the following shall occur at the master station:
 - a. Alarm message displayed in the alarm message area of the screen.
 - b. The audible alarm shall sound.
 - c. The appropriate Section of the display page shall change colour and flash.
 - d. A full message shall be written on the alarm page.
 - e. The full alarm message shall be printed on the alarm printer.
 - f. The full alarm message shall be recorded, stored on disk and automatically archived.
3. The operator should be able to acknowledge the alarm by pressing an accept alarm key or icon. This action shall stop flashing of all associated alarm messages and displays. However the display shall remain in the alarm state fixed colour to indicate an accepted alarm. When all outstanding alarms have been acknowledged the audible alarm shall be silenced.
4. Once the alarm has cleared, the messages and displays shall return to normal. The alarm message shall stay recorded on the event/alarm log and an alarm cleared message shall also be recorded.
5. If the alarm clears before being acknowledged the sequence of events shall continue as above except the message shall change to indicate a cleared alarm.
6. An audible alarm silence function shall be provided to enable an operator to silence the audible alarm without acknowledging all alarms. On occurrence of any subsequent alarm, the audible alarm shall sound.
7. Each signal within the configured system shall be capable of being assigned an alarm based on the following:
 - a. Four levels per analogue (Lo Lo, Hi Hi, Lo and Hi).
 - b. Rate of change.
 - c. Deviation from set point or other control parameter.
8. Alarms shall be time tagged to 1 second resolution at the I/O's.
9. A minimum of four alarm priorities shall be provided so that those requiring immediate attention may be separated from alarms of lower priority. An audible alarm shall sound for alarms requiring operator action.
10. Typical alarm assignments are as follows:
 - a) critical alarm -an alarm that requires immediate operator action

- b) non critical alarm -an alarm that requires operator action but not necessarily immediate action
- c) operator guide alarm- an alarm that provides information to the operator event - a low priority condition which is recorded.

1.7.13 Data Archiving

The Microsoft® SQL Server 2000 database system must be provided for managing the archives and the system parameters. In addition to the required scope of performance of the databases, the capability for modifying or creating new applications must be considered by the customer in the licenses offered. The selected database system and the tools needed by the contractor within the scope of the database application must be named in the bid.

Continuous process (analogue) data, digital event states, alarms and operator actions shall be archived to a removable media system. The archive media shall be sized to store logged analogue data, at a maximum sample rate of 15 minutes for a period of 15 months. Data recording shall be on dual media. The archive system shall generate an alarm when a file is 75% full.

Analogues will be stored at a rate selected by the operator in the range 1 second to 1 hour. The operator shall have the facility to select the way in which an analogue is stored. The system will provide any combination of the following:

- a. Instantaneous value.
- b. Average value.
- c. Maximum value.
- d. Minimum value.
- e. Not stored.

Maximum, minimum and average values shall be calculated over a period set by the operator in the range 15 minutes to 24 hours, the default shall be 1 hour.

The logging of new data and reception of alarms must be carried out at the same time as the operator is viewing archived data. Any alarms received must be displayed as an overlay on the visual display unit.

1.7.14 Mimic Displays (Mimics)

The Contractor shall configure all the mimics to provide total detailed coverage of the monitoring and control of equipment as detailed in this specification. It is expected that display modifications will be required in the future and therefore the ability to change the displays without programming skills is essential.

Instrumentation shall be displayed using ISO standard symbols. For mimic configuration, it shall be possible to call up a library of standard symbols representing items (e.g. pumps, valves) and add new symbols to the library. Building mimics shall be simple and be achieved by using a mouse or tracker ball pointing device. The mimic displays shall consist of the following pages:

- a) A general diagram covering the whole of the system on a single screen with key data
- b) A general block diagram for each site or area of Site showing the equipment displayed on a series of single screens with key data
- c) Mimic of the equipment and instrumentation connected to each IO module displayed on as many screens as necessary.

1.7.15 Trend Displays

Archived values (instantaneous values or compressed values) can be displayed as curves and in tables on the screen and in reports. The colors and pattern indicate, for example, overshoot limits, substitute values, faults and time jumps. Like the message window, the curve window also has a toolbar for curve controls. A quick help explains the meaning of the individual icons. Individually designed keys can also be configured and saved with the associated operating functions. For authorized operators, it is also possible to change the parameterization online, i.e. to change the colors of the curves or to regroup the groups.

Access to the archives is supported by targeted, direct selection of measuring point groups, measuring points and individual measured values. The selection can be made via

names or time windows. The values of an display section can be focused on in detail using the reading line and zoom function. The scaling of the time axis and value axis is adjusted accordingly and the curve values for the display are interpolated. For a curve window, a shared or separate axis can be configured for each curve with a different value range. Limit violations should be identified by a configurable color change when displayed in the curve window.

Horizontal and vertical "recording directions" of the curves can be set by the configurable direction of the curve display, which makes a recording function possible. Compared to the normal curve display, the x axis and y axis are interchanged by means of the recording function. The y axis is used as time axis. With the recorder function, you can also determine whether the current time is counted down on the upper or lower edge of the curve window. If several curves are displayed at the same time, the control system should also offer the facility for staggering the curves. This setting displays the curves that are to be displayed in a curve window one above the other. For each trend, a value range that is to be displayed can be set for the Y axis.

It shall be possible to plot dynamically updated real time data and archived data on a line graph, to represent analogue or digital information. Each graph shall be capable of displaying 8 plots overlaid on a graph of different colours and line texture. Next to the graph, there shall be a key relating each colour to its function. The horizontal axis shall be time based and user selectable in minutes, hours, days, weeks, for example, together with a start time.

The vertical axis shall be scaled as a percentage of range and be displayed in the colour of the selected reading. To avoid cluttering, the vertical axis scale shall be changed by selecting the individual display. The vertical axis shall be automatically scaled for each selected point, between limits entered by the user. Actual values in engineering units shall be displayed by positioning a cursor at the desired point of the trend graph.

The display of the data shall also be available in tabular form.

1.7.16 Manual Data Entry

1. The system shall be provided with facility for entering data manually via the keyboard. This data will fall into two types:
 - a. Constants which will be changed infrequently. This data may have time and date associated with it.
 - b. Maintenance related comments.

1.7.17 Manually Corrected Data

The system shall allow a person with authorized access to correct manually, erroneous data via the keyboard.

1.7.18 Reports

There shall be a real time spreadsheet facility supplied and installed by the Contractor in the master station. The users shall be able to transfer data from either the archive system or live data to the spreadsheet. The user shall be able to produce daily, weekly, monthly and annual reports using any data and a mixture of formats (tables, graphs, summaries, spreadsheets). It shall be possible to generate reports, either automatically at predetermined intervals, or manually on demand by the Operator. Typical reports on a minimum would be:

- a. Flow rates and total.
- b. Failures of equipment.
- c. Analytical instrumentation parameters, Electrical parameters
- d. Tank levels.
- e. Discharge pressures.
- f. Maintenance schedules.
- g. Process alarm conditions.
- h. Chlorination equipment status etc....

1.7.19 Profiling

From an average, typical or manually entered plot, it shall be possible to set an exception profile whereby readings within an upper and lower level are acceptable. Profiles shall be

set graphically via OW. The user may select for the system to alarm if the reading is outside the profile and highlight such exceptions as part of a report, thereby reducing the need to examine all data, to ensure acceptability. The number of exceptions shall be logged.

1.7.20 Data Manipulation

It shall be possible to perform simple mathematical functions on any data, including the following functions:

- a. Addition
- b. Subtraction
- c. Multiplication
- d. Division
- e. Square root

It shall be possible to log, display or use in a control loop, the resultant data.

1.7.21 Database Query Facilities

The system shall support the use of database relationships and wild card characters to provide database query facilities. It shall be possible for applications integration to configure queries easily and save them for future use. Support of Dynamic Data Exchange (DDE) or Structured Query Language (SQL), to permit data exchange between the DCS and external applications, including spread sheets and databases.

Data shall be presented in tabular format and contain any combination of fields from the main system database. It shall be possible to manipulate the data by specifying search and sort criteria to define data range limits. Once a query table has been created, it shall be possible to store the configuration and initiate successive look-ups, using a point and shoot technique.

1.7.22 Downloading IO Configuration

It shall be possible to download configuration to the IO's from the Engineer's terminal and the Portable Programming Unit (Laptop)

1.7.23 Diagnostics

The system shall have on-line diagnostic facilities to report system faults as they occur. A set of off-line diagnostic routines shall be supplied for more extensive fault diagnosis.

1.7.24 Security Access Levels

The functions available on the system shall be fully flexible so as to allow users access levels to be customized by the system operator, to suit individual user requirements.

Access to management and engineering levels shall be restricted by user selectable passwords or software key switch. The security systems shall be based on a set of privileges, which may be granted or denied to individual users by the system operator.

The security/access levels would be divided between engineers, supervisors and operators.

The system shall be protected from un-authorized changes to the operating system and application programs.

The system shall prevent un-authorized users from re-booting the system or aborting or suspending system-related programs.

The system shall provide three levels of operator access to the system as a minimum, with the first level permitting access to viewing selected plant conditions as described below and the highest level intended for the system manager.

A mechanism shall be provided which prevents users operating at a lower level from accessing functions assigned to a higher level.

The system shall provide a password-protected, user log-on facility for definition of the user access level. It shall be possible to define a minimum of eight privilege levels.

Passwords entered during the log-on process shall not be printed or displayed.

The software shall monitor the actions of the user currently logged on at each node and shall log the current user off after a definable extended period of no operator interaction with the system and produce a printed log-off message.

Logging off of the user shall not shut down the system.

CTRL-ALT-DELETE function of the windows operating system should be disabled to prevent un-authorized use of the system.

System-generated log messages relating to operator actions, such as alarm acknowledgements or set-point changes, shall include the identification of the current logged-on user.

The Contractor shall provide the following defined user access levels as a minimum and additional levels as instructed by the Engineer:

1.7.25 Default level

The default level shall permit users to view all displays except those specifically assigned to a higher level of access.

1.7.26 Operator level

The operator level shall permit authorized users to access default level activities in addition to the following:

- (a) Perform control actions;
- (b) Acknowledge alarms;
- (c) Enter or modify manually entered data for inclusion into reports.

1.7.27 System manager level

The system manager level shall permit authorized users to access default level and operator level activities in addition to the following:

- (a) Modify alarm and control set points, dead bands and time delays;
- (b) Enter or modify historical data;
- (c) Add, delete or modify individual I/O points or point attributes;
- (d) Add, delete or modify field device configurations;
- (e) Create, delete or modify control algorithms;
- (f) Create, delete or modify graphic displays;
- (g) Create, delete or modify system reports;
- (h) Configure trend displays;
- (j) Access the operating system;
- (k) Assign access levels and user passwords;
- (l) Perform any other system maintenance function

1.7.28 Programming

The method of programming will depend upon the Manufacturers system requirements. However, the following standards shall be followed:

- a. All programs shall be written such that they lend themselves easily to alterations and additions.
- b. Good programming practice shall be followed using structured programming techniques. All programs shall be tidy in format and logical to follow. Programs should be extensively annotated with comments and be self-documenting.
- c. The system shall be supplied with programs that use a high level language for the OW.

1.7.28.1 Multilingual Configuration Environment

A software version of the PLC system and HMI must support at a minimum the language, English. The user must be able to change back and forth between the different languages supported in the configuration environment and operator production mode without having to retranslate his application for this.

1.7.28.2 Program – Documentation:

As part of the requirements of this specification full documentation is required as below:

- a. Software user manuals
- b. Database point allocation table
- c. Complete program listing, flow charts for all sequences and control routines
- d. Application software source code
- e. End user license agreements.

1.7.29 MIMIC Panel

A minimum 60" LED screen with necessary CPU shall provide an elementary full colour pictorial flow diagram display of the water supply scheme and treatment plant including points at which chemicals are injected. The mimic shall also include displays of process

values e.g. reservoir levels, process flows, water quality etc. Mounting of LED mimic panel shall be as approved by employer's representative.

The operator interface shall provide facilities to:

- display status of devices associated with the process area concerned (i.e. running, stopped, fault etc.);
- display analogue values associated with that area of the plant;
- annunciate alarms associated with the area of the plant concerned;
- provide facilities for the operator to:
 - silence the alarm (the alarm shall automatically silence after one minute (manually adjustable) if not manually silenced);
 - acknowledge alarms
 - select the duty drive of duty / standby drive pairs;
 - adjust process set points;
 - prompt process actions (i.e. the backwash of a particular filter)

1.7.30 Control Room Furniture (System Console)

In addition to the SCADA/MMI system equipment, the Contractor shall provide furniture (system consoles) to complement or match both the colour and styling of the equipment. Control room furniture shall comply with relevant IEC standards for ergonomic design. System console shall be so designed to house all servers, workstations. Monitors, interface equipment with cables having back entry. Details and design of system consoles shall be submitted to the Engineer for approval.

Typically, The Contractor shall provide two fabric-covered upholstered swivel-type adjustable arm chairs with casters, a rigid and lockable steel cupboard for the storage of operating and maintenance manuals, drawings, logger paper, charts, disks and the like.

The visual display unit consoles or VDU desk shall incorporate at least one drawer unit with drawers for operators' use and for standard files.

1.7.31 Tests on SCADA System

The following tests for various items of local SCADA system including power supply system shall be carried out as a part of FAT in addition to other tests indicated by Contractor in FAT document.

1.7.32 Functional

All cubicles shall be energized and the power supplies tested on the panel and internal lighting arrangements examined.

The boards shall be examined to check that there are no Status Error LEDs lit.

The peripherals like printers etc. shall be energized and proper operation of peripheral checked by self-tests on equipment's which have the facilities and others like VDUs, by connecting them to the system.

The system I/O shall be simulated and checked upto SCADA system database.

By varying the different inputs at random and checking to ensure that right status reporting is done on the SCADA system, the healthiness of all channels shall be checked with rated load connected.

Displays: The following shall be functionally checked

Mimic display: Symbols, colors, for correct/ approved format etc.

Control Operations: Simulated command operations from SCADA without any malfunctioning.

Status changes: Representation of open/close facility and mode of operation

Variables: Engineering units, updating representation

Events and alarms: Generating of alarms, events by verifying inputs at random, color code, formatting, and printing

Trend: proper selection, presentation under different time scales and printing

Reports: Reports shall be checked for correct/ approved format, logging intervals, printing intervals, data accuracy etc.

1.7.33 Response Time Checking:

System response time shall be tested after simulating the full I/O and Man machine interface system.

Time taken from object status change to the presentation of object status on the display.
Time taken to generate and display single alarm and multiple alarms (upto 50) from the time of alarm condition.

Time taken to display a complex picture with all variables from the time of calling the display.

The accuracy of alarms on VDU and printer.

Time stamping accuracy between SCADA and PLC times.

Other Tests on SCADA

Fail safe operation of local SCADA system during total (including battery) backed power failure and restoration.

Fail-safe operation during on-line connection and removal of hand held maintenance unit, if any.

Check of detecting and reporting of failure of subsystem connected to the network on VDU status display.

Check of error free data transfer on Communication system along with modems/communication interfaces.

Check of hard copy unit functions by printing of process pictures.

Check of maintenance, backup (logic/programs, IO database, historical database, system configuration etc.) functions by connecting them to the system.

1.8 Instrument Control Panel (ICP)

1.8.1 General

Control Panel shall be CNC machine prefabricated out of CRCA sheet steel of thickness not less than 2 mm, modular in construction, properly reinforced, powder coated and having rigid frame structure. Internal mounting plate including the gland plate shall be 3 mm thick. The control panel shall have dimensions as per system requirement. However, the control panel height shall not exceed 2200 mm.

The exterior corners and edges shall be rounded to give a smooth overall appearance with projections kept to a minimum.

Lifting lugs shall be provided for installation purposes and shall be replaced with corrosion resistant bolts after installation.

Control Panel shall be completely metal enclosed and shall be dust, moisture and vermin proof. Control Panels and instrument enclosures shall provide a degree of protection as follows:

- Indoor Installation : IP 52
- Outdoor Installation : IP 65

Control Panel shall be free standing type. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation.

Metal sills in the form of metal channels properly drilled shall be furnished along with anchor bolts and necessary hardware for mounting the control panels. These shall be dispatched in advance so that they may be installed and leveled when concrete foundations are poured.

Cable entries to the panels shall be from the bottom with fire retardant spray compound sealing. Control panels shall be provided with louvers along with washable micron filters AIRIN – AIROUT fans. The control panels shall be designed for front as well as rear access.

The CP shall provide separate areas for the PLC, internal power distribution, instrumentation, field cabling termination and for Surge protection devices (SPDs).

1.8.2 Mounting

All equipment on front of panel shall be mounted flush or semi-flush. In case of semi-flush mounting, only flange or bezel shall be visible from the front.

Equipment shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent equipment.

Equipment mounted inside the panel shall be so located that terminals and adjacent devices are readily accessible without the use of special tools. Terminal markings shall be clearly visible.

Cut-outs and wiring for free issue items, if any, shall be according to corresponding equipment manufacturer's drawing. Cut-outs, if any, provided for future mounting of equipment shall be properly blanked-off.

Wherever required, panels/desks shall be matched with other adjacent panels/desks in respect of dimensions, color, appearance and arrangement of equipment on the front.

1.8.3 Earthing for Instruments

The panel shall be equipped with an earth bus securely fixed along the inside base of panel.

All metallic cases of relays, instruments and other panel mounted equipment shall be connected to the instrument earth bus.

Looping of earth connections which would result in loss of earth connection to other devices when the loop is broken shall not be permitted. However, looping of earth connections between equipment to create alternative paths to earth bus shall be provided. A separate instrument earth bus will be created which will be floating and all the cable shields will be terminated onto this bus. This bus will be connected to an electronic earth pit.

1.8.4 Frame Earthing

All metal parts other than those forming part of an electrical circuit shall be connected to a copper earth bar run along the inside bottom of the panel. The minimum section of the earth bar shall be 25 mm x 3 mm. A 15 mm diameter hole is to be provided at each end of the bar. Connection of the earth bar to the station earth shall be carried out by Contractor.

1.8.5 Space Heater

Strip type space heaters of adequate capacity shall be provided inside control panels to prevent moisture condensation on the wiring and panel mounted equipment when the panel is not in operation. The heaters shall operate on 230 V AC. Heaters inside the panels shall not be mounted close to the wiring or any panel mounted equipment. The operation of heaters shall be controlled by thermostats.

1.8.6 Interior Lighting and Receptacles

Each panel shall be provided with a CFL lighting fixture rated for 20 watt, 230V, 1 phase, 50 Hz supply for the interior illumination of the panel during maintenance. The illumination lamp shall be operated by door switch or manual switch. Each panel section shall be provided with separate lighting.

Each panel shall be provided with 230V, 1 phase, 50 Hz, combined 5 amps and 15 amps, 3 pin receptacle with a switch and neon indication. The receptacle with switch shall be mounted inside the panel at a convenient location. If the panel has front and rear doors then maintenance socket shall be provided at both locations.

1.8.7 Voltage Level and Power Supply Units

The incoming power supply to the control panel shall be 230 VAC, 50 Hz. Contractor shall provide necessary transformers, converters, inverters and other associated hardware required to generate the requisite power supply. Generally, voltage levels for control schemes and power supply for instruments shall be 24 V DC. Power supply to all the instruments mounted outside the control panel shall be provided from the power supply units in the control panel. In case the instruments require power supply other than 24 V DC, the Contractor shall provide the necessary convertors. The power supply to all the instruments shall be without interruption and shall be continued even in case of failure of 230 V A.C. power supply. The battery and battery charger shall be provided for this purpose and sizing of the same shall be based on the entire load of instrumentation system.

1.8.8 Labels

All the equipment mounted on the front face of control panel as well as equipment mounted inside the panels shall be provided with individual labels with equipment designation engraved. The labels shall be mounted directly below the respective

equipment. Also the panel shall be provided at the top with a label engraved with panel designation.

1.8.9 Switches and Miniature Circuit Breakers (MCBs)

Each control panel shall be provided with necessary arrangement for receiving, distributing, isolating and protecting of DC and AC supplies for various control, signaling, lighting and space heater circuits. The incoming and sub-circuits shall be separately provided with Miniature Circuit Breakers (MCBs). Potential circuits for relaying and metering also shall be protected by MCBs. All such MCBs will be provided with an auxiliary contact to be used for providing MCB tripped alarm.

1.8.10 Intra-Panel (Panel Internal) Wiring

Connections within a panel, between panel mounted devices and terminal blocks or between two panel mounted devices will be made by 660 volt grade, stranded copper conductor insulated with PVC and designed for a minimum conductor temperature of 90 degrees centigrade. The wires shall be shielded, where necessary.

Panels shall be supplied completely wired internally, with a color coding scheme decided mutually between the Department and the Contractor, to equipment and terminal blocks and ready for external cable connections at the terminal blocks.

Wires within the panel shall be continuous i.e. without splicing and shall comprise stranded copper conductors. Internal wiring or wiring between the two assemblies shall be commensurate with mechanical safety. Prefabricated cables with moulded multipin connectors shall be used.

Wire termination shall be made with solder less crimping type of tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules, marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wires and shall not fall off when the wire is disconnected from terminal blocks. All wires directly connected to trip circuit of breaker or device, shall be distinguished by the addition of a red colored unlettered ferrule.

Relay modules with plug-in type relays and having multipin connector facility shall be used.

1.8.10.1 Terminal Blocks

Terminal blocks for power connection shall be 660V grade, 20 amps rated, one-piece moulded, complete with stud type terminals, washers, nuts and lock nuts and identification markings. Terminal block design shall include a white fibre marking strip with clear plastic, hinged terminal covers. Markings on the terminal strips shall correspond to wire numbers on the wiring diagrams. All control output terminals will be fused type and all other input signal terminals will be clip on shrouded type.

All spare contacts and terminals of the panel mounted equipment and devices shall be wired to terminal blocks.

There shall be a minimum clearance of 250 mm between the first row of terminal blocks and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum 250 mm.

Panel internal wiring shall not be looped directly from instrument to instrument. The same shall be looped through the panel terminal block only.

If accidental short circuiting of certain wires is likely to result in malfunction of equipment, such as closing or tripping of a breaker or positive and negative wires, these wires shall not be terminated on adjacent terminal blocks.

1.8.10.2 Cable Supports

All external cables shall present a neat appearance and shall be suitably braced, placed in troughing clipped or laced to prevent effects of vibration.

1.8.10.3 Terminal/ Identification

Every terminal and test plug shall be uniquely identified within the terminal cabinet by means of a terminal number. Appropriate labels shall be used to permit quick and unambiguous identification of each terminal and test plug.

1.8.10.4 Painting of Control Panel/ Control Desk

The steel sheets of the control panel shall undergo 7 tank treatments prior to powder coating.

- a) All sheet steel work shall be phosphated in accordance with the following procedure:
 - i. The pre treatment shall be hot process with running water for rinsing.
 - ii. Oil, grease and dirt shall be thoroughly removed by emulsion cleaning.
 - iii. Rust and scale shall be removed by trickling with clean water followed by final rinsing with dilute dichromate solution.
- b) The control panel shall be powder coated with minimum thickness of coating of 60 microns. QA test certificate shall be furnished for thickness adhesion and hardening of powder coating.
Instrument Control Panel (ICP) shall be subjected for the following dimensional checks
 - Width
 - Height
 - Depth
 - Cut-out dimension for each panel mounted instrument
 - Spacing between the panel mounted instruments
- (c) High Voltage (HV) test for ICP
The HV test of 1 kV AC for one minute duration shall be implemented between the ICP and the individual power supply feeder which shall be isolated from the respective power supply. Any reduction in voltage level or duration is not acceptable.
- (d) Insulation test for ICP
Insulation test shall be carried out using a 500V megger as specified below (all instruments shall be disconnected from wiring)
 - i. Between individual terminal of terminal block and ground
 - ii. Between individual wire and ground
 - iii. Between adjacent terminals of terminal blocks

The acceptable indigenous makes for panel enclosures are Rittal, Enclotek. The acceptable control panel manufacturers are Siemens, Sai Technologies, Schneider, Tata Honeywell or equivalent as approved by Employer's Representative.

1.9 Flow Measuring System**1.9.1 General**

- i. Flow measuring system shall consist of flow sensor/ transducers, flow transmitter, digital flow indicator and integrator and any other item required to complete the system.
- ii. Flow transducers shall be rugged in construction and shall be suitable for continuous operation. Flow transducers shall have waterproof construction and shall be suitable for installation on underground /above ground pipe lines.
- iii. To avoid the effects of disturbances in the velocity profile, a straight and uninterrupted run, upstream as well as downstream from the location of the flow sensor shall be provided, as required by the flow meter manufacturer and in line with applicable standards.
Contractor shall finalize the exact location of flow transducers in consultation with Employer's Representative.
- iv. The flow transmitter shall be suitable for field mounting and shall accept input from the flow transducer. It shall process the input signal and provide 4-20 mA ADC output proportional to flow rate. Flow transmitters shall have LCD display to indicate instantaneous flow rate. The flow range shall be adjustable.
- v. For ultrasonic flow meters, an insertion / retraction tool assembly shall be provided so that the flow transducers can be removed or inserted without depressurising the pipeline. The same shall be made of anti-corrosive material.
- vi. The flow computer shall be microprocessor based and shall have self diagnosis facilities.

vii. The following standards shall be followed:

- BS EN 24185 - Measurement of fluid flow in closed conduits - Weighing Method.
- BS ISO 12765 – Measurement of fluid flow in closed conduits – Methods using transit-time ultrasonic flow meters
- ISO 8316 – Measurement of fluid flow in closed conduits – Method by collection of the liquid in a volumetric tank
- BS EN ISO 6817 – Measurement of conductive liquid flow in closed conduits – Method using electromagnetic flow meters
- BS EN 29104 (ISO 9104) – Measurement of fluid flow in closed conduit – Method of evaluating the performance of electromagnetic flow measuring system for liquid
- ISO 9826: Measurement of liquid flow in open channel – Parshall Flume and Saniri Flumes.

viii The flow meters shall be suitable for varying flow rates as per the various phases as follows:

- a) Raw Water:
 - Stage-I 10417 to 26000 cum/hr
 - Stage-II 26000 to 44210 cum/hr
- b) Treated Water:
 - Phase-I 8300 to 16667 cum/hr
 - Phase-II 16667 to 22500 cum/hr

1.9.2 Electromagnetic Full Bore Type Flow Meter

Full bore electromagnetic flow meter shall consist of flow sensor (i.e. flow tube), flow transmitter and flow indicator and integrator and any other item required to complete the system. To avoid the effects of disturbances in the velocity profile, a straight and uninterrupted run, upstream as well as downstream from the location of the flow meter shall be provided, as required by the flow meter manufacturer and in line with the applicable standards. Contractor shall finalize the exact location of flow meter in consultation with Employer's Representative.

Flow measurement shall not be affected by physical properties of water viz., temperature, pressure etc., within given limits. Contractor shall provide compensating electronic circuits, if required.

Contractor shall construct a suitable concrete chamber for enclosing flow meter if it is to be mounted on underground pipe lines. A concrete enclosure shall be constructed above the chamber for housing the flow transmitter. For surface pipelines, a concrete cabin shall be constructed around the pipeline for housing the flow meter and the flow transmitter.

A lockable enclosure shall be provided for the flow transmitter cum computing unit.

Flow meters shall be suitable for the water turbidity at site during various seasons. Flow tube shall be rugged in construction and shall be suitable for continuous operation. Flow tube shall have waterproof construction and shall be suitable for installation on underground /above ground pipe lines.

The flow computer and transmitter shall be a single unit suitable for field mounting. It shall accept inputs from flow tube process the signals and shall provide an output proportional to the flow rate. The output shall be suitable for transmitting over a long distance.

a) General:		
1.	Accuracy of flow measurement during FAT	± 0.5% of measured value
2.	Overall accuracy of flow measurement loop.	± 1.0 % of measured value
b)	Flow tube	
(i)	Application	: a) Raw water pumping mains b) Treated water pumping mains. c) Treated water supply lines.
(ii)	Type	: In line full bore electromagnetic

(iii)	Size of flow tube	:	Same as pipe size
(iv)	Process connection	:	Flanged
(v)	Weather Protection Class	:	IP 68 as per IS 13947
(vi)	Surge protection devices (SPD) between flow tube and flow transmitter	:	Required for protection from lightning surges
(vii)	Material of Construction :		
	Electrodes	:	SS 316
	Coil Housing	:	SS 316
	Flanges	:	SS.316
	Grounding ring	:	SS 316
(viii)	Flow tube Lining	:	Hard Rubber ¹
c)	Flow Transmitter Unit		
(i)	Type	:	Microprocessor based with facility to configure the ranges.
(ii)	Type of display	:	4 digit backlit LCD/ LCD , for flow rate in m3/hr. 8 digit backlit LCD/ LCD for totalized flow in ML
(iii)	Units of display	:	Flow rate -m3 / hr Totalized flow – ML
(iii)	Input	:	From flow tube
(iv)	Output	:	4-20 mA DC (isolated) proportional to flow rate
(v)	Power Supply	:	24 V DC
(vi)	Zero and Span Adjustment	:	Required
(vii)	Weather Protection Class	:	IP 65 as per IS 13947
(viii)	Battery backup for totalized flow Type Capacity Backup Time	:	Online 2.5 mVA 8 hours.
(xi)	Facility for on line diagnosis	:	Required
d) <u>Flow indicator and integrator</u>			
Specifications shall be as given under 'Flow Indicator and Integrator'.			

1.9.3 Calibration:

The Electromagnetic flow meter shall be calibrated for the full flow range specified as per BS EN 29104 (Methods of evaluation of electromagnetic flow meters).

The calibration method shall be either gravimetric method as per ISO 4185 (Measurement of fluid flow in closed conduits – weighing method) or volumetric method as per ISO 8316 (Calibration by Volumetric Method). The 'test bed' shall be accredited by national /international certifying authority. The Contractor shall produce accreditation certificates for the test facility and calibration certificate for the flow meter for the review by Employer's representative. The Contractor shall also demonstrate complete calibration on the test bed in the flow meter laboratory. The flow meter shall be acceptable if the accuracy and repeatability is equal to or better than those specified.

1.9.4 Flow Indicator and Integrator

Flow indicator and integrators shall be modular in design. It shall consist of two separate dedicated displays for flow rate indication and total flow indication. It shall accept 4-20 mA DC isolated input. The flow integration shall be carried out in the Programmable Logic Controller (PLC). The flow indicator cum flow integrator shall provide 4-20 mA retransmission output proportional to flow rate.

S.No.	Details	Description
1	Type	Microprocessor based
2	Mounting	Front facia of Control Panel

3	Display	Digital, seven segment back lit LCD / LED display
4	Digit Height	14 mm or Higher
5	No. of Digits for Flow indicator Flow integrator	4 Digits 6 Digits
6	Input	4-20 mA DC (Isolated) from flow transmitter through analogue signal multiplier (Refer Note 2)
7	Zero and span adjustment	Required
8	Manual Reset Facility for flow integrator	Required (shall be password protected)
9	Engineering units:	
	- Flow rate indicator - Flow integrator	Cum/hr ML
10	Battery backup for integrator	Required
11	Retransmitted output	4-20 mA proportional to flow rate
12	Alarm outputs	1 NO + 1 NC for high and low alarms (adjustable)
13	Communication port	RS-485 (With Modbus protocol) for interfacing with PLC
14	Weather Protection Class	IP-52 of IS 13947 Part I
15	Accuracy	± 0.25% of span or better.

Notes:

1. Digital flow indicator and flow integrator shall be a combined unit.
2. Facility shall be available in the analog signal multipliers and in the flow indicator and integrator for providing excitation voltage for the flow transmitter in case of 2-wire flow transmitters.

1.9.5 Flow Switch

- (a) Insertion type flapper flow switches shall be provided for Raw water service. The pressure drop caused by flow switch shall be kept minimum. There shall not be any effect on the switch setting because of vibrations.
- (b) The flow switch shall have screwed / flanged process connection. The body material shall be suitable for withstanding the maximum pressure. Standard industrial switch assembly of the micro switch type with auto reset and adjustable switch differential shall be provided.

1.	Type	Flapper type.
2.	Flapper and other wetted parts material	SS 316.
3.	Enclosure material	Die cast aluminium.
4.	Weather protection class	IP-65 of IS 13947 Part I.
5.	Mounting	In field on pipe.
6.	Switch type	Microswitch.
7.	Switch differential	Adjustable.
8.	Contacts	2NO+2NC.
9.	Repeatability	±2 % or better.
10.	Installation hardware and accessories	Required.

1.9.6 Sight Flow Glass

1.	Type	Flapper type.
2.	Body material	Same as pipe material.
3.	Glass	Toughened.
4.	Process connection	Flanged.

5.	Gasket	PTFE.
6.	Studs and nuts	Required.
7.	Installation hardware and accessories	Required.

1.10 Level Measuring System

1.10.1 General

Level measurement system shall consist of level transducer, level transmitter, digital level indicator and any other items required to complete the level measuring system.

To reduce the effect of water turbulence in reservoirs / tanks, averaging facility should be provided in the transmitter unit for providing steady readings. Stilling pipe shall be provided for level electrodes.

The design and application of the level measuring system shall take into account the reservoir construction, the material, size, shape, environment, process fluid or material, the presence of foam, granules, size etc.

For ultrasonic type and radar level transducers, the design and installation shall avoid any degradation of instrument performance due to spurious reflections, absorption, sound velocity variations, sensor detection area, temperature fluctuations, specific gravity changes and condensation. Facilities shall be provided for rejection of spurious reflection. The level transmitters shall be mounted in suitable weatherproof lockable pedestal enclosures near the level sensor.

1.10.2 Radar Type Level Measuring System

- Radar type level measuring system shall comprise of radar type level sensor, level transmitter, prefabricated integral cable connecting the sensor and transmitter, surge protection devices and any other item required to complete the level measurement loop.
- The level sensor shall be suitable for flange or bracket mounting as required. The installation shall avoid any degradation of instrument performance due to spurious reflections, absorption and condensation of the radar waves. Facilities shall be provided for rejection of spurious reflection.
- The radar type level instrument shall have the facility for dampening/ averaging the effect of waves, undulations on the water surface and discriminate the rate of change of levels to provide steady readings. If required, Contractor shall provide stilling pipe for providing steady readings with the prescribed accuracy.
- A lockable enclosure shall be provided for level transmitter mounted in the field.
- Necessary metallic cantilever platform shall be provided for mounting of the level sensor / transmitter.

I) General		
	Accuracy	+ 5 mm
II) Level sensor/ level transmitter		
1.	Type of transmitter	Indicating type having backlit LCD/ LCD display
2.	Output	4-20 mA, DC (Isolated)
3.	Zero and span adjustment	Required
4.	Prefabricated integral cable between sensor and transmitter	Required
5.	Facility for suppressing echoes from interfering structures	Required
6.	Enclosure Material	Die Cast Aluminium (Non-corrosive)
7.	Process connection flange material	SS 316
8	Weather Protection Class for Transmitter enclosure	IP 65 of IS 13947 Part I
9	Lockable mild steel enclosure (epoxy painted) for sensor and transmitter	Required with weather protection class of IP 65 of IS 13947 Part I

10	Accessories	i) Mounting bracket ii) Name plate / Metal tag
III) Digital Level Indicator		
Specifications shall be as given under 'Digital Panel Meters'.		

1.10.3 Ultrasonic Type Level Measuring System

- Ultrasonic type level measuring devices shall comprise of a transducer, a transmitter, remote level indicator and all other items required completing the control system.
- The level sensor and the field-mounted transmitter shall be separate and interconnected by integral cable of sufficient length.
- The transducer shall be suitable for flange or bracket mounting as required and shall be environmentally protected as per IP65. It shall have ambient temperature compensation and adjustable datum setting facilities.
- The design and application of this ultrasonic level meters shall take into account the vessel or channel construction, the material size, shape, environment, process fluid or material, the presence of foam, granules, size etc.
- The installation shall avoid any degradation of performance from spurious reflections, absorption, sound velocity variations, sensor detection area, temperature fluctuations, specific gravity changes and condensation. For application where spurious reflections are unavoidable the control unit shall be provided with facilities for spurious reflection rejection.

I) General		
1	Accuracy of measuring loop	± 0.5% of full scale
2	Temperature compensation	Required
II) Level sensor/ level transmitter		
1.	Weather protection	IP-65 of IS 13947 Part I
2.	Type	Indicating type having back-lit LCD / LCD display.
3.	Output	4-20 m ADC, Isolated
4.	Mounting	Field
5.	Process Connection Flange material	SS 316
6.	Programming facility with programmer	Required
7.	Prefabricated integral cable for connecting sensor and transmitter	Required
III) Digital Level Indicator		
Specifications shall be as given under 'Digital Panel Meters'.		

1.10.4 Pressure Transmitters

- Pressure measuring system shall consist of pressure transducer and transmitter and digital pressure indicator and any other items required to complete the pressure measuring system. Pressure transmitters shall be provided with a test port so that in-site calibration can be carried out.
- Pressure transmitter shall be rugged in construction and shall be suitable for continuous operation. Pressure transmitters shall be designed for operation over 130% of full range. They shall be capable of withstanding surge pressures likely to occur in the monitored system.
- Pressure transmitters shall be suitable for field mounting. They shall provide 4-20 mA DC output proportional to pressure. Transmitter output shall be isolated and shall be suitable for transmitting over long distance. Pressure transmitters shall have high degree of weatherproof protection as specified in technical particular.
- Pressure sensor shall be capable of operating in the range of pumps discharge pressure, and be of the diaphragm type. It shall be provided complete with

impulse tubings, fittings, two valve manifolds with drain cock/calibration valve.
Local and remote display units shall be provided

I) General		
1	Accuracy of measuring loop	$\pm 0.25\%$ of reading or better
II) Pressure sensor and transmitter		
1	Sensor	Diaphragm Sensor
2	Material of sensor and other wetted parts	SS 316
3	Transmitter type	2-wire, Indicating type
4	Range	Adjustable over full span
5	Zero and span adjustment	Required
6	Output signal	4-20mA DC, Isolated
7	Enclosure protection	IP 65 of IS 13947 Part I
8	Accessories	2-valve manifold with drain cock, impulse tubing, snubbers and all installation hardware
III) Digital Pressure Indicator		
Specifications shall be as given under 'Digital Panel Meters'.		

1.10.5 Pressure Gauges

- Pressure gauges and vacuum gauges shall comply with IS 3624 / BS 1780. Glycerin filled dial shall be provided where the gauge is subjected to pressure pulsation and / or vibrations. The internal parts of pressure gauge shall be stainless steel.
- Pressure gauges shall be provided on discharge and on suction of each pump. Pressure gauges shall be bourdon type and calibrated for the required range. The gauge shall be supplied complete with impulse tubing, two valve manifold with drain cock, fittings etc.
- The minimum diameter for pressure gauges shall be 150 mm. However, where the pressure gauge forms part of an equipment, the equipment manufacturer's standard sizes will be acceptable.

1	Accuracy	+ 1% of full scale
2	Dial size	150 mm
3	Glass	Shatterproof
4	Over range Protection	125% of maximum pressure
5	Housing Material	Die Cast Aluminium
6	Material of sensor and other wetted parts	SS 316
7	Accessories	2-valve manifold with drain cock, impulse tubing, snubbers and all installation hardware

1.11 Temperature Monitoring for Pump Motor

12 channel Temperature scanners shall be provided to measure high winding and bearing temperature for each pump. The high temperature signal shall be used for annunciation of alarm and very high temperature signal shall be used for generating tripping signals. The input signals to temperature scanner shall be derived from industrial type Pt-100 resistance temperature detectors provided in the windings and bearings.

1.11.1 Temperature Scanner

1	Service	Motor winding and bearing and pump bearing temperature measurements for each pump motor in the raw water and clear water pumping stations
2	Range	0 to 200 ^o C
3	Type	Microprocessor based

4	Mounting	On Instrument Control Panel (ICP) of respective pumping station
5	Accuracy	0.2% of range
6	Resolution	0.1° C
7	Input Signal	From RTDs for each pump motor
8	Display	LCD / LED display, 4 digit for data and 2 digit for channel No.
9	Scanning rate	Selectable
10	Communication port for interfacing with PLC system	RS-485 (With Modbus protocol)
11	Set point	2 set points (high and very high) for group of channels. Minimum 3 groups of channels shall be provided. Separate relay required for each set point.
12	Type of contacts	2 change over contacts for each set point
13	No. of channels	12 Nos. (6 Nos. for pump winding temperatures, 2 Nos. for motor bearing temperatures, 2 Nos. for pump bearing temperatures and 2 Nos. spare).
14	Programming	Through keyboard mounted on the front facia
15	Password facility	Required

1.11.2 Portable Temperature Measuring System

A portable temperature measuring system at main pumping stations shall be provided for measuring temperature of pump and motor bearing.

1	Type	Fixed temperature measuring system
2	Range	0-200 °C
3	Display	3½ digit LED/ Backlit LCD
4	Sensor	Thermocouple / Pt 100
5	Power supply	Chargeable battery operated
6	Memory for previous data storage and processing	The instrument shall be capable of storing records of measurement results
7	Accuracy	± 0.5°C
8	Accessories	Temperature sensor with various attachments for measuring bearing temperature, carrying bag, protective cover, batteries and battery charger.

1.12 Portable Sound Level Meter

Portable sound level meters shall be provided for raw water and clear water pumping stations. The sound level meter shall comply with BS EN 60651, BS EN 747, ANSI S 1.4 and S1.43.

1	Type	Portable
2	Range	0-150 dB
3	Display	Back lit LCD to Display Signal level with a quasi analog bar Measuring range Menus for displaying and editing settings Stored measurement results Selected parameters with levels
4	Microphone	Prepolarized free field microphone
5	Power supply	Chargeable battery operated
6	Memory for previous records	Required
7	Internal Real time clock for marking measurements	Required

	with date and time	
8	Data storage and processing	The instrument shall be capable of storing records of measurement results
9	Accessories	Microphone, Shoulder bag, Protective cover, batteries, battery charger

1.13 Vibration Measuring System

Vibration measuring system shall be provided for measurement of pump and motor vibrations for raw water and clear water pumping stations.

1	Type	Portable vibration meter
2	Range	Selectable from 0-1mm/sec, 0-10 mm/sec and 0-100 mm/sec
3	Frequency range	10Hz to 10 kHz
4	Display	LED/ LCD type displaying instantaneous, true peak, with m/s and mm/s ² scales
5	Sensor (Accelerometer)	Piezo electric type
6	Mounting Magnet	Required
7	PTFE Self adhesive tape	Required
8	Power supply	Rechargeable battery operated
9	Memory for previous data storage and processing	The instrument shall be capable of storing records of measurement results
10	Accessories	Vibration sensor mounting kit, shoulder bag, protective cover, batteries and battery charger

1.14 Alarm Annunciator

1.14.1 General

- Microprocessor based alarm annunciators shall be provided for generating audio visual alarms for each abnormal condition as defined in scope of work. Alarms shall be initiated by the opening and closing of volt-free contacts which shall remain unchanged throughout the periods in which the alarm conditions exist. Alarm circuits shall be capable of conversion from open-healthy to open-alarm or vice versa by a simple modification after installation requiring no additional parts or special equipment. Each alarm shall initiate the operation of both visual and audible devices. The sound intensity of each audible device shall be suitable for the maximum sound level of its environment. The sequence of alarm should be user selectable by dip switch.
- The operation or acceptance of one alarm shall not inhibit the operation of the audible device or the flashing of the appropriate alarm indicator if a future alarm condition occurs.
- Alarm circuitry shall be arranged so that spurious or transient alarm states persisting for less than 0.5 seconds (adjustable) do not initiate any action.
- Isolation facilities shall be provided for the hooter using an MCB.
- The annunciator will be split architecture type and the fascia will have LEDs.

1.14.2 Alarm Annunciation

Alarms shall be annunciated at three locations, at the drive starter, at the local HMI and at the central HMI (see details later). A philosophy shall be adopted that all alarms associated with a drive shall be annunciated at the starter whilst a general alarm only for that drive shall be annunciated at the HMIs. Therefore the operator observing a general alarm at an HMI shall have to go to the starter concerned to determine the exact cause of the alarm condition.

1.14.2.1 Technical Particulars Alarm Annunciator

Alarm annunciator shall be provided on instrument control panel for annunciation of alarms in control room. The technical particulars of alarm annunciator are as follows:

1.	Type	Microprocessor based.
2.	Mounting	Flush with panel

3.	Construction	Modular
4.	Inputs	Potential free, NO/NC contacts
5.	Size of windows	50 mm x 35 mm
6.	Operating sequences	First up (user selectable dip switch)
7.	Bulbs per channel	2 (Cluster LEDs)
8.	Push Buttons	For Reset, Accept and Test
9.	Hooter	Required, electronic type
10.	Power supply status indication	Required
11.	Weather protection	IP-52 of IS 13947

1.15 Surge Protection Units

Two numbers of surge protection units shall be provided for each signal loop and power loop for field instruments located outdoor outside the building. One SPD shall be provided in the field near transmitter and the other SPD of the loop shall be mounted in the control panel. The SPDs shall be suitable for withstanding the surge arising out of high energy static discharge/ lightning strikes and protect the instrument from any damage. SPDs shall provide three stages of protection through a quick acting semiconductor like Tranzorb, zener diodes, varistors and an automatic disconnect and reset circuit. SPDs shall be passive units and shall require no power for operation. During the occurrence of a surge it shall clamp on the allowable voltage and pass the excess voltage to the ground. The SPDs shall be of self resetting type to minimize the down time of the measurement loop. The SPDs shall have a weather proof casing and shall be suitable for field / back of panel mounting. There should be total isolation between input, output and ground terminals. The SPDs shall have a minimum surge rating of 10 KA.

1.16 Digital Panel Meters

Digital Panel Meters (DPMs) shall be microprocessor based and modular in design. They shall accept 4-20 mA DC signals from various transmitters for level, pressure, turbidity, residual chlorine, pH etc. and display of the readings in engineering units. The DPMs shall have backlit LCD / LED display.

1	Type	Microprocessor based
2	Display	Digital, seven segment back-lit LCD/LED display
3	Digit Height	14 mm or higher
4.	No. of Digits	4 Digits.
5.	Input	4-20 mA DC (Isolated) from level transmitters/ pressure transmitters/ valve position transmitters through analog signal multipliers (Refer Note 1)
6.	Zero and Span Adjustment	Required
7.	Engineering Units for display	
a)	Level Indicators	Meters
b)	Pressure indicators	Kg/cm ²
c)	Valve position indicators	0 – 100 %
d)	Accuracy	± 0.1 % of span
8.	Enclosure Material	Non corrosive
9.	Enclosure Protection Class	IP-54 of IS 13947 Part I
10.	Retransmission output	4-20 mA DC, Isolated
11.	Alarm outputs	2 NO+NC for high and low alarms (adjustable)

Note:

Facility shall be available in the analog signal multipliers and in the digital indicator for providing excitation voltage for the transmitters in case of 2-wire transmitters.

1.17 Analogue Signal Multipliers

Panel mounted analogue signal multipliers shall be provided for multiplication of analogue signals like flow, level, pressure, pH, turbidity, residual chlorine etc. They shall provide loop power with option to select measurement with power and without. The

multiplier will provide 2 outputs of 4-20mA one for the panel mounted indicator and other for connection to the PLC. There will be total galvanic isolation between field I/Os and also between the 2 outputs.

1.18 Control System

- a) Control philosophy for vertical turbine

1.18.1 Control Logic

The raw water pumping station comprises of duty and standby pumps. A Programmable Logic Controller (PLC) based control system shall be provided for automatic and semi-automatic operation of pumping station

However, the program to be loaded in the PLC shall be suitable for the operation of total no of working as well as standby pumps which are going to be installed in the proposed system.

In the event of failure of automatic controls or by operator choice, it shall be possible to operate the pumping station independent of the PLC function. The control system shall be designed to recover fully to a normal operational state on restoration of power, following a power failure without manual intervention. This requirement includes recovery from the H.T. failure as well as the control system power failure including proposed solar power plant.

‘Remote’ / ‘Local’ selector switch shall be provided on the switchgear panel for each pump.

‘Auto’/ Off / Manual’ selector switch shall be provided for selection of operation mode for each pump on the Instrument Control Panel.

‘Auto / Semi Auto/ Manual’ selector switch for the pumping station operations.

On the SCADA System operator station, a facility shall be provided for selecting various combinations of working and standby pumps. Working no of pumps shall be decided during execution

1.18.2 Control Modes

- a) Semi Auto Control Mode

In this mode the RWPS shall be operated automatically through the PLC based on certain inputs from the SCADA System operator. The control philosophy shall be as below:

Pumps Start Routine

The pump automatic / semiautomatic mode start routine shall be as follows:

- Based on demand of water, the operator should enter the ‘Number of Pumps to be Operated’ and ‘No. of Standby Pumps’.
- Enter the Combination Number for Working- Standby’ Combination of pump
- Permissive Conditions to Start
- Discharge valve is closed.
- Isolation valve is open.
- Discharge valve available for operation.
- Pump drive available for operation.

Start Sequence

- Give command to open the discharge valve.
- After a preset time delay (adjustable) equivalent to 30% open position of the valve, the command shall be issued to start the pump drive.
- Duty pump fails to start or its discharge valve fails to open, close the discharge valve, stop the pump and start the next duty pump.
- When pump starts and discharge valve fully opens, the start sequence for that pump is completed.

The operator shall decide the number of pumps to be operated based on the demand of water supply and considering the water level. The Logic Control software shall have facility for making the entry for number of pumps to be operated. The pumps shall keep running until ‘low low’ level is reached or ‘duty’ cycle is changed. In any condition, no two pumps shall be started simultaneously. The starting of the pumps shall be staggered with a time gap of 2 minutes (with an adjustable timer in the PLC software).

The analog signal of the level measuring system in the raw water intake sump shall be used for monitoring. Level switches shall also be provided in the raw water intake sump to detect 'low low' level for pump tripping.

A software based pump start 'sequence failed to complete' alarm shall be provided. If a start sequence fails to complete within a set time (not operator adjustable) an alarm shall be raised.

In case of tripping of any working pump the next duty pump or standby pump as per logic will be started.

After the duty cycle of the selected combination is over at the end of 48 hours (time duration adjustable), an alarm will be generated on the SCADA system, prompting the operator to either change the combination set or continue with the same combination of pumps.

Stop Sequence

The pump automatic mode stop routine shall be as follows:

- Give command to close the valve.
- After a time delay (adjustable) equivalent to discharge valve reaching 30% open position during valve closing operation, the command shall be given to stop pump drive.
- When the pump stops and the discharge valve fully closes, the stop sequence is complete.
- A software based alarm for 'pump stop sequence failed to complete' shall be generated if stop sequence fails to complete within a set time.
- The pump shall stop immediately under hardwired trip condition and the discharge valve shall close. In case power supply to the motorized valve is not available, the valve shall close on resumption of power.

b) Auto Mode

The Auto mode shall be similar to Semi-Auto mode except that the duty cycle shall be rotated automatically by the PLC system in Auto mode of pumping station.

Duty Rotation

The raw water pumps shall be automatically duty rotated so as to achieve equal running hours of the pumps. For this purpose, there will be a duty cycle of combination of pump duties as Working and Standby. These combinations shall be rotated (cyclically) automatically at time span adjustable.

- In case a working pump fails the standby pump shall start automatically.
- Facilities shall be provided for selecting the combinations of Pump operations manually by the operator.
- Time counters shall be provided in the PLC system, for registering the run time for each pump.

Changeover from Auto / Semi-Auto to Manual Mode

When the pumps are running and when the auto/ manual selector switch of a pump is changed from 'Auto' to 'Manual' or vice-versa, the status (running / stopped) of the pump shall not change.

c) Manual Control Mode from SCADA System

In this mode, the raw water pumps and valves shall be operated manually from the local PC based SCADA system by the SCADA System operator. The control commands shall be routed through the PLC. The PLC program shall prevent simultaneous starts or stops of the pumps. After a 'Start Pump' or 'Stop Pump' command is given by the operator, the start or stop sequences as detailed above shall be automatically performed by the PLC program.

d) Local Control Mode

In the 'Local' mode, the pumps shall be operated through pushbuttons provided on the switchgear panel. The pumps shall be operated independent of the PLC function. The motorized valves shall be operated through pushbuttons provided on the valve actuator.

- The pumps shall stop automatically if the level in the raw water intake sump is at 'low low' level.
- All the protection controls (hardwired) provided to the pumps shall be operative in this mode.

Control philosophy for Chak Level Centrifugal pumps

The philosophy for Chak Level Centrifugal pumps shall be same as described above for vertical turbine pumps.

1.19 Control Panel Power Supply

The primary power supply for the control panels for pump houses, shall be derived from the respective LV switchboard at 240 V AC. The voltage level for control schemes and power supply for the instrumentation and control system shall be 24 V DC. The 24 V DC shall be derived from 230 V AC from LV switchboard. The 24 V DC power supply system shall cover the following items:

- (a) Sealed maintenance free (SMF) batteries
- (b) 24 V DC rectifier unit with float cum boost charger for 24 V DC battery
- (c) DC distribution board.

The batteries shall be sized to provide sufficient power to maintain the instrumentation and control system of the pumping stations equipment functioning for a period of 1 hour. The battery shall have maximum recharge time of 8 hours. The control supply voltage for all the control panels and field instruments shall be derived from the battery and battery charger. For detailed technical specification (except the output voltage level) of battery and battery charger refer electrical specifications

1.20 Uninterruptible Power Supply (UPS) System

- a) Contractor shall provide Online Uninterruptible Power Supply (UPS) System with One Hour back-up time at full load for the local PC based SCADA systems. Contractor shall clearly indicate the offered UPS rating in the bid document.
- b) The UPS shall be floor mounted, self contained and metal clad.
- c) The UPS shall be incorporating a six pulse rectifier and pulse width modulation inverter technology with microprocessor control. It shall incorporate a static bypass switch that shall operate in event of UPS failure, overload or manual initiation in order to transfer the output supply to mains without disturbance to the output supply.
- d) The batteries used for power supply system shall be rechargeable, Sealed Maintenance Free (SMF) Lead Acid type. The battery supply to the UPS shall be via a fused load break switch dis-connector circuit breaker. The battery recharge time to 90% of full charge shall be approximately ten times the discharge time at full load.
- e) The various alarms and status parameters of UPS system shall be made available to the local SCADA system(s) for monitoring purpose using RS-232 serial communication port provided in UPS offered.
- f) Software for shutdown of the PC in case mains power supply is not restored shall be provided as a part of the UPS.
- g) Total Harmonic Distortion (THD) of UPS shall be less than five percent and any single harmonic distortion shall be less than three percent.
- h) After a dip or failure of the supply, the rectifier controller shall ramp up the DC voltage slowly.
- i) Designing of all power supply items shall be as per the latest national/international standards such as IS, BS and IEC. Employer has right to reject the system at any time, if standards are not met by the Contractor. Contractor shall clearly indicate the standards.
- j) Power supply scheme and all design calculations for selection of UPS and Battery capacity shall be furnished by the Contractor in detail along with the bid document.

- k) Based on the three phase 415 VAC power supply available at site all required AC/DC voltages for SCADA and Communication system etc. shall be derived from this supply and proper isolation, earthing and safety requirements as per Indian Electricity (IE) Rules shall be complied by the Contractor.
- l) Contractor shall provide required and sufficient nos. of AC and DC feeders as required shall be provided for the PC based local SCADA system. At least 2 nos. of spare feeders shall be provided in AC, DC system.
- m) The Uninterruptible Power Supply (UPS) System with SMF Lead Acid battery shall conform to the minimum following specifications:

Sr	Description	Technical Particulars
1.0	UNINTERRUPTIBLE POWER SUPPLY SYSTEM (UPS)	Required for SCADA and Communication systems
1.1	Rated Power at PF = 0.7	Contractor to design and indicate
1.2	Input Voltage	240 VAC Single phase to be made available by Contractor from 415 VAC +/- 10 %, 3 Phase, 4W, 50 Hz +/- 5 Hz made available at one point at site
1.3	Allowable variations in input	
a)	Voltage	+/- 10 %
b)	Frequency	+/- 5 %
c)	Combined voltage and frequency	+/- 10 %
1.4	Output	
a)	Voltage	230 VAC, Single phase
b)	Frequency	50 Hz +/- 0.5 % (free running) and +/- 3% (Sync mode)
c)	Regulation	Less than +/- 1 %
d)	Transient Response	+/- 5% for 100% Load Variation, Correction in 10 m-sec or better
e)	Inverter Technology	PWM (IGBT)
f)	Distortion (AC harmonics)	< 5 % THD, and < 3 % for any single harmonic
g)	Short term Overload	110 % for 30 min, 150 % for 10 secs, 200 % for 5 cycles
h)	Efficiency	Inverter - 92 % or better and AC to AC 85% or better
i)	Load Power Factor	
j)	Static Bypass	Required with transfer time less than 5 m-sec
k)	Manual Bypass Switch	Required
l)	Backup Period	One Hour Backup time at 100 % load
1.5	Protections	
a)	Mains Over/Under	Required
b)	DC Over/Under Voltage	Required
c)	Inverter Over/Under Voltage	Required
d)	Inverter Overload	Required
e)	Overheat	Required
f)	Built-in Soft/ Cold start	Required
g)	Snubber circuits for devices	Required
1.6	LED Indicators	
a)	Mains On	Required
b)	Inverter On	Required

Sr	Description	Technical Particulars
c)	Battery on Charge	Required
d)	Mains Over/Under Voltage	Required
e)	Low Battery Imminent	Required
f)	DC Over/Under Voltage	Required
g)	Inverter Overload	Required
h)	Load On Inverter	Required
i)	Load on Auxiliary Supply	Required
k)	Overheat	Required
1.7	Digital Metering 16 x 2 or better LCD for:	
a)	DC Volts	Required
b)	AC I/P and O/P Volts	Required
c)	DC Current	Required
d)	AC O/P Current	Required
e)	Frequency	Required
f)	% Battery	Required
1.8	Audible Alarm	Required
1.9	Isolation of UPS output from Mains Input	Required
1.10	Alarm Contacts for Self Diagnostics	Required
1.11	Protection Class	IP 21 or better
1.12	Temperature	0 to 50 °C
1.13	Relative humidity	Upto 95% Non-condensing
1.14	Batteries	
a)	Type of battery	Sealed maintenance free (SMF) lead Acid type
b)	Number of cells per unit	Contractor to design and indicate
c)	Nominal cell voltage	Contractor to design and indicate
d)	Final cell voltage	Contractor to design and indicate
e)	Capacity at 100% load	For One hour backup time
f)	Mounting arrangement	Open type multitier
g)	Following Accessories but not limited to the following shall be provided	
h)	Set of inter cell, inter row and inter bank connectors and number plates as required for the complete installation	Required
i)	Accessories for testing and maintenance: Centre zero voltmeter	Required (range Contractor to indicate)

1.20.1 Tests on UPS system:

UPS system of local SCADA system shall be tested at manufacturer's work and also at site for its performance, functional and operation requirements.

Following are the tests to be carried out.

- Voltage regulation 0-100 % of load
- Load test, current limiter operation
- Output voltage variation
- Ripple and harmonic measurement
- Efficiency and power factor
- Megger and HV test for insulation
- Heat run
- Functional tests
- Alarms and self-diagnostics tests
- Communication with local SCADA system
- DC start for UPS

Control System Voltages

Description	Voltage
Instrumentation power supplies	24 V DC
PLC input-output modules	24 V DC
PLC input-output circuits/loops	24 V DC
SCADA System	230 V AC (UPS)

1.21 Control System Protection

All circuits shall be protected against short circuit by the provision of adequate numbers of miniature circuit breakers.

For ease of maintenance and system security power supplies to each instrument loop and each PLC module shall be protected with an individual MCB.

Suitable earthing shall be provided for all the control panels. The same shall be connected to electrical earth.

Earthing shall be provided for electronic equipment and shall be connected to electronic earthing arrangement. The same shall be separate from electrical earth.

1.22 Cabinets for Field Instruments

Cabinets shall be provided for enclosing instruments and associated accessories which are mounted outside the control panel such as transmitter, SPDs, terminal blocks etc. at all measurement locations.

It shall be fabricated from cold rolled steel with powder coating sheet of standard gauge and shall be suitable for wall mounting or pedestal mounting as required.

The cabinet shall be properly powder coated from inside by white paint and powder coated from outside by shade RAL 7032.

The cabinet shall conform to IP-65 protection and shall have built in locking facility. The cabinet shall be earthed properly. A steel plate/pipe, as per the requirement, shall be provided in the cabinet for mounting the instrument and accessories.

1.23 Instrument Power Supply Cables and Instrumentation Signal Cables

Contractor shall include in his scope the supply and laying of instrumentation signal and instrument power supply cables and associated civil / mechanical work required for completing the system.

Cables shall be capable of satisfactorily withstanding without damage, transportation to site, installation at site, and operation under normal and short circuit conditions of the various systems to which the respective cables are connected when operating under the climatic conditions prevailing at the site as indicated in this specification.

Cable joints in instrument signals and power supply cables shall not be permitted.

Cables shall be capable of satisfactory performance when laid on trays, in trenches, conduits, ducts and when directly buried in the ground.

Cables shall be capable of operating satisfactorily under a power supply system voltage variation of $\pm 15\%$, a frequency variation of $\pm 5.0\%$.

1.23.1 Instrumentation Cables**1.23.1.1 Cables for Digital Signals**

660V/1100 V grade multicore cables, multistranded high conductivity annealed 1.0 sq.mm stranded tinned copper conductor, extruded PVC insulated, overall screened with braided wire or with aluminiummylar tape, ATC drain wire run continuously in contact with aluminium tape, inner sheathed with extruded PVC, armoured with galvanized steel wire overall sheathed with extruded PVC conforming to IS:1554 and IEC:189 Part II.

1.23.1.2 Cables for Analog Signals and Signals from Temperature Sensors

660 V/1100 V annealed, tinned, high conductivity 1.0 sqmm stranded copper conductor extruded PVC insulated two/ three cores twisted into pair/ triad, laid up collectively, individual pair/ triad shielded and overall shielded with wire braiding or aluminiummylar tape, ATC drain wire run continuously in contact with aluminum side of the tape, inner sheathed with extruded PVC, armoured with galvanized steel wire, overall sheathed with extruded PVC conforming to IS:1554 and IEC:189 Part II.

1.23.2 Laying Of Cables

A distance of minimum 300mm shall be maintained between the cables carrying low voltage AC and DC signals and a distance of minimum 600mm shall be maintained between signal cables and HT cables. In outdoor areas, the cables shall be directly buried. Each instrumentation and power supply cable shall be terminated to individual panel/terminal box. Identification of each cable shall be by proper ferrules at each junction as per cable schedule to be prepared by Contractor.

Cables shall be laid in accordance with layout drawings and cable schedule which shall be prepared by Contractor and submitted for Employer's Representatives approval.

Cables shall be laid in accordance with layout drawings and cable schedule which shall be prepared by Contractor and submitted for Employer's Representatives approval.

All cable routes shall be carefully measured and cables cut to the required lengths, leaving sufficient amount for the final connection of the cable to the terminals on either end. Various cable lengths cut from the cable reels shall be carefully selected to prevent undue wastage of cables. A loop of 1 meter shall be left near each field instrument before terminating the cable.

Cables shall be complete uncut lengths from one termination to the other.

All cables shall be identified close to their termination point by cable numbers as per cable interconnection schedules. Identification tags shall be securely fastened to the cables at both the ends.

Cable shall be rigidly supported on structural steel and masonry, using individually cast or malleable iron galvanized clips, multiple cable supports or cable trays.

1.24 Junction Boxes

In order to make the most economic use of cable ladder/tray and duct capacity, multicore cabling shall be utilized in order to connect instrumentation groups by using suitably located sub-distribution junction boxes.

The junction boxes shall have weather protection suitable for the area in which they are to be installed and for the type of circuit. They shall be readily accessible for maintenance and clearly labeled. Junction boxes shall be constructed of die cast aluminium / CI and provide degree of protection IP 65.

Separate cables shall be used for digital and analog signals.

Wires and terminals for the digital and analog signals shall be segregated within junction boxes. Also wires and terminals for AC and DC signals shall be segregated within the junction boxes.

SECTION XI

OPERATION AND MAINTENANCE

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SECTION 11: OPERATION AND MAINTENANCE

11.0 GENERAL

This section applies to the specifications of materials used for operation and maintenance, the workmanship, period for routine maintenance, specifications for the acceptable quality of treated water, maintenance of records, and responsibilities during operation and maintenance period.

The Contractor shall operate and maintain the entire Kaliteer lift Scheme System including intake Chambal ,intake plant, the raw water mains ,HDPE& MS Pipe network ,surge protection system, , electric substations at Pump House campus, the PLC systems, all ancillary buildings, campus area, roads and ancillary civil structures along pipeline and road for the entire period specified in the Contract.

11.1 SPECIFICATIONS

The specification of materials used for repairs shall be the same as have been used in the original work. Specifications for any materials which were not used during construction shall be approved by the Employer's Representative prior to commencement of the operation and maintenance period and must be incorporated in the O&M manual. Without being limited by this clause, during O&M period the Contractor shall use appropriate material for repairs even if material required for such repairs has not been approved earlier, and no delay in making such repairs shall be subjected to such limitation. However, subsequent to use of such material the Contractor shall submit proposals for the approval of specifications of such material. The approved material will subsequently form a part of the O&M manual.

11.2 ACTIVITIES DURING O&M PERIOD

11.2.1 General

Within the framework of the Contractor's responsibilities given above, the Contractor shall carry out the following activities. However, these shall not limit the requirement for other activities which otherwise are required as per term and conditions of Contract or to fulfill the Contractor's responsibilities or are essential as per good industrial practices. The Contractor shall be responsible for, but not limited to, the following:

- a) Drawing 20 Cumec water from Chambal river and supplying into the Parvati and Ramsagar dam via distribution network of mains and Maintenance of system...
- b) Keeping watch and ward for detecting any leakage , theft from distribution pipe line network and ensuring safety of whole pipe network including all specials, valves, metering arrangements.
- c) Providing the required staff, but not less then the minimum specified numbers/ level, during operation and maintenance period and additional staff as per requirement during periodic maintenance and in emergencies.
- d) Liaison with DISCOM to ensuring uninterrupted power supply as per requirement.
- e) Providing all required consumables required for functioning of plant and equipment except power charges.
- f) Maintenance of pump houses, electric substations, etc., at the pumping station, official buildings, , and their campus, staff quarters and their surroundings, etc.(all works constructed in this Contract) in neat and clean condition.
- g) Monitoring and controlling of the complete distribution of the complete distribution network through plc scada effectively and ensuring distribution of water as per design and maintaining design pressure and discharge at every outlet .
- h) The contractor will be responsible for the proper functioning of the pumping and pipe distribution system to ensure design pressure head and discharge and maintenance of system
- i) Maintenance of the lighting fixtures and the lighting system of all areas and replacement of all non- functional lighting fixtures within 24 hours.
- j) To maintain the valve chambers along the pipeline in clean and dry conditions.

k) Maintaining;

- Repair history of all mechanical, electrical and instrumentation control equipment in pumpingstation, water transmission mains and communication instruments;
- Logbooks through PLC system;
- Every day power availability, input voltage and current, frequency, power factor, kWh meterreadings and kW reading for Substation at Intake and raw water pump house;
- Every day water pumping quantity at main pump house at an interval of 15 minutes.
- Daily log of operations of all the important equipment electrically actuated valves, etc., withtime tag;
- Daily start–stop operation of pumps with every hour readings for operating voltage, amperageand power factor;
- Hourly readings of pressure on the manifold, flow rate in manifold and integrated quantity ofwater;
- Hourly levels of sumps;
- Daily list of alarms with time tag;
- Logbook format and the data to be included in the logbook shall be decided during commissioning in consultation with department;
- Last periodic maintenance done for all equipment/buildings of the system;
- Observations made during patrolling of the pipeline and roads.

In addition to maintenance of above logbooks the Contractor is required to maintain one inspection book at each pump house and pump rooms. The complaints entered in the complaint register must be investigated and remedial measures must immediately be taken.

- l)** Providing required spares and maintaining adequate inventory of required accessories or equipment itself for repair of system so that the electrical, mechanical, instrumentation and control system, pipe and pipe appurtenances and surge system and the communication system can work efficiently as per the guarantees given or minimum required efficiencies asked for in the Contract, without any additional costs to department. The Contractor may use spares and tools and tackles supplied with the Contract as required by him. However at the end of the Contract the Contractor shall hand over the full spares, tools and tackles as supplied with the Contract by replacing the used items with fresh supplies of the same specifications.
- m)** Providing manpower for the required repairs of all facilities along with the manpower and materials for repair of the roads, buildings and campus area utilities.
- n)** Maintaining the drinking water supply facilities in main pump house building campus and all its units, and other buildings.
- o)** Maintaining stores for the electrical, mechanical and instrumentation and control equipment. The maintenance of stores will include but shall not be limited to:
- p)** Providing adequate man power for watch and ward of both pump house

- Loading / unloading of materials received and issued for works;
- Proper arrangement of material in stores to ensure its safety and easy availability;
- Maintaining store areas in a neat and tidy condition;
- Keeping records and accounting for the incoming materials,
- Keeping records and accounting for the consumed materials.

The Contractor shall be solely responsible for the safety and security of the goods in the store and will be responsible for any loss or damages in stores for any reason. He may opt for insurance cover against the value of the goods to be stored without any additional costs on the Department.

- i) Daily patrolling of the water mains to identify and report the damages / defects of pipe and pipe appurtenances, CD works, en-route structures.
- j) Periodic and routine maintenance as per the manufacturer's recommendations and recommended schedules, as well as emergency (breakdown) maintenance as and when required. Maintaining a fleet consisting of at least one JCB or other equivalent or superior hauling machine, sufficient inspection/patrolling vehicles and material hauling vehicles and any other vehicles/ machinery/ equipment for adequate and timely repairs and/or for routine/ periodic maintenance/ patrolling of the system.
- k) Periodic routine maintenance of structures/buildings of pumping station and others built in the Contract, campus area of pumping station(s). Such maintenance must ensure adequate cleanliness, ventilation, illumination and structural safety. In addition to this, the general hygienic standards must be maintained and adequate plantation, horticultural activities must be taken up to maintain the total environment of the campus / building pleasant.
- l) Providing transportation facilities between various areas.
- m) Updating and periodic submissions of the operation and maintenance manual as defined in specifications for O&M works. The Contractor shall take up all periodic maintenance works provided in the approved O&M manual.
- n) Submission of monthly report.
- o) Entering in to AMC contractor with system/equipment suppliers as necessary it is mandatory to enter in to an agreement for a 8years maintenance contract with the PLC and SCADA system suppliers or the authorized system integrator whose ever has executed the work for this project
- p) Co-ordination with other agencies such as Electricity Supply Company.
- q) Providing all machinery like JCB, generator, drain pumps, crane, welding machine, etc., as required for proper and timely maintenance activities.
- r) Insurance: The Contractor shall, without limiting his or the Employer's obligations and responsibilities, insure;
 - I. The work together with material and plant for incorporation therein, to the full replacement cost (term "cost" in this context shall include profit).
 - II. The Contractor's equipment and other things brought onto site by the Contractor, for a sum sufficient to provide for their replacement at the site.
 - III. The insurance shall be in the joint names of the Contractor and the Employer at the Contractor's cost and shall cover the Employer and the Contractor against all losses or damages from whatsoever cause arising from the start of the O&M until the date of completion of O&M in respect of the facility or any section or part thereof as the case may be.
 - IV. Any amount not insured or not recovered from the insurer shall be borne by the Contractor

11.3 EXPERIENCE AND QUALIFICATION OF STAFF

For all operation and maintenance works, the Contractor shall provide skilled staff, which has adequate qualifications and sufficient experience of similar works. CV of General Manager, Shift-in-charge, Plant Supervisors will have to be got approved from the Employer. The following Table 12.1 describes the minimum levels of staffing, and their minimum qualifications and experience in similar works, theta the Contractor will be required deploy for

carrying out the O&M functions:

Table 12.1: Minimum Requirements for Staff and Qualifications(During Operation Period)

S.No	Designation	Qualification	Experience	Nos.			
A. General Staff (common for the whole project)							
1.	General Manager	Graduate Engineer (E/M)	15 years	1			
2.	Foreman-Electrical.	Diploma /ITI	5/10 years	1			
3.	Foreman-Mechanical	Diploma/ITI	5/10 years	1			
4.	Foreman Instrumentation	Diploma	5 years	1			
5.	Instrumentation Technician	ITI Instrumentation	10 years	2			
6.	Helpers	10th Pass	-	2			
Total of A.				8			
S.No	Designation	Qualification	Experience	Shift-1 8-4pm	Nos. Shift-2 4pm-12	Shift-3 12-8am	Total
B. Intake Pumping Station.							
1.	Shift-in-charge	Graduate (Elect/Mech.) OR Diploma (Elect/Mech.)	5 years 10 years	1	1	1	3
2.	Electrician	ITI (Elect.)	5 years	1	1	1	3
3.	Helpers	8th Pass	-	2	1	1	4
4.	Security Guards	8th pass	-	1	1	1	3
5	Attendant Rest House.	-	-	1	-	-	1
6	Cook	-	5 years	2 for 24 hours			2
		Total		7	5	4	16
Total of B			16				
D. Transmission Main Pipe line							
1.	Fitters	ITI-Fitting Trade	5 years	2			2
2.	Helpers	8th pass	-	2			2
3.	Welders	-	2 years	1			1
		Total		5			5
Total of C			5				
E. Minimum Requirements for Staff and Qualifications(During Non-Operation Period)							
S.No	Designation	Qualification	Experience	Nos.			
1.	General Manager	Graduate Engineer (E/M)	15 years	1			
2.	Helpers	10th Pass	-	2			
3.	Cook			2 for 24 hours			
4.	Security Guards	8th Pass	-	2 for 24 hours			
Total of D.				7			

Note:

- The above requirement is minimum only. The Contractor will arrange extra work force, as and when required, so as to smoothly run the operation and maintenance including preventive maintenance, repairs etc. and general cleanliness of the installations.
- The Contractor will have to maintain adequate transportation facilities for daily patrolling of the pipe line and will ensure regular watch on pipe line.
- The above staff strength is exclusive of leave reserve required for different category of staff. The Contractor shall ensure availability of the personnel given in the above table for all seven days in a week.
- The Contractor shall make appropriate arrangements for maintenance of items like road work, buildings, arboriculture, patrolling and maintenance of civil structures, vehicle operations and other activities defined to fulfill its obligations under O&M Contract.

11.4 PUMPING STATIONS

- (i) Operation of plants on 24x7 basis during July to September or as per schedule decided by Engineer-in-charge , including provision of required manpower for routine operation of pumping station.
- (ii) Maintaining the pumping station PLC, including hardware and software along with all instruments, in proper working condition. The downtime of the control system shall not exceed 2 hours. During the downtime, the Contractor shall continue to operate the pumping station in manual mode using the local panel controls and the readings from local instruments.
- (iii) Routine and periodic maintenance of the entire control system and instruments as per the manufacturer's recommendations
- (iv) Replacement of damaged control, communication cables, and power supply cables
- (v) Repair or replacement, as required, of all instruments such as flow meters, pressure sensors, pressure gauges, level sensors, float level switches, temperature scanners, vibration sensors, noise meter, data loggers along with all other equipment. The down time of any individual instrument as referred above shall not exceed 24 hours.
- (vi) Periodic site calibration of all measuring/metering equipment at every 6 months minimum or as recommended by the manufacturer. The calibration at the manufacturer's works/ independent laboratory shall be carried out only in case of major failure of the instrument.
- (vii) Repair or replacement, as required, of damaged electrical equipment/ parts for proper functioning of electrical system
- (viii) Maintenance of the cooling and lubricating systems
- (ix) .Routine maintenance of the pumps/ motors as per recommendation of the manufacturer.
- (x) Replacement of bearings, damaged impellers and other damaged parts so that the operation of pumps ensures the guaranteed efficiencies with desired noise and vibration levels.
- (xi) Routine and periodic maintenance of the EOT cranes as per the manufacturer's recommendations.
- (xii) Breakdown maintenance of all electrical, mechanical, instrumentation and control equipment, EOT crane, etc.
- (xiii) Re-painting of the exposed mild steel components of pipe line, ladders, railings etc. in the pump house in the 3rd , 5th and 8th year of O&M to keep them in good shape.
- (xiv) Maintaining the surrounding areas of the pumping stations free from shrubs, weeds, grass and other unplanned vegetations.
- (xv) Routine monitoring of substation equipment and taking preventive measures as required
- (xvi) Keeping the hourly records of:
 - Status of pumps
 - Current
 - Voltage
 - Frequency
 - Active and reactive power
 - Water level at suction reservoir
 - Suction and delivery gauge readings
 - Rate of flow
 - Pump head
 - Keeping daily records of:
 - Total number of hours of operation
 - Total quantity pumped
 - Total energy(kWh) consumption
- (xvii) Specific requirements of pumping station maintenance are as listed in the following Table 12.2:

Table 12.2: Maintenance Schedule for Pumping Stations

Activity	Frequency
Removal of clogged materials from screens (only for raw water pumping plant)	Daily 6 times
Temperature of WTI/OTI w.r.t ambient temperature	Daily 4 times
Oil level in the conservator	Daily
Oil level in the bushing	Daily
Temperature of RTD, BTM in motors w.r.t. ambient temp.	Daily
Watering garden around plant, if provided	Daily 4 times
Checking of disconnectors' operation	Weekly
Operation of crane for all motions	Weekly
Cleaning of level sensors	Weekly
House keeping plant and its surroundings (Includes removal of dust, dirt, cobweb etc)	Daily
Checking vibration and noise level of pump sets	Daily
Fully closing and opening of sluice gates and valves	Monthly
Submission of report on maintenance to Employer	Monthly
IR and PI values of motors	Monthly
Condition of silica gel in breather and replacement(if required)	Monthly
Replacement of bearings	Within a day of breakdown
Replacement of bulbs, lamps etc	Within a day of breakdown
Tightening of gland	When leakage increases beyond acceptable limit
Greasing, oiling	As per manufacturers recommendation
Attending breakdowns	As and when it occurs
Preparation of list of spares for satisfactory operation	Half-yearly
Transformer oil sample checking	Half-yearly
Inspection of switchboard, cable box, etc.(i.e. visual inspection, tightness of nuts and bolts, IR values, earthing contacts, checking tightness of terminal block, etc.)	Half-yearly
Measurement of earth resistance	Yearly
Checking of relays/ alarm (trough secondary injection)	Yearly
Condition of gasket and replacement (if required)	Yearly

- (xviii) Disposal of screened material.
- (xix) Providing all consumables such as grease, oil, stationery, water for gardening, etc.
- (xx) Providing office furniture for operating and maintenance staff.
- (xxiv) Providing safety accessories such as gloves, shoes, first aid box etc.
- (xxv) Ensuring safety of plant and equipment.
- (xxvi) Furnishing required information to Employer.
- (xxvii) Any compensation charges levied by Vidhyut Nigam towards low power factor, overloading or any other such penalties will be borne by the Contractor.
- (xxviii) Contractor will be given a minimum of 15 days advance notice by the Employer's Representative for changing the impellers when required.

to ensure their most economic consumption and minimize wastage.

11.5 LUBRICATION

The Contractor, in the operation and maintenance manuals, shall furnish a complete schedule of recommended oils and other lubricants. The number of types of lubricants shall be kept to a minimum. In case of grease lubricated bearings for electric motors, lithium base grease is preferred.

The Contractor shall indicate the brand name of indigenously available equivalent lubricants, with their complete duty specifications, in the O&M manual. The Contractor shall also furnish the schedule of quantities for each fill, frequency of filling and annual requirement in O&M manual.

Where lubrication is effected by means of grease, preference shall be given to a pressure system which does not require frequent adjustment or recharging. Frequent, for this purpose, means more than once in a month.

Where more than one type of special grease is required, a grease gun for each special type shall be used.

All lubricant systems shall be designed so as not to cause a fire or pollution hazard.

The Contractor shall supply flushing oil for such lubrication system when an item of plant is ready for preliminary running.

11.6 SPARE PARTS

All spare parts used for the equipment in the maintenance of the system must be from the manufacturer of the equipment or, if the equipment itself has been made with parts from other manufacturers, the parts must be of the same make as used in the equipment supplied and installed.

All spare parts shall be packed for long storage under the climatic conditions prevailing at the Site. Each spare part shall be labeled on the outside of its packing with its description, number and purpose and, if more than one spare is packed in a single case, a general description of the case contents shall be shown on the outside and a packing list enclosed.

11.7 PARTICULAR REQUIREMENTS DURING O&M

The workmanship observed for all repair and maintenance work must be in accordance to “Good Engineering Practices”. O&M of 33kV substation shall be included in the scope, including but not limited to the following items:

- (i) Maintenance of 33kV substation at Pump House
- (ii) Routine monitoring of substation equipment and taking preventive measures (as required)
- (iii) Fortnightly patrolling for monitoring of transmission/ tower/pole line
- (iv) Preventive and breakdown maintenance of substation (as required)

11.8 PIPELINE

The rubber gaskets/rings, nut and bolts, etc., to be used shall be as per the specifications given for the respective items.

After each repair the damaged coating of pipes must be repaired and, if in trench conditions, the trench must be filled with approved soil, well compacted to its original density, up to the existing ground level.

Stretches along pipe alignments where cover is washed out or removed due to other reasons must be rehabilitated so that the minimum cover required is always maintained.

All cracks in pipe supporting structures, valve chambers and their edges must be raked, filled and made good with cement sand mortar 1:2.

The repairs may include but not limited to items: -

- a) Repair of leaks, damaged portion of road, embankment, pipe and pipe appurtenances, CD works and en-route structures identified during patrolling.
- b) Emergency repair(s) of burst(s) for maintaining regular supplies.
- c) Operation of all motorized valves quarterly to check its proper functioning electrically as well as for manual operation. Maintenance of all valves in leakless conditions. Quarterly inspection of, expansion joints and surge protection equipment/system, insulating joints and repairs if required. Contractor shall submit quarterly reports of all such activities done.
- d) Maintenance of inventory for repair of pipe leak(s) and burst(s), valves (air valve, sluice valves, butterfly valves), expansion joints, surge protection devices, anti-corrosion devices or any other pipe appurtenances or equipment(s) installed.
- e) Quarterly lubrication of all motorized gear boxes along the alignment.

- f) Maintaining the valve chambers along the pipeline in clean and dry conditions.
 - g) Maintaining portable generating set for operation of valve actuator and dewatering of scour valve chambers and dewatering in case of burst/repair of pipe.
 - h) Maintaining the soil cover on the pipe damaged due to rains, runoff or any to other reason.
 - i) Repair of damaged coatings during maintenance operations.
 - j) Maintaining clean conditions at saddle and ring girder supports and oiling/greasing of all supports.
- No water losses are admissible in the transmission system.

11.9 PUMPING STATION AND ALL OTHER BUILDINGS

The Contractor shall carry out ordinary repairs to buildings during the O&M period. The repairs may include but not limited to the following items:

- (i) Easing of doors and windows, monsoon repairs to roofs, attention to drains, rain water spouts, attention to plinth protection.
- (ii) External white or color wash, external or internal painting, internal distempering, renewal of approach roads within the campus.

The frequency of repairs must not be less than as specified below:

Sr.No.	Nature of Repair	Frequency of repair for Residential Buildings	Frequency of repair for other Buildings
1	External finishing (color washing) after attending minor repairs such as damage to plaster, etc.	Once in a year	Every two year
2	Internal finishing (distemper / painting) after attending minor repairs such as damage to plaster etc	In 3 rd , 5 th and 8 th year of O&M	In 3 rd , 5 th and 8 th year of O&M

- (iii) Repairs to other official buildings must be carried out during May to June except for white and color washing work, which should be done in September and October after monsoon in residential buildings.

Following repairs prior to onset of monsoon are essential:

1. Any faults in the electric installation, leakages, earthing, exposed wire ends and any hazards on this account to the users/inmates of the buildings, should be taken care of suitably; wiring, which is damaged or outlived, should be replaced.
2. Damaged sanitary lines should be replaced and choked lines cleared.
3. Proper drainage of the area around the building should be ensured to avoid stagnation of rain water/ house effluent, in order to prevent malarial conditions. Where courtyards exist in the buildings, their drainage into the outer drains should be ensured. Any choked drains should be cleared properly.
4. Leaking roofs should be attended to immediately with suitable repairs/ treatment, as the case may be. The rain waterspouts should also be cleared of blockages, etc. The roof should be swept clean of leaves, debris, etc., if any.
5. The plaster on outer walls of the building, which is exposed to weather, should be repaired before rains in order to prevent dampness inside. Where plinth protection has been provided, it should be checked and the damaged portions, if any, should be repaired before rains.
6. Damaged flooring should be repaired/ replaced as per requirement, in order to prevent dampness inside the rooms, etc., during rains.
7. Periodic repairs of damaged floors, door/window fittings, water taps, water coolers, furniture, desert coolers, electric circuits, must be taken up on complaints using the material of same quality as used during construction.

11.10 ROADS

11.10.1 General

The works shall be carried out in conformity with the relevant Specifications to the required level, grade and lines using approved materials. The works shall be carried out using light duty machinery or manual means provided the quality of the end product does not suffer. In execution of maintenance works, a reference is made to the IRC publications: "Manual for Maintenance of Roads" for guidance and compliance wherever applicable. Wherever the

Specification is not clear, good Engineering practice shall be adopted in the construction to the satisfaction of the Employer's Representative.

11.10.2 Maintenance Work of Road During O&M Period:-

- Repairing potholes and undulations found in the roads and road cuts.
- Repairing edges of the pavement.
- Repairs to shoulders at least 1.5 m on either side of road and to maintain them in proper gradient i.e. 3%.
- Ensuring that the pavement and the shoulders at least 1.5 m on either side are kept clear of any obstruction.
- Keeping a check on the encroachment and damage to the Government property.
- Cleaning and repairing of roadside and catch water drains.
- Jungle clearance to have proper site clearance.
- Cleaning of roads by removing dead animals, fallen trees, stones etc.
- Maintaining the kilometer stones, road signs and caution boards, drums etc. fixed on the road in a good state of repairs. This will generally involve the following activities:
 - i) Fixing of dislocated boards and stones.
 - ii) Periodical painting
 - iii) Repairs to boards such as welding or tightening of nuts and bolts.
 - iv) Fixing of new boards where necessary.
- Maintaining all diversion in good condition.
- Maintaining speed humps nicely.
- Maintenance of cross drainage (CD) Works: This will generally involve the following activities:
 - i) Clearing of the silt of waterway.
 - ii) Repairs to the damaged portions of the CD works.
 - iii) Repairs to cut off walls, apron, parapet walls etc.
 - iv) Painting of culverts and bridges.
 - v) Reporting of any serious abnormality and conditions to the Executive Engineer.
 - vi) Maintaining the u/s and d/s of waterway clean by cutting of vegetation, excavation etc.
- **Maintenance of Signs:**

The signs along with the posts shall be maintained in proper position, and kept clean and legible at all times. Damaged signs shall be replaced immediately. All signs shall be inspected at least twice a year. Special care shall be taken to see that weeds, shrubbery, mud etc. are not allowed to obscure any sign.
- **Maintenance of arboriculture:** This will generally involve the following activities:
 - i) Watering of plants at required intervals.
 - ii) Re-plantation without any additional cost in place of dead plants or damaged plants
 - iii) Inter cultural operation such as hoeing and weeding etc.
 - iv) Pruning and trimming and cutting of old big trees for required growth.

11.11 RESTORATION OF RAIN CUTS

Earthwork for restoration of rain cuts in embankments and shoulders shall be made using suitable material and compacting the same.

Materials

The material used for restoration of rain cuts shall be got approved from Employer's Representative and shall in general be as specified for earth work in embankment in section 3.

Construction Operation

The area affected by rain cuts shall be cleared of all loose soil and benched. The width of the benches shall be at least 300 mm and they shall extend continuously for a sufficient length. The height of the benches shall be in the range of 150-300 mm.

Fresh material shall be deposited in layers not exceeding 250 mm loose thickness and compacted so as to match with the benching at moisture content close to the optimum. Compaction shall be carried out using suitable equipment

such as plate compactors and rammers or by suitable implements handled manually. The finished work shall conform to alignment, levels and slopes as indicated in the approved drawing.

11.12 MAINTENANCE OF EARTHEN SHOULDER

Scope

The work of maintenance of earthen shoulder shall include making up the irregularities/loss of material on shoulder to the design level by adding fresh approved soil and compacting it with appropriate equipment, or stripping excess soil from the shoulder surface, as required.

Material

The material to be added to the shoulder, if required, shall be select soil as specified for shoulder works.

Construction Procedure

- 1) Making up of the earthen shoulder by adding extra soil and compacting the same; and/or
- 2) Stripping a layer of soil to achieve the required grade and level

Wherever extra earth is required to be added, the earthen shoulder shall be stripped and loosened to receive fresh soil. The deficiency of thickness shall be made up in layers of loose thickness not exceeding 250 mm. Water shall be added, if required, to attain the optimum moisture content and the layer compacted by 80 to 200 kN smooth wheel roller, vibratory roller, hand roller, plate vibrator or hand rammer to obtain at least 94% maximum dry density in accordance with IS:2720 (Part 8). The finished surface shall have the specified cross slope and line in accordance with the drawing. The side shall be trimmed to the required slope with the help of grader or manual methods using hand tools.

Wherever the earth is required to be excavated from the shoulder, this shall be done either using equipment like grader or by manual means using hand tools. The resulting surface shall be uniform and have a field density of at least 94% maximum dry density obtained in accordance with IS:2720 (Part 8). If the surface is not uniformly compacted, it shall be excavated to a depth of 150 mm and the soil mixed with water if required and compacted at moisture content close to the optimum to achieve 94% of maximum density as stated above.

11.13 MISCELLANEOUS WORKS

The Contractor under this scope of work is also required to maintain the road in a clean condition, which includes the cleaning of stones, fallen trees, dead animals, etc., as and when noticed by the patrolling teams or as directed by the Employer's Representative.

The pipe culverts and the other cross drainage structures built or rehabilitated under the Contract will be regularly inspected and suitable cleaning, grading works will be done to ensure against impounding near the structures. The structural damages will be repaired or dismantled and re-constructed considering the extent of damage as per directions of Employer's Representative.

The Contractor will also take up the works required for yearly maintenance of the sign boards, hectometer, kilometer and five kilometer stones and road marking, ensuring that they are in good shape and suited for the purpose for which they are installed.

11.14 OPERATIONS AND MAINTENANCE MANUAL

The comprehensive manual shall be submitted before the operation and maintenance period, as specified. It shall be periodically updated to incorporate the "best practices" experience gained while carrying out the O&M activities, broadly on the principals listed below:

1. Up-dating any changes in the procedures set out in the O&M manual, as deemed necessary based on any limitations observed during the maintenance period, including incorporating additional procedures for maintenance of other repairs/break downs not incorporated in the maintenance manual but faced during O&M period.
2. Procedures for repair of leaks/burst in different types of pipes must be provided, with supporting drawings. The O&M manual must be updated if any differences are observed during O&M period.
3. Frequency of spares used in maintenance of valves (air-valve, sluice valves and butterfly valves), expansion joints, equipment installed for surge protection and protection against corrosion must be recorded for updating the contents of the manual.
4. Records of trouble shooting points and details of events causing troubles (break down's) during maintenance of pumps / motors / measuring equipment(s), / electric panel and accessories there in must be maintained and used for updating the contents of the manual.
5. Records of locations and type of damages observed during maintenance of road which are of recurring nature must be used in updating the manual.

6. Records of trouble shooting points and details of events causing trouble (breakdowns) during maintenance of 33kV substations, etc., must be maintained and used for updating the contents of manual.
7. Records of Inventory used must be maintained and the relevant portion of O&M manual must be updated to list out the inventory requirements for maintaining the system for 12 months.
8. The provisions in the manual must incorporate every aspect of good industrial practices even if not elaborated here or in other parts of the bid document. The provisions in the approved operation and maintenance document shall be valid and binding for both the parties during operation and maintenance along with the additions and deletions made.
9. The manual so prepared must be updated after the end of every year of operation and maintenance, giving effect to the experience gained and the observations made by the Department during the maintenance period.
10. At the time of handing over after completion of O&M period, all the equipment, including standby equipment, must be in good working order.

11.15 PENALTIES FOR FAILURE TO ACHIEVE THE FUNCTIONAL GUARANTEES

In case of failure to supply the required quantity of water, liquidated damages shall be imposed for such failure to meet the performance criteria, as described in the following. The Employer will be entitled to recover any such damages from the monthly progress payments to be made to the Contractor in the month in which the failure occurred, or at any time thereafter from the subsequent monthly progress payments.

11.15.1 Break down

For the breakdown of pump / pumps (after utilizing stand by capacity) installed at

(i) Pumping stations

S. No.	Break down of pump / pumps period in hours	Penalty in % of daily O&M charges payable for complete system
1	1	20
2	1-3	30
3	3-6	40
4	6-9	50
5	9-12	60
6	For more than 12 hr and up to 24 hr break down period penalty will be levied 200 % and if continued for more than 24 hour than penalty shall be levied @ 250 % per day	
Note:- No penalty will be imposed in case of break down due to interruption in power supply from JVVNL		

Break Down of SCADA

S. No.	Break down period in hours	Penalty in % of daily O&M charges
1	0-3	5
2	3-6	10
3	6-9	20
4	9-12	30
5	5% for each successive hour	

11.15.2 Leakage /Burst in Pipe Lines**(i) Mains/ Sub mains**

S. No.	Break down period in hours	Penalty in % of daily O&M charges
1	0-3	0
2	3-6	2
3	6-9	4
4	9-12	6
5	5% for each successive hour	

11.15.3 Short/Excess Supply:

The supply is to be measured for each day from 00:00 midnight to next midnight. The Contractor is expected to meet the daily supply at each Chak outlet as per the quantity decided for that Chak on the basis of Flow Factor .

(i)

- No LD shall be imposed for failure to supply due to non-availability of power on the part of JVVNL.
- In case the Contractor fails to achieve functional guarantees on a continuous basis, due to condition A and condition B and penalty amount becomes equal to or more than 50% of the monthly O&M value for a period more than one months in a year i.e. 30 days in a year, then the Employer reserves the right to terminate the Contractor after en-cashing all the Security Deposits, Retention Money and Performance Guarantees.

11.15.4 Short fall in Manpower Deployment

The Contractor will ensure the deployment of the minimum man power listed in tables above in this section for the stipulated time period. Failing to which a penalty on the basis of per day per person shall be imposed on him at the rate 1.5 times the rate quoted by him in bid proposal.

11.15.5 Power Consumption in Pumping Stations:-

The expected power consumption shall be calculated every month on the basis of the power consumption claimed by the Contractor along with the offer and the actual duty conditions for the month (calculation can be done on hourly basis). It will be compared with the actual power consumption and if the consumption is higher than the expected consumption, liquidated damages shall be recovered from the Contractor at the rate of two times of the charges for the extra power consumed and paid to JVVNL.

Application of liquidated damages for excess power consumption will not be subject to any upper limit.

11.16 PAYMENTS

The Contractor, at the time of bidding, will be responsible to ensure the completeness and adequacy of his Bid Price to fulfill the entire responsibilities as described above. His bid price, as quoted in the Schedule of Prices, shall include all costs for carrying out all O&M responsibilities, except for the following item for which the Employer will bear the cost

- (i) The cost of electric power consumed at pump house, office buildings, Rest house and other public facilities within the campus will be paid by the Contractor and shall be reimbursed by the Employer as per the following condition.
- (ii) Contractor shall give complete details of total power consumption, Power consumption in both pump houses, and the acceptable power consumption as per the agreement for the same along with the power cost refund claim. The refund for the power shall be made only after deducting the cost of 2 times the units consumed in excess of the guaranteed consumption.
- (iii) The guarantees for power consumption would come into effect after the commissioning of the system.

HANDING OVER OF THE SYSTEM

After completion of operation & Maintenance period Contractor shall Hand Over the entire system to Employer in fully operational & maintained condition. If desired Employer may ask Contractor to arrange for performance tests on the system or component of the system to ascertain the performance of the system. Cost of such tests shall be borne by the Contractor and no claim for payment shall be entertained by the Employer on this account.

Contractor shall also provide Tools and Tackles listed in following table in three sets to the Employer at the time of handing over of the system to the Employer. for each pump house

S. No.	Particulars	per	Qty.
1	Trolley mounted Portable Generating of 25 kVA with canopy built in Panel/plug 50 amp.	No	1
2	Tripod with Chain Pulley Blocks of 1 Ton capacity (6.0m legs)	No	2
3	Single phase Welding Set, 250 amp., 220 Volt, air cooled stud type, wheel mounted with 15 mtr welding cable, 2 mtr. welding cable for earthing, one welding holder, one welding screen with glass and 3 cable lugs, one pair hand gloves and one wire brush	No	1
4	Portable Hand Drill (Heavy Duty) of capacity 13 mm to 23 mm with ½” drill chuck but without drill bits and drill stand.	No	1
5	Pipe wrench 10”, 14”, 18”, 24” and 36” of ISI mark	Set	2
6	Round files of sizes 8”, 10”, 12”, 14” & 16” (medium cut type)	Set	2
7	Flat Files of sizes 8”, 10”, 12” (medium cut type)	Set	2
8	Screw Driver set	No	2
9	Insulating Fuse Puller for all types of fuse to be used in Project components	Set	2
10	Pulley Puller for the Project components	Set	2
11	12” and 18” Hacksaw Frame with 36 blades of ISI mark	Set	2
12	Nose Pliers ISI mark	No	2
13	Tong Tester, 1000 Amp	No	2
14	Crimping tool upto 95 sq. mm	No	2
15	Hydraulic Crimping tool, 25 to 400 sq. mm.	No	2
16	Hydraulic Jack, 5 Ton capacity	No	2
17	Pipe dye set ½” to 2”	Set	2
18	Hammer of 200gm, 450gm, 1kg, 5kg & 20kg weight	Set	2
19	Aluminum Folding ladder of 8 meters	No	2
20	Set of Ring spanners & Fixed spanners (covering all sizes)	Set	2
21	Allen keys (As per plant and machines supplied)	Set	3
22	Set of Tommy	No	3
23	Vacuum cleaner (Industrial type)	No	2
24	Electrical driven submersible type de-watering pumps of 5 kW with 5 meters hose pipe	No	1
25	Megger, 1000 volt	No	1
26	Flexible pipe of 25mm dia for gardening	m	300
27	Hand Grinder (Angle 7”)	No	1

28	Bench Vice No. 6, Apex or equivalent make	No	1
29	Multi-meter (Digital)	No	2
30	Nose meter (Digital)	No	2
31	Set of tools and tackles for repair and maintenance of DI pipes as per relevant BIS/ International standard and as per recommendations of manufacturer. *	Set	1
32	Potable ultrasonic flow meter	Set	1

11.18 FORMATS

Some suggested formats to be followed for proper recording of pumping plant operations are given below. The format can be finalized during execution stage.

A PLANT DATA

Pumping Station:

Date:

Time Hrs	Voltage V	Frequency Hz	Speed Rpm*	Energy meter reading kWh	Flow reading Cu.m	Head (m)	Signature
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
			Total =				

Signature:

B. PUMP OPERATION

Pumping Station:

Date:

Time Hrs	Pump no								
	1	2	3	4	5	6	7	8	9
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
Total hours of operation									

Mark 'X' if pump is not available

Indicate Starting and Stopping time

Signature:

C PUMP DATA

Pumping Station:

Pump No.

Date:

Time Hrs	Voltage (V)	Current	Suction gauge reading* (m)	Water level in sump (m)	Delivery gauge reading (m)	Total head (m)	Signature
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							

* For Horizontal pumps only

Signature:

D POWER STATEMENT

Pumping Station:

Month:

Date

<u>Date</u>	Theoretical power consumption (kWh)	Allowances	Actual Power consumption (kWh)	Difference	Signature
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					
31.					

E MONTHLY REPORT

Pumping station:

Month and year

	Pump no									
	1	2	3	4	5	6	7	8	9	10
Number of hours of operation										
Vibration mm/sec										
Noise level dBA										
Total quantity pumped ml										
Energy consumption kWh										
Total no of hrs of power failure										
Total no of pump set hrs not available										
Reason for non availability of pump set										
Action taken for rectification										
Non availability of any other equipment and reason										
Action taken for rectification										

Signature:

F WATER RECEIVED AT CHAK OUTLET STATEMENT

Chak No.:

Month:

Date

<u>Date</u> <u>/Hour</u>	1	2	3	4	5	6	to	19	20	21	22	23	24	Total Flow of the day in M ³	% of total flow of system during same period	Flow factor for chak	% Deviati on
1.																	
2.																	
3.																	
4.																	
5.																	
6.																	
7.																	
8.																	
9.																	
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26.																	
27.																	
28.																	
29.																	
30.																	
31.																	

Signature:

LIST OF SPECIFIED MAKES

SN	Particulars of Item for instruments	Specified makes
	Breakers & Relay	
1	HIGH VOLTAGE DOUBLE BRAKE ISOLATOR WITH OR WITHOUT EARTH BRAKER	ATLAS/ABB/ELPRO/PRACTIL/ SKIPPER SEIL
2	VACCUM CIRCUIT BRAKER	ABB/BHEL/CGL/SCHNEIDER/JYPTI / STELMEC
3	MOULDED CASE CIRCUIT BREAKER	SCHNEIDER/L&T /C&S /SIEMENS /ER
4	PROJECTION RELAYS	SCHNEIDER/ABB/SIEMENS /ER
5	HRC FUSES	L&T /SIEMENS/ER/HAVELLS
6	CONTROL FUSES	SCHNEIDER/L&T/C&S/SIEMENS/HAVELS
	CABLE & WIRES	
7	HT CABLE	CCI/UNISTAR/RPG/HAVELLS/KEI/ DYNAMIC CABLES / POLICAB
8	LT CABLE	CCI/INCAP/UNISTAR/RPG/NICCO/ HAVELLS /KEI/DYNAMIC CABLE/PLYCAB
9	CONTROL CABLE	CCI/UNIVERSAL/FINOLEX/GEMSCAB/RPG/KEI/CORDS / DYNAMIC CABLE/POLYCAB
10	PVC LIGHTING WIRES	FINOLEX / RPG/GEMSCAB/KEI/POLYCAB
	CENTRIFUGAL PUMPS	
11	DEWATERING / POLDAR MUMP	KBL/M&P/KSB/SU/MBM/WPIL/JASCO/SINTECH
12	BACK WASH PUMPS	KIRLOSKAR/M&P/JYOTI/WPIL
13	DOSE METERING PUMPS	ASIALMI/SWELLORF /VK/SR
14	SLUDGE / NON CLOG SEWAGE PUMP	KIRLOSKAR /M&P/JYOTI/MBH/WPIL/JASCO/SINTECH
15	VT PUMPS	FLOWMORE/M&P/KBL/WPIL/JYOTI/AQUA/ SINTECH (Upto 250 KW)
16	HSC PUMPS	FLOWMORE/M&P/KBL/WPIL/JYOTI/LUBI/MAXFLOW (Upto 45 KW)/GRUNDFOS/JASCO (upto 50 KW)/ SINTECH (Upto 25 KW)
17	SUBMERSIBLE CENTRIFUGAL PUMP	AQUA /MBM (Upto 50 KW)WPIL (upto 50 KW)/ JASCO (Upto 50KW)
	FLOW METER	
18	ELECTROMAGNETIC FULL BORE TYPE FLOW METER	KROHNE MARSHALL/ NIVO CONTROL/ E&H / SIEMENS/TLT/ SBEM/ABB/ELECTRONET / ADEPT
19	ULTRA SONIC TYPE FLOW METER	E&H/KROHNE MARSHALL/SIEMENS/NIVO CONTROL / CHETAS/ RTL/ARAD (Upto 300 mm) ELECTRONET (Upto 300 MM) / ADEPT (Insertion type and clamp on type)
20	MECHANICAL TURBINE TYPE FLOW METER	ITRON/CAPSTAN/ NIVO CONTROL / AQUAMET/RTL/ ARAD (Upto 300 mm)
	MOTORS	
21	H.T MOTORS	KIRLOSKER ELCTRIC CO. LTD. (KEC.) I SIEMENS INDIA LTD. (SIEMENS)/CROMPTON GREAVES LTD. (CROMPTON) BHARAT HEAVY ELECTRICAL ,LTD, (BHEL) IGENERAL- ELECTRIC CO. LTD; (GEC) /NGEF

SN	Particulars of Item for instruments	Specified makes
		(NGEF) / JYOTI/ JEUMONT(Up-to 600KW)/ WEG (Up-to 5 MW)/TMEIC(Up- To 5 MW)
22	L.T MOTOR	KEC/SIEMENS/ABB/NGEF/JYOTI/LUBI (Upto 150 KW)/ HAVELLS (Upto 200 KW)
23	INDUCTION MOTOR	KEE/NGEF/CGL/BHEL/SIEMENS.
	PROCESS CONTROL INSTRUMENTS	
24	ALTERNATOR	KEC/JYOTI/AVK/CROMPTON
25	ANNUCIATOR	MASIBUS/LETROTEK/APLAB/MINILEC/PEACON
26	CAPACITOR	L&T/YASH/KHATAU JANKAR/UNISTAR
27	INDICATOR METERS	AE/IMP/RISHAB/E&H/MILLBORN
28	LEVEL INDICATOR	FORBES ,MARSHAL /YOKO GAWA / BELLS CONTROL /SBEM/ E&H/RLT/techtrol
29	Level SENSOR S (CAPACITANCE TYPE)	LEVCON/TOSHNIWAL/PUNE TECHTROL/SBEM/E&H/RLT
30	LEVEL SENSORS (ULTRA SONIC TYPE)	FISHER ROSE MOUNT/HONEY WELL/VEGA INSTRUMENT/KROHNE MARSHALL /SIEMENS/SBEM/E&H/RTL
31	LEVEL SWITCH	FISHER ROSE MOUNT/HONEY WELL/VEGA INSTRUMENT/KROHNE MARSHALL /SIEMENS/SBEM/E&H/RTL/TECHTROL
32	LEVEL TRANSMITTER	FISHER ROSE MOUNT /HONEY WELL/SIEMENS/VEGA INSTRUMENTS/ KROHNE MARSHALL/SBEM/E7H/RTL/ELECTRONET/TECHTROL
33	MECHANICAL FLOW INDICATOR	SCHLUMBERGER (ACTRIES) / CAPSTAN
34	METERING	AE/IMP/RISHAB/E&H
35	MULTI FUNCTION METERS	IMP/SIEMENS/RISHAB/AE
36	NOISE METER	CYGNET
37	PRESSURE GAUGE	BELLS CONTROL/ JN MARSHAL/ H GURU/ MANOMETER INDIA
38	PRESSURE INDICATOR	FISHER ROSE MOUNT/BELLS CONTROLS/HONEYWELL/ FOX BORO/ E&H/RLT
39	PRESSURE LOGGERS	L&T ABB/MASIBUS /LETROTEK
40	PRESSURE TRANSMITTER	FISHER ROSE MOUNT/NONEY WELL/FOX BORO/ BDO FORBES MARSHAL/YOKO GAWA/SIEMEN/E&H/RLT/ ELECTRONNET
41	RECTIFIER	CANARA ELECTRIC
	SWITCHGEAR & SWITCHGEAR PANELS	
42	33 KVS WTCHYARD CONTROL PANEL	L&T /SIEMENS/SCHNEIDER
43	HT SWTICH GEAR PANEL	L&T /SIEMENS/SCHNEIDER/ABB/C&S/CGL/HT SWTCHGEARS/ SWATI SWITCHGEARS/PCE
44	LT SWTICH GEAR PANEL	L&T /SIEMENS/SCHNEIDER/ABB/C&S/CGL/HT SWTCHGEARS/ SWATI SWITCHGEARS/PCE/HAVELLS/ DYNAMIC/GK MARKETING/DIVYA/ HT SWTICH GEARS//ENGINEERS & ENGINEERS/MILLBORN/SUN AUTOMAT/ JOHNS ELECTRIC/NISH TECHNO PROJECT / CAM/PCE/PYROTECH/POWER TECH

SN	Particulars of Item for instruments	Specified makes
45	CONTACTORS	ABB/L&T/C&S/SIEMENS/BCH/HAVELLS/DIVYA
46	TOR SWITCH	L7T /KAYEES/SCHNEIDER/SIEMENS/SALZER
	TRANSFORMERS	
47	33 /6.6 KV POWER TRANSFORMER	ABB/CGL/ALSTROM/BHARAT BIJLEE/KIRLOSKAR / UTTAM (BHARAT)/ VOLTAMP/VARDHMAN / ELECTSRO –MECH/ SKIPPERS / FTS (5MVA 33/HKV)
48	33 OR 6.6/433 KV AUSILIARY TRANSFORMER	ABB/CGL/ALSTOM/BHRAT BIJLEE /KIRLOSKAR / UTTAM (BHARAT)/ VOLTAMP/VARDHMAN / ELECTSRO –MECH/ SKIPPERS / FTS (5MVA 33/HKV)
49	CURRENT TRANSFORMERS (CT)	ABB/BHEL/KAPPA/JYOTI/SKIPPER SEIL
50	POTENTIAL TRANSFORMERS (PT)	ABB/BHEL/KAPPA/JYOTI/SKIPPER SEIL
	VALVES	
51	AUTOMACTIC FLOW CONTROL	DARLING MUESCO
52	PRESSURE REDUCING VALVES	DARLING MUESCO
53	BUTTER FLY VALVE	KIRLOSKAR BORHTER LTD /INDIAN VALVE COMPANY /FFOURESS ENGINEERING /ADVACE/DURGA ENGEGG/MAYUR/R&D/ DALUI/JPPITOR (Upto 1600 MM)/KARTAR (Upto 250 mm) / AVK/UPADHAYA/MARCK (upto 600 mm)/ PATSONS/VAG/CALSENS/ RG (Upto 600 mm)SIGMA (Upto 800 mm) KENNEDY (Upto 1200mm)
54	DI RESILIENT (Sfot)seated BUTTER FLY VALVE	AVK/VAG/JUPITER (Upto 700 mm)/JVC/DVPL/RG (UPTO 600 mm)/KBL (upto 2500 mm)/ R&D (Upto 900mm) SIGMA (upto 1200 mm) SHIVA (Upto 300 mm)/ KENNED (upto 1200 mm)
55	SLUICE VALVE	KIRLOSKAR BORHTER LTD , PUNE /INDIAN VALVE COMPANY /FOURESS ENGINEERING/ DURGA ENGINEERING/SHIV DURGA/KEYSTONE/ MAYUR/ DALUI/ R&D/JPPITOR (Upto 1200 MM)/KARTAR (Upto 600 mm) / AVK/SHIVA(UPTO 600 mm)/UPADHAYA/BEW Upto 300mm)/PATSONS/VAG/SACHDEVA (upto 1200 mm)/ CALSENS/HARI (upto 250 mm)/RAMESH 9upto 500 mm) Pn.1.0 and upto 300 mm Pn 1.6)/SIGMA (Upto 800 mm Pn 1.0 and Pn. 1.6)/KENNEDY (Upto 1200 mm) Pn 1.0 and Pn 1.6)/ KRANTI (Upto 200 mm CI)
56	DI RESILIENT (Soft) seated SLUICE VALVE	SIGMA (Upto 1000 mm Pn 1.0 and Pn 1.6) / AVK/ BEW upto 300 mm/VAG/ JUPIETER (upto 450 mm)/SACHDEVA (Upto 1000 mm)/ SHIVA (Upto 600 mm Pn 1.0 and Pn 1.6) / MAYUR (Upto 300 mm) /IVC/DVPL/KARTAR (Upto 600 mm) /KBL (upto 1300 mm)/ R&D (upto 900 mm)PN 1.0 and upto 300 mm Pn 1.6)/ KENNED (upto 600 mm Pn 1.0 and Pn 1.6)
57	DOUBLE PLATE CHECK VALVE	ADVACE/KBL/IVC/R&D/DURGA /MAYUR/DALUI/PATSON/ VAG / KENNED Y(upto 800 mm)
58	NON RETURN VALVE	KIRLOSKAR BORHTER LTD , PUNE /INDIAN VALVE

SN	Particulars of Item for instruments	Specified makes
		COMPANY /FOURESS ENGINEERING/ DURGA ENGINEERING/SHIV DURGA/KEYSTONE/ MAYUR/ DALUI/ R&D/JUPITOR (Upto 1200 MM)/KARTAR (Upto 600 mm) / AVK/SHIVA(UPTO 600 mm)/UPADHAYA/BEW Upto 300mm)/PATSONS/VAG/SACHDEVA (upto 1200 mm)/ CALSENS/HARI (upto 250 mm)/RAMESH (upto 250 mm)/SIGMA (Upto 800 mm)/KENNEDY (Upto 600 mm)/ KRANTI (Upto 150 mm CI)
59	DI RESILIENT (SOFT) SEATED NON RETURN VALVE	AVK/VAG/IVC/DVPL/RG (upto 600 mm) KBL (Upto 600 mm)/KENNEDY (Upto 600 mm) SIGMA (600 MM)/SHIVA (upto 600 mm)
60.	KINETIC AIR VALVE	KIRLOSKAR BORHTER LTD , /INDIAN VALVE COMPANY /ADVANCE VALVE/ INTER VALVE/FOURESS ENGINEERING/R&D / DURGA ENGINEERING/SHIV/ DURGA/MAYUR/ DALUI/ R&D/ /SHIVAQ/ UPADHAYA/BEW/ AFT/ PATSONS/AVK/ VAG/ CALSENS/JUPITTER/RG (upto 200 mm)/SIGMA (Upto 200) KENNEDY (upto 200 mm)
61	DI Resilient (soft) seated KINETIC AIR VALVE	AVK/VAG/IVC/DVPL/RG 9upto 200 mm)/KBL (upto 150 mm)/R&D (upto 200 mm)/KENNEDY 9upto 200 mm) / SIGMA (UPTO 200 mm)/ SHIVA (upto 200 mm)
62	SLUICE GATE	JASH/BHARAT INDUSTRIAL CORP/ORIENTAL/ FLUID CONTROLS
	Other ITEMS	
63.	AIR CONDITIONERS (Window)	VOLTAS LTD/ (VOLTAS)/CARRIER AIRCON LTD (CARRIERS)/ FEDERS LLOYD/ AIRCON/ BLUE STAR LTD(BLUE STAR)
64	AIR CONDITIONER (Mini split)	VOLTAS LTD/ (VOLTAS)/ FEDERS LLOYD/ AIRCON/ BLUE STAR LTD(BLUE STAR)
65	BACK WASH BLOWER	KAY INTERNATIONAL /SWAM/EVERST/WEEPL/USHA / ACME
66	BATTERY	EXIDE/STANDARD/FUKUWA/AMCO
67	BATTERY CHARGER	SABNIFE POWER SYSTEM/CHHABIELECT/UPTRON/AMCO
68	CHLORINATORS	INDUSTRIAL DEVICE PVT. LTD/BANCO/IEC FABCAM LTD/CHLOROCONTROL/TUSCON JESCO/CONTROLMATIK ABW/SEACLORMAC
69	CHLORINE LEAKAGE DETECTION SYSTEM	METIJO
70	COMPRESSOR FOR AIR VESSEL	ANGERSOL RAND/ELGI/CP
71	DISMANTLING JOINTS (BELLOWS TYPE)	SUR INDUSTRIES/PRECISE/BELOFLEX
72	DISMANTLING JOINTS (TELESCOPIC TYPE)	ORIENTAL/SHIV DURGA/SUR INDUSTRIES/ DWRENNIND/ MANGALA/ QUALITECH/SYSTEC FLEXO PRODUCT/ DURGA / MAYUR/SHIVA/BEW
73	ELECTRICAL ACTUATOR	ROTORK/LIMITORK/AUMA INDAI/MARSH/ENTROK/SD TORK
74	EMERGENCY DG SYSTEM ENGINE	KIRLOSKAR/KIRLOSKAR CUMMINS/ GREAVES COTTON/ CATER PILLAR/ASHOKA LEYLAND
75	EXHAUST FAN	BAJAJ ELECTRICAL LTD//GEC/KHAITAN LETC

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		(KHAITAN) JAI ENGG. WORKS.
76	FLASH MIXURE	FABCO/PARAMOUNT/HDO/REMI
77	INDICATING LAMPS	L&T/BCH/SIEMENS/VAISHNO/TECHNIC/RASS/C&S
78	LIFTING MACHINE EOT CRANES	EDDY CRANE ENGINEERS PVT/. LTD (EEPL)/ACME MANUFACTURES ENGINEERS (AACME) ROCKWELL HOIST CRANES PVT. LTD. NEW DELHI/REWA/ WH BRADDY / JAPS
79	LIFTING MACHINE HOIST	EDDY CRANES/ACME/INDEX/JAPS
80.	LIGHTING FIXTURES	PHILIPS/BAJAJ/MYSORE LAMPS/GE APAR/HAVELLS
81	MOULDED WATER STORAGE TANK	SYNTEX/POLYCON/POLYLAKE/LAXMI
82	OUTDOOR LIGHTING ARRESSTOR	ALPRO/OBLUM/IGE/SKIPPER SEIL
83	PAINTS	ASIAN/SHALIMAR/JENSON & NICHOLSON/GOODLAC NEROLAC/ ICL/BRITISH PAINT / CLEAN COATS
84	PLC SCADA	ABB/HONEYWELL/SCHENIDGER/L&T/ SIEMENS/E&H/GE/PHOENIX CONTACT/FORBES MARSHALL/MITSUBISHI ELECTRIC /OMRON
85	PUSH BUTTON	L&T/BCH/SIEMENS/VAISHNO/TECHNIC/RASS/ C&S
86	SURGE CONTROL DEVICES (AIR VESSEL)	L&T / SHRIDHARAN/SURESEAL
87	SURGE CONTROL DEVICES (ZVV)	SURESEAL/MANNEMANN MEER/MEGHA ENGINEERING /FLOWNIX
88	TAPE COATING ON MS PIPE	LLYOD INSULATION/IWL/BITU-TECH/SEAL FOR LIFE/
89	WEIGHING DEVICE (BRIDGE WEIGHING DEVICE)	AVERY