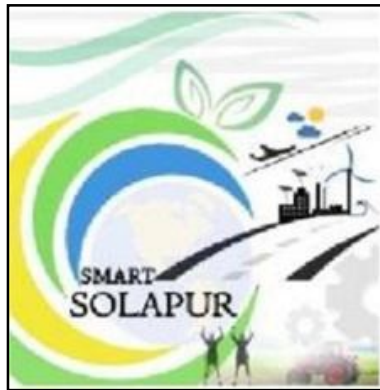




Solapur City Development Corporation Limited



Tender No.

**Augmentation to Solapur City Water Supply Project
(Ujani Dam As A Source – 110 MLD)**

On

Design, Build, Maintain, Operate and Transfer (DBMOT) Basis

**Solapur City Development Corporation Limited,
Dist. Planning Office, New Collector Office premises, Near Govt. Milk Dairy,
Saat Rasta, Solapur - 413003, Maharashtra, India**

NOVEMBER 2018

**Augmentation to Solapur City Water Supply Scheme
(Ujani Dam as a source – 110 MLD) on Design, Build, Maintain, Operate and
Transfer (DBMOT) basis**

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Solapur City Development Corporation Limited

Dist. Planning Office, New Collector Office premises, Near Govt. Milk Dairy, Saat Rasta, Solapur - 413003, Maharashtra, India
Tel:-0217- 2318800 E-mail:- solapurcitydcl@gmail.com

e-TENDER NOTICE

Solapur City Development Corporation Limited (SCDCL), Solapur hereby invites e-Tender from eligible bidders through e-tendering Portal for Augmentation to Solapur City Water Supply Project (Ujani Dam as a source – 110 MLD) on Design, Build, Maintain, Operate and Transfer (DBMOT) basis.

The e-Tender details are as under:

S.N.	Parameters	Details			
1	Tender/Bid No.				
2	Department	Solapur City Development Corporation Limited (SCDCL), Solapur.			
3	Name of Work	Augmentation to Solapur City Water Supply Project (Ujani Dam as a source – 110 MLD) on Design, Build, Maintain, Operate and Transfer (DBMOT) basis.			
4	Tender Details	Estimated Cost of Work (in INR)	Tender Fees (in INR)	Earnest Money Deposit (EMD) (in INR)	Period of Completion in Months (including monsoon)
		359,04,28,480/- (Rs. 359.04 Cr)	5,900/-	1,79,53,000/-	Construction Period – Thirty (30) Months Operation & Maintenance Period – Sixty (60) Months thereafter.
5	Contact Details	Chief Executive Officer, Solapur City Development Corporation Limited Dist. Planning Office, New Collector Office premises, Near Govt. Milk Dairy, Saat Rasta, Solapur - 413003, Maharashtra, India Tel:-0217- 2318800 E-mail:- solapurcitydcl@gmail.com			
6	Important Dates				
		Milestone	From date/time	To date/time	
		Tender Publishing Date	15/11/2018 @ 11:00 Hrs		
		Bid document download	15/11/2018 @ 13:00 Hrs	10/12/2018 @ 17:00 Hrs	
		Pre Bid Meeting	27/11/2018 @ 12:30 Hrs		
		Online submission of bid	01/12/2018 @ 11:00 Hrs	10/12/2018 @ 18:00 Hrs	
		Bid opening (Technical)	11/12/2018 @ 12:00 Hrs		
	Bid opening (Commercial) if possible	11/12/2018 @ 12:00 Hrs			

This e-Tender shall be available for download on registration by eligible bidder at <https://mahatenders.gov.in> as per the above mentioned dates.

Date:

Place:

(Dr. Avinash Dhakne, IAS)
Chief Executive Officer, SCDCL, Solapur



Solapur City Development Corporation Limited
Dist. Planning Office, New Collector Office premises, Near Govt.
Milk Dairy, Saat Rasta, Solapur, 413003, Maharashtra, India
Tel:-0217- 2318800 E-mail:- solapurcitydcl@gmail.com

DETAILED e-TENDER NOTICE AND GUIDELINES FOR SUBMISSION OF e-TENDER

Maharashtra Government e-Tendering Portal: <https://mahatenders.gov.in>

Digitally signed and unconditional online Tenders are hereby invited by the Chief Executive Officer, Solapur City Development Corporation Limited (SCDCL), Solapur from experienced and eligible bidders fulfilling the following conditions:

1. Details of Tender

Name of Work: Augmentation to Solapur City Water Supply Project (Ujani Dam as a Source – 110 MLD) on Design, Build, Maintain, Operate and Transfer (DBMOT) basis

Sr. No.	Estimated Cost of Work (in INR)	Tender Fees (in INR)	Earnest Money Deposit (in INR)	Period of Completion (including Monsoon)
1	Rs. 359,04,28,480/- (Rupees Three Hundred Fifty Nine Crores Four Lakhs Twenty Eight Thousand Four Hundred Eighty Only)	Rs 5,900/- (Rs. Five Thousand Nine Hundred Only) (Including 9% CGST + 9% SGST)	Rs. 1,79,53,000/- (Rupees One Crores Seventy Nine Lakhs Fifty Three Thousand Only)	Construction Period – Thirty (30) Months Operation & Maintenance Period – Sixty (60) Months thereafter.

2. Online Schedule of E-Tender

The e-tenders will be only received online on above mentioned e- Tendering portal and will be opened by SCDCL, Solapur on scheduled date and time as follows:

Sr. No.	Activities	Date & Time
1	Tender publishing date	15/11/2018
2	Documents download start date	15/11/2018 13.00 Hrs
3	Documents download end date	10/12/2018 17.00 Hrs.
4	Pre-bid meeting date	27/11/2018 12.30 Hrs.
5	Bid submission start date	01/12/2018 11.00 Hrs.
6	Bid submission closing date	10/12/2018 18.00 Hrs.
7	Bid opening date (Envelope A - Technical Bid)	11/12/2018 12.00 Hrs.
8	Bid opening date (Envelope B - Commercial Bid) if Possible	11/12/2018 12.00 Hrs.

Note: Interested and eligible bidders may send their queries **Only** through email on or prior to 27/11/2018 on email id - solapurcitydcl@gmail.com

3. To participate in the bid process, the bidders shall have a valid Digital Signature Certificate (DSC) having both signing and Encryption Certificates obtained from any Certifying Authorities empanelled by Controller of Certifying Authorities, India. In case of requirement of DSC, Bidders shall go to <https://mahatenders.gov.in> and follow the procedure mentioned in the document "Procedure for Digital Certificate".

Bidders who are participating in e-tendering for the first time shall register and obtain User ID & Password from the above mentioned portal. For further references/ queries bidders shall go through the tutorial section on the e-tender portal <https://maharatenders.gov.in>

4. Bid Eligibility

The eligibility criteria for the bidders shall be as per the prescribed criteria in **Annexure 1** to this notice.

5. Bid Validity

1. The offer/proposal e-tender submitted by the Bidders shall be valid for minimum period of 180 (One hundred and eighty) days from the last date of submission of Bid, i.e. from the date of the Tender Closing.
2. On completion of the validity period, unless the Bidder withdraws its bid in writing and communicates to SCDCL, the bid validity shall be deemed to be extended until such time that the contract is awarded to successful Bidder or bidder formally (in writing) withdraws its bid.
3. In event of such extension, bidders shall submit new EMD submitted as Bank Guarantee to cover the extended period of validity of their bids before expiry of the earlier Bank Guarantee.

6. Form of Bidders

The Bidder for participation in the selection process, may be (a) a single entity or (b) a Consortium, coming together to execute the Project. No Member at any given point of time may assign or delegate its rights, duties or obligations under the Agreement except with prior written consent of SCDCL. No bidder applying individually, or as a member of a Consortium, as the case may be, can be member of another consortia bidding for the Project. In the event the Bidder is a Consortium, it shall comply with the additional requirements as prescribed under the Bidding Documents.

1. The number of members in a Consortium shall not exceed 3 (Three).
2. The members of the Consortium shall commit that each of the members, whose experience will be evaluated for the purposes of the Bidding Document, shall collectively subscribe to and hold 100% (one hundred percent) of the subscribed and paid up equity of the SPV until a period of 2 (two) years from the date of commissioning of the Project, subject to the terms of the Bidding Document.
3. The members of the consortium shall nominate one member as the lead member (the “**Lead Member**”), who shall have an equity share holding of at least 51% (fifty one per cent) of the subscribed and paid up equity of the SPV till first 2 (two) years of operation from the date of commissioning of the Project (“**Commissioning Date**”). After completion of the second year from commencement of the O&M Works, the member of consortium who has been assigned the role of operation and maintenance may become lead member and shall hold not less than 26% (twenty six percent) of the subscribed and paid-up equity shareholding of the SPV till date of handing over of operation after

- successful completion of Project. The nomination(s) shall be supported by a duly notarized Power of Attorney, as prescribed under the Bidding Documents, signed by all the other members of the Consortium.
4. The Lead Member shall remain responsible for successful delivery of the Project at all times during the term of the resultant Contract Agreement.
 5. The Lead Member shall be authorized and shall be fully responsible for the accuracy and veracity of the representations and information submitted by the members of the Consortium from time to time.
 6. Members of the Consortium shall enter into a binding Joint Bidding Agreement, substantially in the form specified in the Bidding Documents and shall undertake that all Members shall comply with all lock-in requirements set forth in the Bidding Documents.
 7. The technical and commercial capacity and Net Worth of the Member/ Members shall satisfy the conditions of eligibility as prescribed in this Bidding Documents.
 8. The nomination of the Lead Member shall be supported by a duly notarized Power of Attorney substantially in the relevant form prescribed under the Bidding Documents, signed by the other members of the Consortium. The duties, responsibilities and powers of such Lead Member shall be specifically included in the Consortium Agreement. The other members of the Consortium shall authorize the Lead Member to incur liabilities and to receive instructions and payments for and on behalf of the Consortium. SCDCL expects that Lead Member shall have maximum responsibility pertaining to execution of Assignment;
 9. Notwithstanding any other provision in this Notice or the Bidding Documents, any change to the composition of the consortium can be done only with the prior approval of SCDCL. The Lead Member shall be responsible for the scope of work to be delivered by the exiting member, whether he does it himself or through a new member of the consortium. The Lead Member shall incorporate relevant changes in the Joint Bidding Agreement;
 10. All members of the consortium are required to follow the highest level of work ethics, if any member of the consortium has a Conflict of Interest or indulges in “Prohibited Practices”; the whole Consortium is liable to be disqualified. Further, in the event any entity has been barred by the Central Government or any State Government, as the case may be, from participating in any project or bid, and the bar subsists as on the last date of submission of the bid, it would not be eligible to submit a Proposal either by itself or as part of a Consortium.

7. Tender Fee Payment:

Tender Document and supporting documents may be downloaded for reference purpose from the e-Tendering Portal during the period mentioned in the tender notice. Interested and eligible Bidders shall make online payment (Non-Refundable) for an amount mentioned above as Tender fee including GST **Rs. 5,900/-** (Rs. Five Thousand Nine Hundred only) through an online payment gateway during bid preparation using Debit Card/Credit Card/Net Banking. Tender Fee receipt shall be system generated during bid preparation by the Bidder. Tender fee receipt shall be uploaded in **Envelope A** during bid preparation by the bidder. The bid shall be treated as non-responsive if the receipt is not found in **Envelope A** (digitally uploaded Envelope) in e tender portal by bidder prior to / on last date of submission.

8. Earnest Money Deposit (EMD) payment:

1. EMD for this work shall be as mentioned in clause (1) of this notice.
2. **EMD through Bank Guarantee:** The EMD of an amount of Rs. 1,79,53,000/- (Rupees One Crores Seventy Nine Lakhs Fifty Three Thousand Only) shall be paid in form of Bank Guarantee (BG) from the list of nationalized/scheduled banks as per RBI guidelines. The bidder shall upload the scanned copy of the Bank Guarantee as part of Envelope A on the online Mahatenders e-tendering portal only. The bidder shall submit the physical BG with SCDCL, only after opening of the Envelope-A. EMD submission shall be successful only if scanned copy digitally uploaded by bidder in Envelope A and the physical copy of the BG submitted by the bidders after opening of Envelope A matches in totality. In case the bidder submits the BG in any other form (scanned or physical) prior to the opening of the Envelope A in online e-tendering solution, apart from the process as suggested, the bid shall be summarily rejected. The BG shall have validity for a period of 180 (One hundred and eighty) days from the last date of submission of the bids and shall be extended by the bidders as mentioned in clause (5) above. After the bid validity period, the BG would be discharged by SCDCL as per the terms and conditions of the Bid documents.

The details of SCDCL's Bank for tender fee are given below:

Sr. No.	Particulars	Information
1.	Bank Name	Bank of Maharashtra
2.	Branch Name	Solapur Camp
3.	IFS Code	MAHB000163
4.	Account No.	60255694669

It shall be sole responsibility of the Bidder to share SCDCL banker details with the BG issuing bank. SCDCL shall bear no responsibility for any delays in submission of Bank Guarantee for EMD by the bidder. The bidders shall complete all formalities and processes related to EMD and Tender Fees (Online Payment, including International Cards) well in advance to avoid any last minute challenges in the e-tender process and the system.

4. The bidders shall not be able to submit their bids, if they fail to complete the payment of EMD using the above mentioned payment modes after downloading the system generated challan.
5. The bidders shall upload scanned copy of EMD paid receipt during bid preparation in Envelope A.
6. The bidders shall mention the beneficiary account details for EMD refund in the Earnest Money Deposit Form in the e-Tendering solution as required for Refund by SCDCL.
7. The beneficiary account provided for EMD refund shall be kept active by the bidders after award of Tender for successful transaction of EMD refund.
8. SCDCL or e-Tendering Service Provider shall not be liable for delays caused in EMD refund due to incorrect/inactive beneficiary account details.
9. The EMD of unsuccessful bidders shall be refunded only after finalization of the tender for which the above refund details are required. Bidders shall also upload scanned copy of cancelled cheque along with refund letter for refund of their EMD payment with Envelope-A documents.
10. The EMD of unsuccessful bidders shall be returned by SCDCL, without any interest, as promptly as possible and latest by 120th (One hundred and twentieth) day of signing of the contract by the successful bidder or when SCDCL cancels the bidding process.
11. The EMD of the successful bidder shall be returned within suitable timeframe from the date of submission of performance bank guarantee by the successful bidder.
12. The EMD shall be furnished in Indian Rupees only. No interest shall be payable by SCDCL on the EMD and tender fee (non-refundable).
13. SCDCL reserves the right to reject any or all of the tender offers, without assigning any reasons thereof.

14. Conditional tender will not be accepted.
15. If there is any amendment in the tender the same shall be published on following e-Tender portals
e-tender Portal: <https://mahatenders.gov.in>
16. The bidders should visit the project site prior to submission of their tenders and ascertain the local site condition, working restrictions, constraints, conditions in tender document regarding necessary approvals, NOC required for the work from the local authorities and shall quote the offer taking into consideration the above while execution of the work. No claim or compensation for any extra payments incurred by the bidders towards the approvals/ NOCs/ permissions will be entertained by SCDCL, which shall be noted.
17. The bidders shall maintain and observe highest standard of ethics during the procurement of tender. If it is found at any time that a bidder has been involved in corrupt and fraudulent practices, then SCDCL will have the right to cancel such bidder's bid. SCDCL reserves the right to declare the bidder ineligible, either indefinitely or for a stated period of time, to be awarded a contract by SCDCL or by any SCDCL related organization. SCDCL will not be liable for any loss incurred by bidder and will not be liable to pay any compensation and/or damages.
18. All information in relation to the bidder, and the bidder's business and bidder's assets which would be useful to bid process and/or the project, or which may be relevant to the project, should be made and disclosed to SCDCL, and such information shall: (a) be true, correct, and accurate and complete in all respects, and no such information should omit to state any fact necessary to make such statements accurate; and (b) not be misleading, whether by inclusion of any misleading information or omission of relevant information or both.
19. The bidders should not be blacklisted/debarred by Central/State Government in India or similar agencies globally for unsatisfactory past performance, corrupt, fraudulent or any other unethical business practices, in past 3 (three) years.

This e-Tender shall be available for free download on bidder registration at <https://mahatenders.gov.in> as per the above mentioned dates. The submission of the e-Tender response is through Maharashtra Governments e- tendering portal only. For participating in this e-Tender and avoiding last minute technical

challenges if any, the guidelines mentioned in the e- Tender document on e-Tendering Portal shall be followed by all the bidders.

The bidders shall go through the e-Tender Standard Operating Procedure (SOP) and Frequently Asked Questions (FAQs) hosted at Maharashtra Government's e- Tendering portal for detailed understanding of e-tendering submission process. For any e-Tendering support, mail or contact e-tendering Helpdesk mentioned on web site or call Helpdesk on (022)25315555 well in advance (at least 24 hours before last date of submission). For ease of submission of bids on e-tender portal please refer and follow the user manuals by copying the hyperlinks below and pasting it in your browser:

a) e-Tendering Toolkit for Bidders

<https://maharashtra.etenders.in/mah/toolkitBidder.asp>

b) Bidders Registration:

<https://maharashtra.etenders.in/tnduploads/mah/.../RegistrationofContractorsOnline.pdf>

c) Bid Preparation and Payment:

<https://maharashtra.etenders.in/tnduploads/mah/pressnotices/Bid%20Preperation.pdf>

d) Guidelines to Bidder User

<https://maharashtra.etenders.in/tnduploads/mah/pressnotices/GuidelinesBidderUser.pdf>

e) Bidders Manual Kit

<https://mahatenders.gov.in/nicgep/app?page=BiddersManualKit&service=page>

Date:

Place: Solapur

-Sd-

(Dr. Avinash Dhakne, IAS)
Chief Executive Officer, SCDCL, Solapur

ANNEXURE 1 - ELIGIBILITY CRITERIA

The bidder shall be evaluated based on the Eligibility Criteria mentioned below. The bidder shall submit all the documents as mentioned below as per the formats mentioned in the tender along with all supporting documents:

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member + 2 other members)			
	Factor	Requirement		All Members Combined	Other Members	Lead Member	Submission Requirement
1. Eligibility							
1.1	Registered Legal Entity.	The Single Entity/ Lead member and Consortium partners (if any) must be a registered contractor for unlimited/equivalent class from any Government Agency in India.	Must meet requirement	N/A	Must meet requirement	Must meet requirement	Certificate of Registration from concerned organization. (Format 1.1)

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement		All Members Combined	Other Members	Lead Member	Submission Requirement
1. Eligibility							
1.2	Duration of Company in operation.	Operation for a period of at least 5 years, prior to the last date of submission of bid.	Must meet requirement	N/A	Must meet requirement	Must meet requirement	For Companies incorporated in India, Certificate of Incorporation/Registration under Companies Act, 1956/2013 or partnership firm registered under the Partnership Act. Memorandum and Articles of Association. (Format 1.2)

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member+ other members)			
	Factor	Requirement			All Members Combined	Other Members	Lead Member
2. Financial Criteria							
2.1	Average Annual Turnover	Average annual turnover for last Five financial years. (2013-14, 2014-15, 2015-16, 2016-17, 2017-18)	INR 108 Cr.	INR 108 Cr.	INR 22 Cr.	INR 65 Cr.	Audited Financial Statement for Financial years (2013-14, 2014-15, 2015-16, 2016-17, 2017-18) Statutory auditor's certificate OR certificate from Company Secretary of the bidder clearly specifying the annual turnover for the specified years. (Format 2.1)
2.2	Net Worth & Working Capital	i) The Bidders net worth should be positive for last five consecutive years. ii) The Net Working Capital should be positive. iii) The bidder shall not have Financial Sickness	Must meet requirement	N/A	Must meet requirement	Must meet requirement	Audited Financial Statement for Financial years (2013-14, 2014-15, 2015-16, 2016-17, 2017-18) Statutory auditor's certificate OR certificate from Company Secretary of the bidder clearly specifying the annual turnover for the specified years. (Format 2.2)

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement			All Members Combined	Other Members	Lead Member
2. Financial Criteria							
2.3	Bid Capacity	<p>The bidder's bid capacity shall not be less than: - The Formulation of Bid capacity is as follows. Working Bid Capacity = $(A \times N \times 2) - B$ A = average annual construction turnover of the bidder for last three financial years. N = Number of years prescribed for construction of work for which bids have been invited. B = Value of existing commitments and ongoing works to be completed (for all the clients of the bidder) during the period of completion of work for which bids have been invited.</p>	INR 240 Cr.	INR 240 Cr.	INR 48 Cr.	INR 144 Cr.	<p>Audited Financial Statement for Financial years (2013-14, 2014-15, 2015-16, 2016-17, 2017-18) Statutory auditor's certificate OR certificate from Company Secretary of the bidder clearly specifying the annual turnover for the specified years. (Format 2.3)</p>

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement			All Members Combined	Other Members	Lead Member
2. Financial Criteria							
2.4	Line of Credit.	The bidder shall have line of credit from nationalized or a schedule bank.	INR 45 Cr.	INR 45 Cr.	INR 9 Cr.	INR 27 Cr.	Audited Financial Statement for Financial years (2013-14, 2014-15, 2015-16, 2016-17, 2017-18) Statutory auditor's certificate OR certificate from Company Secretary of the bidder clearly specifying the annual turnover for the specified years. (Format 2.4)
2.5	Blacklisting/Debarment	As on date of submission of the proposal, the bidder should not be blacklisted/debarred by Central/State Government or similar agencies globally for unsatisfactory past performance, corrupt, fraudulent or any other unethical business practices, in past Three (3) years.	Must meet requirement	N/A	Must meet requirement	Must meet requirement	Undertaking by the authorized signatory of the Bid. (Format 2.5)

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement			All Members Combined	Other Members	Lead Member
2. Financial Criteria							
2.6	National Company Law Tribunal (NCLT) and CDR	i) As on date of submission of the proposal, the bidder who have applied for Corporate Debt Restructure (CDR) or ii) facing any litigations regarding recovery from any financial institution or approached NCLT or NCLAT in past Three (3) years shall be ineligible to bid	Must meet requirement	N/A	Must meet requirement	Must meet requirement	Undertaking by the authorized signatory of the Bid.
3. Experience of Similar Works (Format 3)							
3.1	Similar Work	Experience of having successfully completed similar works of Design, Execution, Commissioning and Testing of water supply scheme during the last 7 years ending date of invitation. Similar works means-Any Single Water Supply Scheme executed in one or more packages with similar essential components of intake in the submergence of dam/pumping station and pipeline.	Three works each of INR 144 Cr. OR Two works each of INR 180 Cr. OR Single work of INR 251 Cr.	Three works each of INR 144 Cr. OR Two works each of INR 180 Cr. OR Single work of INR 251 Cr.			Work order and Completion Certificate from Client not below the rank of Executive Engineer/ Chief Officer/ City Engineer and equivalent rank, highlighting the parameters specified in the Criteria.

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements			Documentation	
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement		All Members Combined	Other Members	Lead Member	Submission Requirement
4. Physical Criteria (Format 4)							
4.1	Head Works	Contractor should have constructed and commissioned at least one Head Work on the bank of major river or in submergence of dam including construction of Jack well with pump house and approach channel / Slotted pipe gallery / intake well and connecting pipe Under single contract.	Single work of 150 MLD	Single work of 150 MLD			Work order and Completion Certificate from Client not below the rank of Executive Engineer/ Chief Officer/ City Engineer and equivalent rank, highlighting the parameters specified in the Criteria.
4.2	RCC approach bridge	Contractor should have experience of Designing, constructing and satisfactory completion of RCC approach bridge of minimum width 2.50 m and minimum length 60 m in single contract.	Single work of 60 M	Single work of 60 M			

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement		All Members Combined	Other Members	Lead Member	Submission Requirement
4. Physical Criteria (Format 4)							
4.3	MS Pipeline	Contractor should have experience of Providing, lowering, laying, jointing and satisfactory hydraulic testing and commissioning of MS pipe line work of minimum 660 mm diameter OD Under single contract.	Single work of 27.50 Km.	Single work of 27.50 Km.			Work order and Completion Certificate from Client not below the rank of Executive Engineer/ Chief Officer/ City Engineer and equivalent rank, highlighting the parameters specified in the Criteria.
4.4	BPT	Contractor should have experience of Designing, constructing, hydraulically testing and satisfactory commissioning of RCC ESR/GSR/BPT/Sump of minimum 2.5 Lakh Lit. capacity in single contract.	Single work of 2.5 Lakh Lit. capacity	Single work of 2.5 Lakh Lit. capacity			

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement			All Members Combined	Other Members	Lead Member
4. Physical Criteria (Format 4)							
4.5	Raw Water Pumping Machinery	Contractor shall have experience of successful and satisfactory completion and commissioning of the works listed below with any Government Department / Organization/ Local Body. 1.Total Installed Capacity – 3.3 kV pumps -2175 HP 2. Individual Capacity 3.3 kV pumps – 375 HP	Work of Vertical Turbine Pumping Machinery <u>under single contract.</u> 1. Total Installed Capacity – 3.3 kV pumps - 2175 HP 2. Individual Capacity 3.3 kV pumps – 375 HP 3. Transformer & substation. Capacity – 1500 kVA, 33/3.3 kV	Work of Vertical Turbine Pumping Machinery <u>under single contract.</u> 1. Total Installed Capacity – 3.3 kV pumps - 2175 HP 2. Individual Capacity 3.3 kV pumps – 375 HP 3. Transformer & substation. Capacity – 1500 kVA, 33/3.3 kV			Work order and Completion Certificate from Client not below the rank of Executive Engineer/ Chief Officer/ City Engineer and equivalent rank, highlighting the parameters specified in the Criteria.

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements			Documentation	
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement		All Members Combined	Other Members	Lead Member	Submission Requirement
4. Physical Criteria (Format 4)							
4.6	Operation & Maintenance (Minimum experience: 2 Years)	The Bidder shall have completed successfully and satisfactorily, Operation & Maintenance of water supply scheme (With Head works, MS Pipe line, High Tension Pumping Machinery) for minimum 2 consecutive years in the last 10 years.	Single work of at least 55 MLD	Single work of at least 55 MLD			Work order and Completion Certificate from Client not below the rank of Executive Engineer/ Chief Officer/ City Engineer and equivalent rank, highlighting the parameters specified in the Criteria.

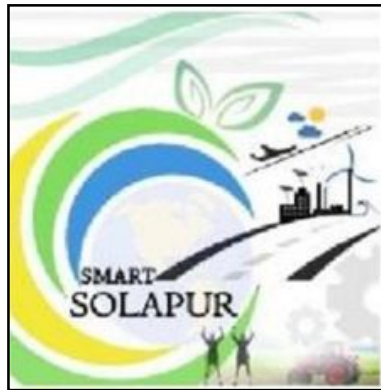
NOTE TO BIDDERS

The bidders to use these factors for the purpose of evaluation of the completed works in the past and bringing those to the current price level for the above criteria.

2017-18	1.00
2016-17	1.10
2015-16	1.21
2014-15	1.33
2013-14	1.46
2012-13	1.61
2011-12	1.77
2010-11	1.95
2009-10	2.14
2008-09	2.36
2007-08	2.59



Solapur City Development Corporation Limited



Tender No.

**Augmentation to Solapur City Water Supply Project
(Ujani Dam As A Source – 110 MLD)**

On

Design, Build, Maintain, Operate and Transfer (DBMOT) Basis

PART I – BIDDING PROCEDURE

**Solapur City Development Corporation Limited,
Dist. Planning Office, New Collector Office premises, Near Govt. Milk Dairy,
Saat Rasta, Solapur - 413003, Maharashtra, India**

NOVEMBER 2018

SECTION 1

INSTRUCTIONS TO BIDDERS (ITB)

A. GENERAL

1 Scope of Bid

1.1 The Chief Executive Officer, Solapur City Development Corporation Limited, Solapur (“**SCDCL**”), invites e tender from experienced and eligible bidders for **Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) (“Project”) on Design, Build, Maintain, Operate and Transfer (DBMOT) basis (“Works”)**. The Works are briefly described below.

TYPE OF WORK	DESCRIPTION OF WORKS
Part: 1 Survey and Investigations	1. Topographical surveys and geotechnical investigations and other relevant investigations for the Project as envisaged by the SCDCL and submission of the aforesaid reports with SCDCL.
Part: 2 Head Works, Raw Water Pumping Station, Raw water Pumping Machinery.	1. Design, engineering and construction of Head works (Jackwell, Overhead Pump House, Approach Channel, Approach Bridge) and raw water pumping station for lifting of about 300 million litres per day (MLD) raw water from the backwaters of Ujani Dam, situated about 100 km from Solapur City. 2. Design, engineering and construction of the raw water Pumping machinery for 110 MLD.

TYPE OF WORK	DESCRIPTION OF WORKS
Part: 3 Raw water pumping main, Break Pressure Tank (BPT), Raw water Gravity main, Tappings, Crossings.	1. Design, engineering and construction of the raw water pumping main from the Head works up to the proposed Break Pressure Tank at Varawade on Pune-Solapur National Highway No. 65. 2. Design engineering and construction of break pressure tank (BPT) at Varawade Toll Plaza located about 28.50 Km from Head works. 3. Design, engineering and construction of the raw water gravity main from BPT to Soregaon WTP, located at about 81.50 km from the BPT. 4. Provision of tapping to Pakni WTP and Soregaon WTP on Raw Water Gravity Main 5. Design, engineering, permission and construction of all (en-route) crossing of railway, National/State Highway, MDR/ODR, river, nala and canal crossings.
Part : 4 Miscellaneous works	1. Commissioning of the Scheme and Trial run for 3 months 2. Operate and maintain the scheme for Five years.

1.2 The successful Bidder will be expected to complete the design and build portion of the Works, including trial run and commissioning (“**Construction Works**”), within **30 (Thirty) months** (including monsoon) from the date of commencement of the Construction Works. It is clarified that the Construction Works will be deemed to have been commenced from the date SCDCL issues the notice to proceed with respect to the Construction Works.

In addition, after completion of the Construction Works and acceptance by SCDCL, the successful Bidder will be required to operate and maintain the works (“**O&M Works**”) such as head works, pumping station, raw water pumping machinery, pumping main, BPT and raw water gravity main for a period of **5 (Five) years** (including monsoon)

2 Source of Funds:

The Project shall be funded by SMC through CSR fund from NTPC and Solapur City Development Corporation Limited (SCDCL).

3. Eligible Bidders

- 3.1 This ITB is open to experienced and qualified Bidders meeting the eligibility criteria specified in Section 3 of Part 1 of this Bidding Document. The Bidder's competence and capability with respect to the Eligibility Criteria is proposed to be established by evaluating the Technical Capacity and Financial Capacity of the Bidder.
- 3.2 The bidders shall provide such evidence of their continued eligibility satisfactory to SCDCL, as SCDCL shall reasonably request.
- 3.3 A Bidder shall not have a conflict of interest as provided in Clause 6 of this ITB.
- 3.4 Government-owned enterprises in India shall be eligible only if they can establish that they are legally and financially autonomous and operate under Commercial law.

4. Eligible Materials, Equipment and Services

- 4.1 The provision and use of any materials, equipment and services to be supplied under the Contract Agreement shall not infringe or violate any industrial property or intellectual property rights or claims of any third party.

5. Qualification of the Bidder

- 5.1 To be qualified for award of the Contract Agreement pursuant to the Bidding Document, more particularly specified in Clause 9 of this ITB, Bidders shall demonstrate technical and financial capability as per the technical qualification criteria mentioned in Section 3 of the Bidding Document and submit along with the Proposal power of attorney, statement of legal capacity and a Joint Bidding Agreement as per the formats prescribed in Section 3 of the Bidding Documents. Further the Bidder shall meet SCDCL's requirements as specified in Section 6 of the Bidding Document ("**Employer's Requirement**").
- 5.2 The forms prescribed under Section 3 of the Bidding Document are to be submitted along with the technical bidding forms prescribed under Section 4 of the Bidding Document.
- 5.3 The Bidder shall:
 - (a) Submit a duly notarized power of attorney authorizing the signatory of the bid to commit the Bidder substantially in the form specified under Schedule 2 of Section 3 of the Bidding Document.

- (b) Submit updated information for current contract commitments/ works in progress and financial resources in sufficient details so as to enable reassessment of the financial capacity of the Bidder, including members of the consortium where the Bidders are bidding through a consortium.
 - (c) Submit proposals regarding work methods, scheduling and resourcing which shall be provided in sufficient detail to confirm the Bidder's capability to complete the works in accordance with the specifications and the time for completion.
- 5.4 The Bidder shall provide adequate representations to SCDCL, to the satisfaction of SCDCL, stating that the Bidder has the financial capability to undertake the Project and the Works contemplated there under, including the availability of adequate financial resources and that it fulfills the cash flow requirement for the Works under this Project.
- 5.5 The Bidder must also satisfactorily demonstrate that: (i) it has the personnel for the key positions that meet the minimum qualifications as set out in the Employer's Requirements; (ii) it has access to the minimum levels of key plant, equipment and machinery that are set out in the Employer's Requirements; (iii) its proposals regarding work methods, scheduling and mobilization of resources are adequate to demonstrate the Bidder's capability to complete the Works in accordance with the specifications and time for completion referred to in the Bidding Documents; and (iv) its understanding of the requirements of the contract as per Clause 13 is clear and unambiguous. Any unsatisfactory assessment of these requirements may lead to the Bidder being evaluated as non-responsive.
- 5.6 Where the Bidder is a single entity, it may be required to form an appropriate special purpose vehicle, incorporated under the Indian Companies Act, 2013 (the "**SPV**"), to execute the Contract Agreement, substantially in the form specified in Part III of Section 9 of the Bidding Document and implement the Project. The Bidder shall ensure that the SPV shall not undertake any business activities, directly or indirectly, other than the implementation of the Project.
- 5.7 In case the Bidder is a consortium, it shall, in addition to forming an SPV as prescribed in Sub-Clause 5.6 above, comply with the following additional requirements:
 - (a) The Bidder should submit a duly notarized power of attorney, authorizing the signatory of the proposal for the Project ("**Proposal**") to commit the Bidder. In the case of a consortium, the members

forming the consortium should submit a duly notarized power of attorney in favour of the Lead Member, nominated in accordance with Clause 5.7(e) of this ITB; and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the partners and duly notarized substantially in the form specified under Schedule 2 of Section 3 of the Bidding Document. The Bidder should also furnish all corporate approvals necessary for the issuance of the said power of attorney, including certified true copies of resolutions passed by the board of directors of the bidders giving such powers of attorney;

- (b) Number of members in a consortium shall not exceed 3 (three), and information sought in the Proposal may be restricted to 3 (three) members in the order of their equity contribution, subject Sub-Clause 5.7 (c) below;
- (c) Members of the consortium shall enter into a binding joint bidding agreement, substantially in the form specified at Schedule 1 of Section 3 of the Bidding Documents (the “**Jt. Bidding Agreement**”), for the purpose of submitting the Proposal and submitting a bid in the event of being short-listed. The Jt. Bidding Agreement, to be submitted along with the Proposal, shall, inter alia:
 - i. convey the intent to form an SPV with shareholding/ ownership equity commitment(s) in accordance with the Bidding Document, which would enter into the Contract Agreement and subsequently perform all the obligations of the SPV in terms of the Contract Agreement, in case the Project is awarded to the consortium;
 - ii. clearly outline the proposed roles and responsibilities, if any, of each member and clearly define the proposed administrative arrangements (organization chart) for the management and execution and commit to the scope of work, rights, obligations and liabilities to be held by each member; specifically commit that the Lead Member shall be answerable on behalf of other members for the performance of obligations under the Bidding Documents;
 - iii. commit the minimum equity stake to be held by each member;
 - iv. commit to the profit and loss sharing ratio of each member;
 - v. commit that each of the members, whose experience will be evaluated for the purposes of the Bidding Document, shall collectively subscribe to and hold 100% (one hundred percent) of

the subscribed and paid up equity of the SPV at all times till a period of 2 (two) years from the Commissioning Date, subject to Sub-Clause 5.7 (e) and 5.9;

vi. include a statement to the effect that all members of the consortium shall be liable jointly and severally for all obligations of the SPV in relation to the Project until the Completion Date is achieved in accordance with the Bidding Documents and the Contract Agreement;

vii. Undertake:

- I. that notwithstanding anything contrary contained in the Bidding Document or the Contract Agreement, the Lead Member shall always be liable for obligations of all the consortium members i.e. for both its own liability as well as the liability of other members and all the members of the consortium shall always be liable for obligations limited to their scope of work. However, the members of the consortium shall be severally liable for the completion of the Project.
- II. that the Lead Member shall be liable for the entire scope of work and risks involved and further shall be liable and responsible for ensuring the individual and collective commitment of each of the members of the Consortium in discharging all of their respective general obligations under the Bidding Documents or the Contract Agreement.
- III. that each member shall be individually liable for the performance of its part of the obligations without in any way limiting the scope of collective liability envisaged in the Contract Agreement.
- IV. that the members of the Consortium shall alone be liable for all obligations of the identified sub-contractor and clearly indemnify SCDCL against any losses or third party claims arising due to the sub-contractor/consortium's default.
- V. that the Lead Member is liable to manage the complete assignment by taking responsibility of delivery per scope and maintain transparency around monetary terms.

- (d) subject to the provisions of Sub-Clause (a) above, the Proposal should contain the information required for each member of the consortium;
- (e) members of the consortium shall nominate one member as the lead member (the “**Lead Member**”), who shall have an equity share holding of at least 51% (fifty one per cent) of the subscribed and paid up equity of the SPV till first 2 (two) years of operation from the Commissioning Date. After completion of second year from commencement of the O&M Works, the member of consortium who has been assigned the role of operation and maintenance may become lead member and shall hold not less than 26% (twenty six percent) of the subscribed and paid-up equity shareholding of the SPV till date of handing over of operation after successful completion of Project. The nomination(s) shall be supported by a duly notarized power of attorney, as per the format at Schedule 2 of Section 3, signed by all the other members of the consortium; the Proposal should include a brief description of the roles and responsibilities of individual members, particularly with reference to financial, technical and operations and maintenance obligations;
- (f) An individual Bidder cannot at the same time be member of a consortium applying for pre-Bidding. Further, a member of a particular consortium cannot be member of any other consortium applying for bidding;
- (g) the consortium members have the financial standing and resources to fund the required equity and to raise the debt necessary for undertaking and implementing the Project in accordance with this Bidding Document;
- (h) all members of the consortium shall be jointly and severally liable for the execution of the Contract Agreement in accordance with the terms of the Contract Agreement, and a relevant statement to this effect shall be included in the authorization mentioned under (b) above as well as in the Bid Form and the Form of Contract Agreement (in case of a successful bid); and
- (i) Except as provided under the Bidding Documents, there shall not be any amendment to the Jt. Bidding Agreement without the prior written consent of SCDCL.

5.8 The Bidder has to fulfill the Technical and Financial Evaluation criteria given in Section 3 of Bidding Documents to qualify for further evaluation.

5.9 Notwithstanding any other provision in the ITB and/ or Bidding Documents, any change to the composition of the consortium can be done only with the prior approval of the SCDCL.

6 Conflict of Interest

6.1 All Bidders found to be in conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest with one or more parties in a bidding process if they:

- (a) Have controlling 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 a 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 a bid of another Bidder, or influence the decisions of SCDCL regarding the bidding process; or
- (e) submit more than one bid in the bidding process, except where alternative offers may be permitted under the Bidding Documents; this does not limit the participation of subcontractors in more than one bid or as Bidders and subcontractors simultaneously; or
- (f) Participated as a consultant in preparing the design or technical specifications of the goods and related services or works that are the subject of a bid.

7 Cost of Bidding

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

8 Site Visit

8.1 The Bidder is advised to visit and examine the site of Works (“**Site**”) and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the bid and entering into a contract for completion of the Works. The costs of visiting the Site shall be at the Bidder's own expense.

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

B. BIDDING DOCUMENTS

9 Content of Bidding Documents

- 9.1 The bidding documents are those stated below, and should be read in conjunction with any addenda issued in accordance with Clause 11 of ITB (“**Bidding Document**”):

PART I BIDDING PROCEDURES

- Section 1 - Instructions to Bidders (ITB)**
- Section 2 - Bid Data Sheet (BDS)**
- Section 3 - Evaluation and Qualification Criteria (EQC)**
- Section 4 - Technical Bidding Forms (TBF)**
- Section 5 - Financial Bidding Forms (FBF)**

PART II EMPLOYER’S REQUIREMENTS

- Section 6 - Employer’s Requirements (ERQ)**
- Section 6 A - General Requirements**
- Section 6 B - Standard Specification**
- Section 6 C - Particular Specification**
- Section 6 D - Drawings**

PART III CONDITIONS OF CONTRACT AND CONTRACT FORMS

- Section 7 - General Conditions of Contract (GCC) Section**
- Section 8 - Particular Conditions of Contract (PCC)**
- Section 9 - Contract Forms (COF)**

- 9.2 The Bidder is expected to examine carefully the contents of the Bidding Documents. Failure to comply with the requirements of bid submission will be at the Bidder's own risk. Pursuant to Clause 28, bids which are not substantially responsive to the requirements of the Bidding Documents will be rejected.
- 9.3 Bidders are informed that the site information which is included in Section 6 (Employer's Requirements) is provided only for the Bidders' information, and SCDCL does not warrant either its accuracy or sufficiency. The Bidder is responsible to inspect and examine the Site, its surroundings and other available information and data, and to have satisfied himself, so far as practicable, before submitting the bid as to the form and nature of the Site, the hydrological and climatic conditions, the extent and nature of the Works, the means of access to the Site and the accommodation that the Bidder may require, and all other risks, contingencies and circumstances which may influence or affect the Bid. Bidders are also advised to carry out any additional surveys or investigations that they may deem to be appropriate or necessary before submitting the bid.

10 Clarifications on Bidding Documents

- 10.1 A prospective Bidder requiring any clarification of the Bidding Documents may notify SCDCL by e-mail at the following email address:
solapurcitydcl@gmail.com
SCDCL will respond to any request for clarification which it receives prior to the pre-bid meeting as per time schedule stated in e-tender notice. Copies of SCDCL's response, including a description of the enquiry, will be forwarded to all Bidders.

11 Amendment of Bidding Document

- 11.1 At any time prior to the deadline for submission of bids, SCDCL may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder, modify the Bidding Documents by issuing an addendum.
- 11.2 Any addendum thus issued shall be part of the Bidding Documents pursuant to Sub-Clause 9.1 of this ITB, and shall be published on the Mahatenders e-tendering portal. It is the responsibility of the bidder to regularly visit and check the Mahatenders e-tendering portal and register itself for auto alerts.
- 11.3 In order to afford prospective Bidders reasonable time in which to take an addendum into account in preparing their bids, or for any reason deemed

appropriate by SCDCL, SCDCL may extend the deadline for submission of bids, in accordance with Clause 23 of this ITB.

C. PREPARATION OF BIDS

12 Language of Bid

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

13 Documents Comprising the Bid

13.1 Bidder shall follow the instructions on the Mahatenders e-tendering portal for submission of e-tender. Proposals will be submitted online on SCDCL e-tendering Portal in two separate electronic envelopes, marked as “Envelope A” and “Envelope B”. The contents of these envelopes will be as under:

ENVELOPE A:

(i) TENDER FEE

Receipt of Tender Fee payment of Rs. 5,900/- (Rupees Five Thousand Nine Hundred Only) including GST of Rs 900/- (Rupees Nine Hundred Only), towards the non-refundable cost of the Bidding Document through Debit card/ credit card/ Net banking/ RTGS / NEFT.

(ii) EARNEST MONEY DEPOSIT (EMD)

Receipt of Earnest Money Deposit (EMD) payment of Rs. 1,79,53,000/- (Rupees One Crores Seventy Nine Lakhs Fifty Three Thousand Only) in the form of Bank Guarantee (BG) from the list of Nationalised Banks as notified by the Reserve Bank of India guidelines. The proforma of the BG is as provided in Section 9.

(iii) TECHNICAL BIDDING FORMS

- (i) Technical Bidding Form (TBF), signed by the authorized signatory;
- (ii) Schedules of Technical Bidding Forms;
- (iii) Bid data sheet, signed by the authorized signatory;
- (iv) Information on Eligibility & Qualification as per section 3;

- (v) any other information/data required to be submitted by Bidders in accordance with these ITB.

ENVELOPE B: FINANCIAL BIDDING FORMS

Without limiting the generality of the foregoing, the Financial Bidding Form shall contain the following:

- (i) Fully Completed Schedules of Prices (in Indian Rupees only).
- (ii) Any other details required to be completed and submitted by Bidders in accordance with these Instructions to Bidders.

If any of the documents or Schedules as mentioned above are found to be incorrect / in complete / defective / missing, then SCDCL reserves its rights to either call for the clarification/ additional information or declare the bid as non- responsive summarily.

Note: The Bidder shall submit the aforementioned documents specified in Sub-Clause 13.1 above in the relevant Envelopes. Any incorrect submission of documents in the Envelope to which such document does not pertain, will result in the bid being non responsive. For the ease of reference of the Bidders, please refer to Annexure 3 of this ITB that contains a checklist of documents to be submitted in the respective envelopes to be submitted by the Bidders.

14 Bid Form and Price Schedules

- 14.1 The Bidder shall complete the Bid Forms and schedules furnished in the Bidding Documents in the manner and detail indicated therein, following the requirements of Clause 15 and 16.

15 Bid Prices

- 15.1 Unless specified otherwise in Employer's Requirements, Bidders shall quote for the entire facilities on a "single point responsibility" basis such that the total bid price covers all the Bidder's obligations as a Contractor mentioned in or to be reasonably inferred from the Bidding Documents in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction, installation and completion of the facilities including operation and maintenance of the facilities for the entire period until the Completion Date. This includes all requirements under the Bidder's responsibilities as a Contractor (as defined under the Conditions of Contract) for testing, trial run and commissioning of the facilities and, where

so required by the Bidding Documents, the acquisition of all permits, approvals and licenses, etc., operation, maintenance and training services and such other items and services as may be specified in the Bidding Documents, all in accordance with the requirements of General Conditions of Contract as specified in Section 7 of the Bidding Documents and Particular Conditions of Contract comprising (a) Part A (Bid Data Sheet provided under Section 2 of the Bidding Documents) and Part B (Particular Conditions of Contract) as specified in Section 8 of the Bidding Documents (collectively, the “**Conditions of Contract**”).

All the taxes applicable and prevailing on the date of submission of bids have to be considered in the Bidders Financial Bid. Any effect due to change in rate of tax or substitution of tax or imposition of new tax or levy from time to time during the currency of the contract after the date of submission of bid shall be reimbursed to or recovered from the Bidder at the time of payment.

The prices quoted by the Bidder for the O&M Works shall not include the cost of raw water and electricity which will be paid directly by Solapur Municipal Corporation (SMC) to the concerned agency/ authority during the operation and maintenance period. The Bidder shall ensure bonafide use of electricity and water during the period of Works.

- 15.2 The quoted rates shall be deemed to include all the leads and lifts for transportation of materials.

16 Bid Currencies

Prices shall be quoted in the **Indian Rupees** only.

17 Bid Validity

- 17.1 Bids shall remain valid for a period of **180 (one hundred and eighty)** days from the last date of submission of bid, *i.e.* from the date of the Tender Closing.
- 17.2 On completion of the validity period, unless the Bidder withdraws its bid in writing and communicates to SCDCL, the bid validity shall be deemed to be extended until such time that the contract is awarded to successful Bidder or bidder formally (in writing) withdraws its bid.
- 17.3 In the event of such extension, bidders shall submit new EMD submitted as Bank Guarantee to cover the extended period of validity of their bids before expiry of the earlier Bank Guarantee.

18 Bid Security/ Earnest Money Deposit (EMD)

- 18.1 The Bidder shall furnish, as part of its **Envelope A**, a bid security/EMD in the amount of as per Bid Data Sheet
- 18.2 Not used.
- 18.3 Any bid not accompanied by an acceptable bid security shall be rejected by SCDCL as non-responsive.
- 18.4 The bid security/EMD of the unsuccessful Bidders will be returned as promptly as possible, after award and signing of the Contract Agreement or expiration of the period of bid validity, whichever is earlier.
- 18.5 The bid security/EMD of the successful Bidder will be returned when the Bidder has signed the Contract Agreement and furnished the required performance security.
- 18.6 The bid security may be forfeited:
- a) if the Bidder withdraws its bid, except as provided in Sub-Clauses 25.1
 - b) if the Bidder does not accept the correction of its bid price, pursuant to Sub-Clause 36.2; or
 - c) if the Bidder is determined, at any time prior to award of contract, to have engaged in corrupt or fraudulent practices as defined under Sub-Clause 45.1 in competing for the contract; or
 - d) in the case of a successful Bidder, if it fails within the specified time limit to
 - (i) sign the Contract Agreement, or
 - (ii) furnish the required performance security.

19 Alternative Proposals by Bidders

- 19.1 Bidders shall submit offers which comply with the requirements of the Bidding Documents, including the terms and conditions of the Bidding Document and the basic Employer's Requirements as indicated in the Bidding Documents in so far as they relate to the design basis, raw and treated water quality parameters.

The attention of the Bidders is drawn to the provisions of Clause 28 regarding the rejection of bids which are not substantially responsive to the requirements of the Bidding Documents.

20 Pre-Bid Meeting

20.1 The Bidder or its official representative is invited to attend the pre-bid meeting as per Bid Data Sheet.

20.2 The purpose of the first pre-bid meeting, which will be held on 27 /11/ 2018 at 12:30 a.m. (IST), unless otherwise rescheduled by SCDCL by way of notification uploaded in Mahatender's website, will be to present the salient features of the Bidding Documents to the Bidders, including the bid submittal requirements, the Conditions of Contract (including payment terms and conditions), and the technical features of the Employer's Requirements.

SCDCL at its discretion may call for additional pre bid meeting, if so needed.

20.3 The Bidder is advised to visit the Site and study the Bidding Document thoroughly, and is requested to submit questions by email so as to reach SCDCL not later than time schedule stated in e-tender notice. It is the Bidder's responsibility to ensure that the questions raised reach the concerned officials within the prescribed time.

20.4 Minutes of the meetings, including the text of the questions raised and the responses given, will uploaded on the Mahatenders e- Tendering Portal. Any modification of the Bidding Documents listed in Sub-Clause 9.1 which may become necessary as a result of the pre-bid meetings shall be made by SCDCL exclusively through the issue of an addendum pursuant to Clause 11 on standard set of deviations.

20.5 Non attendance at the pre-bid meetings will not be a cause for disqualification of a Bidder. Nevertheless, senior representatives of the Bidders are strongly encouraged to participate in the pre-bid meetings to help ensure that they fully understand the key concerns of SCDCL and the Employer's Requirements.

21 Format and Signing of Bid

21.1 The Bidders shall upload on Mahatenders e-tendering portal the documents comprising the bid as described in Clause 13 of this ITB.

21.2 The bid shall be digitally signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation or a confirmation through Mahatenders website as specified in the Bid Data Sheet and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the bid where entries or amendments have been made shall be signed by the person signing the bid.

21.3 In case a Bidder quotes his rates which are equal to or lower than 10% below the estimated cost of the Project, the Bidder shall be required to deposit an additional security deposit in the form of Bank Guarantee equal to 100% of amount which is the difference between his quoted price and the amount equal to the 89 % of the estimated cost. Only then his bid shall be considered for the award of the contract. This additional security deposit has to be submitted after receiving the Letter of Acceptance (defined below) from SCDCL and as a condition precedent for award of the contract.

D. SUBMISSION OF BIDS

22 Uploading of Bids

22.1 The bid shall only be submitted online on the Mahatenders e-tendering portal in “two electronic envelope system” within the prescribed time schedule. Physical bids or any physical copies of documents in connection with the bid shall not be accepted.

22.2 The details of the envelopes are mentioned in Clause 13 of this ITB.

23 Deadline for Submission of Bids

23.1 Bids must be received by SCDCL online not later than the date and time specified in the schedule of the tender. Bidders shall follow the electronic bid submission procedures specified in the detailed e-tender notice. Bidders shall follow and comply with all guidelines with respect to e-tender submissions well in time.

23.2 SCDCL may, at its discretion, extend the deadline for submission of bids by issuing an addendum in accordance with Clause 11, in which case all rights and obligations of SCDCL and the Bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.

24 Late Bids

Late bids will not be accepted.

25 Modification and Withdrawal of Bids

25.1 A Bidder may withdraw, substitute or modify its bid after it has been submitted only in accordance with the e-tendering procedure.

25.2 withdrawal of a bid during the interval between the deadline for submission of bids and the expiration of the period of bid validity specified in Sub-Clause 17.1 may result in the forfeiture of the bid security pursuant to Sub-Clause 18.6.

E. OPENING AND EVALUATION OF TECHNICAL BIDDING FORMS

26 Bid Opening

26.1 The bids (in the e-tender format) shall be opened at the date, time and place as specified in Bid Data Sheet/ Schedule of tender at its own risk.

26.2 Documents in the Envelope A will be verified by the bid opening authority to check their validity as per requirement. If any particular document of any bid is either missing or does not meet the requirements specified, note to that effect will be made by the bid opening authority. SCDCL will carry out scrutiny and analysis of various documents / data submitted in Envelope A to determine if the Bidder meets the eligibility and qualification requirements set forth in Section III. SCDCL reserves the right to seek additional information/clarification/ documents to determine if the Bidder meets the eligibility criteria.

26.3 The technical designs and Technical Bidding Forms submitted in Envelope A will be scrutinized to ensure that the Bidder's proposal conforms to the Employer's Requirements. The Technical Bidding Forms of the Bidder would be subjected to scrutiny to ensure that it meets the requirements of the Designs Criteria /scope of work etc. If it is found that the Technical Bidding Forms fail substantially to meet the provisions in the Bidding Documents, the bid shall be treated as non-responsive and rejected. At the discretion of SCDCL and if required, clarification / additional information may be sought from the Bidder and the Bidder may be requested to modify his Technical Bidding Forms to conform to the requirements of the Bidding Documents without changing the financial offer. The bid shall be treated as non- responsive

and rejected if the Bidder fails to modify his proposal accordingly. SCDCL reserves the right to visit any site claimed by the bidder at the bidder's cost to ascertain the genuineness of the claim of the bidder.

26.4 After the analysis and scrutiny of documents and the evaluation of the Technical Bidding Forms of the Bidders, SCDCL shall declare the outcome of scrutiny and shall open financial bid (Envelope B) of the qualified Bidders on scheduled date. The Envelope B shall be opened only in respect of those Bidders whose Technical Bidding Forms conforms to the Employer's Requirements. The lump-sum offer/ bid price quoted by each qualified Bidder will be made available on website by bid opening authority for information of Bidders

26.5 Opening of Envelope B shall not relieve the Bidder from any of his obligations stipulated in the Bidding Documents. Even at the stage after the financial bids are opened if it is revealed (notwithstanding the scrutiny at the stage covered in 26.4 and 26.5) that that the Technical Bidding Forms of the Bidder(s) fails substantially to meet the provisions in the Bidding Documents, such bids shall be treated as non-responsive and rejected. Wherever required, clarification / additional information may be sought from the Bidder and the Bidder may be requested to modify his Technical Bidding Forms to conform to the requirements of the Bidding Documents without changing the financial offer. The bid shall be treated as non- responsive and rejected if the Bidder fails to modify his proposal accordingly. This will be subject to SCDCL's prior permission and the interest of the Project.

27 Process to be Confidential

27.1 Unless requested by SCDCL, from the time the bids are opened to the time the contract is awarded, the Bidders or their representatives should not contact SCDCL or any other persons involved in the evaluation process on any matter related to their technical or Financial Bidding Forms. Any effort by a Bidder to influence SCDCL's processing of bids or award decisions may result in rejection of the Bidder's bid and forfeiture of the bid security in accordance with the provisions of Sub-clause 18.6.

27.2 Information relating to the examination, clarification, evaluation and comparison of bids and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process.

28 Preliminary Examination of Technical Bidding Forms

28.1 SCDCL will examine the bids to determine whether they are complete, whether the documents have been properly signed, whether the required security is included, and whether the bids are generally in order. Any bids found to be non-responsive for any reason or not meeting the minimum levels of the performance or other criteria specified in the Bidding Documents may be rejected by SCDCL, at its sole discretion, and not included for further consideration. In cases where proposed alternatives are submitted by the Bidders, SCDCL may, at its sole discretion, also carry out a preliminary examination of such alternatives to determine whether these are acceptable or not.

29 Evaluation and Comparison of Technical Bidding Forms

29.1 SCDCL will carry out a detailed evaluation of the bids in order to determine whether the Bidders are qualified and whether the technical aspects are substantially responsive to the requirements set forth in the Bidding Documents. In order to reach such a determination, SCDCL will examine the information supplied by the Bidders and other requirements in the Bidding Documents, taking into account the following factors:

(a) Qualification

- (i) The determination will take into account the Bidder's experience, financial, technical capabilities and past performance which will be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to Sub-Clause 5.1 through 5.5 and Clause 13, as well as such other information as SCDCL deems necessary and appropriate; and
- (ii) An affirmative determination will be a prerequisite for SCDCL to continue with the evaluation of the Technical Bidding Forms; a negative determination will result in rejection of the Bidder's bid.

(b) Technical

- (i) Overall completeness and compliance with the Employer's Requirements including those described in Sub-Clauses 5.2, 5.3 and Clause 13, as well as such other information as SCDCL deems necessary and appropriate; the technical merits of plant and equipment offered and deviations from the Employer's Requirements; suitability of the facilities offered in relation to the environmental and

- climatic conditions prevailing at the site; quality, function and operation of any process control concept included in the bid;
- (ii) Overall understanding of requirements of the contract for successful completion within the stipulated time period;
 - (iii) Demonstration of Bidders' capability for satisfactory construction methodology proper planning of activities, procurement and deployment of necessary resources;
 - (iv) Achievement of specified performance criteria by the facilities;
 - (v) Compliance with the time schedule stated in the e-Tender Notice and any alternative time schedules offered by Bidders, as evidenced by a milestone schedule provided in the Employer's Requirement;
 - (vi) Technical Bidding Forms for operation and maintenance of the facilities;
 - (vii) Type, quantity and long-term availability of spare parts and maintenance services;
 - (viii) Any deviations to the commercial and contractual provisions stipulated in the Bidding Documents.

30 Clarification of Technical Bidding Forms and Contacting SCDCL

30.1 SCDCL may conduct clarification meetings with each or any Bidder to discuss any matters, technical or otherwise, where SCDCL requires clarifications from the bidders with respect to the Technical Bidding Forms. SCDCL may also require each or any Bidder to make a detailed presentation about overall understanding of the requirements of the contract for successful completion within the stipulated time period and demonstration of Bidders' capability for satisfactory construction methodology, proper planning of activities, procurement and deployment of necessary resources. Bidders shall provide an undertaking to abide by any and all clarifications suggested by SCDCL to substantiate the technical information submitted. It is further clarified that all documents and/ or information submitted by the Bidder in response to any clarifications sought by SCDCL with respect to the Technical Bidding Forms shall form a part of the technical submissions by the Bidder to SCDCL and the Bidder shall furnish an undertaking to SCDCL to be bound by such documents and/ or information.

30.2 Not used.

30.3 Not used.

30.4 Any effort by the Bidder to influence SCDCL in SCDCL's evaluation of Technical Bidding Forms, bid comparison or SCDCL's decisions on acceptance or rejection of bids may result in the rejection of the Bidder's bid and forfeiture of the bid security in accordance with the provisions of Sub- clause 18.6.

31 Invitation to Attend Opening of Financial Bidding Forms

31.1 At the end of the evaluation of the Technical Bidding Forms, SCDCL will invite Bidders who have submitted substantially responsive Technical Bidding Forms and who have been determined as being qualified for award to attend the bid opening of the Financial Bidding Forms. Bidders shall be given reasonable notice of the Financial Bidding Form bid opening. The Bidder's shall regularly visit the Mahatenders e-tendering portal and keep itself updated of all notifications and updates provided by SCDCL in relation to the Bidding Documents and the bid.

31.2 SCDCL will notify Bidders that have been rejected on the grounds of being substantially non-responsive to the requirements of the Bidding Documents.

F. OPENING AND EVALUATION OF FINANCIAL BIDDING FORMS

32 Opening of Financial Bidding Forms

32.1 SCDCL will open the Financial Bidding Forms of all Bidders who are declared by SCDCL as qualified with respect to its submission under Envelope B as declared in the Mahatenders e-tendering portal at the time and date at the location advised to the Bidders. The Bidder's representatives who are present shall sign a register/ attendance sheet evidencing their attendance.

32.2 The Bidder's names, the Bid Prices, the total amount of each bid, and such other details as SCDCL may consider appropriate, will be announced and recorded by SCDCL at the opening. The Bidder's representatives will be required to sign this Mahatenders e-tendering portal auto generated report.

32.3 SCDCL shall prepare minutes of the bid opening, including the information disclosed to those present in accordance with Sub-Clause 32.2.

33 Process to be Confidential

33.1 Unless requested by SCDCL, from the time the bids are opened to the time the contract is awarded, the Bidders or their representatives should not contact SCDCL or any other persons involved in the evaluation process on any matter related to their technical or Financial Bidding Forms.

33.2 Information relating to the examination, clarification, evaluation and comparison of bids and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced.

34 Clarification of Financial Bidding Forms and Contacting SCDCL

34.1 To assist in the examination, evaluation and comparison of Financial Bidding Forms, SCDCL may, at its discretion, ask any Bidder for clarification of its bid. The request for clarification and the response shall be in writing, but no change in the price or substance of the bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by SCDCL in the evaluation of the bids in accordance with Clause 36.

34.2 Subject to Sub-clause 34.1, no Bidder shall contact SCDCL on any matter relating to its bid from the time of opening of Financial Bidding Forms to the time the contract is awarded. If the Bidder wishes to bring additional information to the notice of SCDCL, it should do so in writing by email.

34.3 Any effort by the Bidder to influence SCDCL in SCDCL's evaluation of Financial Bidding Forms, bid comparison or contract award decisions may result in the rejection of the Bidder's bid and forfeiture of the bid security in accordance with the provisions of Sub-clause 18.6.

35 Preliminary Examination of Financial Bidding Forms and Determination of Responsiveness

35.1 SCDCL will examine the bids to determine whether they are complete, whether the documents have been properly signed, whether the bids are

substantially responsive to the requirements of the Bidding Documents, and whether the bids provide any clarification and/or substantiation that SCDCL may require pursuant to Clause 34.

35.2 A substantially responsive bid is one which conforms to all the terms, conditions and requirements of the Bidding Documents without material deviation or reservation and includes the amendments and changes, if any, requested by SCDCL during the evaluation of the Bidder's Technical Bidding Forms. Conditional bids will not be accepted.

35.3 **If a Financial Bidding Form is not substantially responsive or not conforming with Technical Bidding Forms submitted by Bidder or technical or financial criteria set by SCDCL, it will be rejected by SCDCL, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.**

36 Correction of Errors

36.1 Financial Bidding Forms determined to be substantially responsive will be checked by SCDCL for any arithmetic errors. Arithmetical errors will be rectified on the following basis:

- (i) Bidders are required to quote the lump sum prices or unit rates in figures only. For unit rate items, if there is a discrepancy between the quoted unit rate and the total price per item that is obtained by multiplying the unit rate and quantity, the unit rate shall prevail and the total price per item will be corrected unless in the opinion of SCDCL there is an obvious misplacement of the decimal point in the unit rate, in which case the total price as quoted will govern and the unit rate will be corrected. For lump sum items, where the quantity is "one", if there is a discrepancy between the quoted unit rate and the total price for the item, then the unit rate will prevail and the total price of the item will be corrected unless in the opinion of SCDCL there is an obvious misplacement in the decimal point of the unit rate, in which case the total price as quoted will govern and the unit rate will be corrected.
- (ii) If there is a discrepancy between the total bid amount and the sum of the total costs, the sum of the total costs shall prevail and the total bid amount will be corrected.

36.2 The amount stated in the Form of Bid for Financial Bidding Form will be adjusted by SCDCL in accordance with the above procedure for the correction of errors and shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount of bid, its bid will be

rejected, and the bid security may be forfeited in accordance with Sub-Clause 18.6 (b).

37 Conversion to a Single Currency

37.1 Not Used.

38 Evaluation and Comparison of Financial Bidding Forms

38.1 SCDCL will evaluate and compare only the bids determined to be substantially responsive in accordance with Clause 35.

38.2 Pursuant to Sub-Clause 38.3, the following evaluation methods will be followed:

(a) **Time Schedule:** The plant and equipment covered by this bid are required to be shipped, installed and the facilities completed within the period specified in the Bidding Document. **Bidders submitting bids which deviate from the time schedule specified will be rejected.**

(b) **Work, services, facilities, etc., to be provided by SCDCL:** Where bids include for the undertaking of work or the provision of services or facilities by SCDCL in excess of the provisions allowed for in the Bidding Documents, SCDCL shall assess the costs of such additional work, services and/or facilities during the duration of the contract. Such costs shall be added to the bid price for evaluation.

Financial offers from different Bidders will be compared in Indian Rupees only.

For the purpose of comparative evaluation of bids received, the total of the following shall be considered.

- (i) The lump sum amount in Indian Rupees quoted by the Bidder in Section 5: Financial Bidding Forms.
- (ii) The Net Present Value (NPV) of the lump sum amount quoted by the Bidder for each year of the operation and maintenance of the system in Section 5: Financial Bidding Forms. NPV shall be calculated by discounting @ /10% per year to the month in which the bids are due for submission. The total value of above items thus obtained in Indian Rupees shall be compared amongst various Bidders to determine the lowest evaluated bid.

- 38.3 (a) Any adjustments in price which result from the above procedures shall be added, for purposes of comparative evaluation only, to arrive at an “Evaluated Bid Price.” Bid prices quoted by Bidders shall remain unaltered except for corrections for arithmetical errors pursuant to Sub- Clauses 36.1 and 36.2.
- (b) SCDCL reserves the right to accept or reject any variation or deviation. Variations, deviations, and other factors which are in excess of the requirements of the Bidding Documents or otherwise result in the accrual of unsolicited benefits to SCDCL shall not be taken into account in bid evaluation.
- (c) The estimated effect of the price adjustment provisions of the Particular Conditions of Contract, applied over the period of execution of the Contract Agreement, shall not be taken into account in bid evaluation.
- (d) If the bid of the successful Bidder is substantially below SCDCL’s estimate for the contract, or if the bid price is found by SCDCL to be severely imbalanced with respect to SCDCL’s estimate and/or to bids submitted by other Bidders through front-end loading of the quoted prices, SCDCL may require the Bidder to produce detailed price analyses to demonstrate the internal consistency of those prices. After evaluation of the price analysis, SCDCL may require that the amount of the performance security set forth in Clause 44 be increased at the expense of the successful Bidder to a level sufficient to protect SCDCL against financial loss in the event of default of the successful Bidder under the Contract Agreement.
- (e) The summation of price Schedule – 1A, (17 items) shall match – [A] in figures and in words with Price Schedule -1.
- (f) The bidder shall mention the same price in figures and in words in the summary of prices.
- (g) The bidder shall mention in price Schedule – 2 the NPV of 5 years in figures and in words and this shall match with the figures and words mentioned in Summary of Prices.
- (h) If any discrepancies are observed, SCDCL reserves the right to ask for clarification / reject the bid / consider the lowest amount mentioned, at the risk and cost of the bidder.

39 Terms of Payment

39.1 SCDCL shall make the payments to the successful Bidder as per the terms specified in **Annexure 2** to this ITB.

G. AWARD OF CONTRACT

40 Award

40.1 Subject to Clause 41, SCDCL will award the Contract to the Bidder whose bid has been determined to be substantially responsive to the Bidding Documents and who has offered the Lowest Evaluated Bid Price, provided that such Bidder has been determined to be (i) eligible in accordance with the provisions of Clause 3; and (ii) qualified in accordance with the provisions of Clause 5 and subject to the approval of competent authority.

41 SCDCL's Right to Accept any Bid and to Reject any or all Bids

41.1 Notwithstanding Clause 40, SCDCL reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids, at any time prior to award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for SCDCL's action.

42 Notification of Award

42.1 Prior to expiration of the period of bid validity prescribed by SCDCL, SCDCL will notify the successful Bidder by email to the authorized signatory of the Bidder, that its bid has been accepted. This letter (hereinafter and in the Conditions of Contract called the "**Letter of Acceptance**") shall name the sum which SCDCL will pay the Contractor in consideration of the execution, completion, operation and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Conditions of Contract called "the **Contract Price**").

42.2 The notification of award and the execution of the Contract Agreement will constitute the formation of the Contract.

42.3 Upon the furnishing of a performance security, the successful Bidder shall form the SPV for the Project. SCDCL will promptly notify the other Bidders that their bids have been unsuccessful.

43 Signing of Contract Agreement and Formation of Special Purpose Vehicle (SPV) for the Project.

43.1 At the same time that he notifies the successful Bidder that its bid has been accepted, SCDCL will send the Bidder the Form of Contract Agreement provided in the Bidding Documents, incorporating all agreements between the parties.

43.2 Within 15 (fifteen) days of receipt of the Letter of Acceptance, the successful Bidder shall form an SPV for the Project. Within 8 (eight) days of receipt of the Form of Agreement, the successful Bidder shall sign the Form of Agreement through the SPV and return it to SCDCL.

43.3 SCDCL reserves the right to reschedule the timelines in the interest of the Project.

44 Performance Security

44.1 Within 28 (twenty eight) days of receipt of the notification of award from SCDCL, the successful Bidder shall furnish to SCDCL a performance security in an amount of two percent (2%) of the Contract Price in accordance with the Conditions of Contract, or in such other amount as SCDCL may determine as being necessary to bring the performance security to a level sufficient to protect SCDCL against financial loss in the event of default of the successful Bidder in accordance with the provisions of Sub-Clause 38.3(d). The form of performance security provided in Section 6 of the Bidding Documents may be used or some other form acceptable to SCDCL.

The performance security shall be denominated solely in Indian Rupees in the amount specified in the Bidding Document, and shall be in the form of an unconditional and irrevocable bank guarantee of Required denominations issued either by a Nationalized Bank located in India. The issuing branch of such bank shall be located in Solapur, Maharashtra, and the bank guarantee shall, if invoked, be encashable when presented in the branch office of such bank located in Solapur. SCDCL reserves the right to allow the adjustment of the performance security guarantee against the EMD of the successful bidder.

44.2 Failure of the successful Bidder to comply with the requirements of Clauses 43 or 44 shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security.

44.3 Not used.

45 Corrupt or Fraudulent Practices

45.1 “Corrupt practice” means behavior on the part of officials in the public or private sectors by which they improperly and unlawfully enrich themselves and/or those close to them, or induce others to do so, by misusing the position in which they are placed, and it includes the offering, giving, receiving or soliciting of anything of value to influence the action of any such official in the procurement process or in contract execution; and

“Fraudulent practice” means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of SCDCL, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive SCDCL of the benefits of free and open competition.

SCDCL in such cases;

- a) Will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;
- b) Will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract if at any time it determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing contract.

45.2 Furthermore, Bidders shall be aware of the provisions stated in Sub-Clause 15.2 (g) of the General Conditions of Contract.

ANNEXURE 2

TERMS OF PAYMENT

SUB-WORK WISE BREAKUP FOR PAYMENT

A) Design and Construction -

1. Detailed breakup for Sub-work 1: Survey, Investigation including Geo-tech Investigation and Design.

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 1
1	Topographical alignment survey & block contour survey	80%
2	Raw Water Analysis	2 %
3	Survey and Geo-tech Investigation	
	a) Intake Works	2 %
	b) BPT	2 %
	c) Pipeline	4 %
4	Pipeline Crossing Railway, NH, SH, MDR, ODR & Other village roads for Pipeline	10%
	Total Percentage -	100 %

2. Detailed breakup for Sub-work 2: Construction of Jackwell with over head Pump house

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 2
1	Earthwork	40 %
2	Coffer dam	4 %
3	Foundation	5 %
4	Columns and Vertical wall	30 %
5	Beams, Slabs and Chajja	8 %
6	General Building Works	11 %
7	Supply, fabrication & Erection of Structural Steel works	2 %
	Total Percentage -	100 %

Note – Due to unavoidable reason if location of Jackwell is changed no extra payment is payable/recoverable.

3. Detailed breakup for Sub-work 3: Construction of Approach Channel

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 3
1	Earthwork	45 %
2	Dewatering	3 %
3	Coffer Dam	33 %
4	UCR for Guide Wall	3 %
5	Disposing of Excavated stuff	16 %
	Total Percentage -	100 %
6	The variation in the length of Approach channel shall be payable/recoverable as per rate per meter derived as follows	
	1. Cost of Approach channel (100 M) = 100 % of cost of Sub work 3	
	2. Rate per m for variation in length of Approach channel = ((quoted price of sub work 3) / 100	

4. Detailed breakup for Sub-work 4: Construction of Approach Bridge (120 M)

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 4
1	Earthwork	4 %
2	Foundation	15 %
3	Columns	3 %
4	Beams and Slabs	55 %
5	General Building Works	23 %
	Total Percentage -	100 %
6	The variation in the length of Approach Bridge and Approach Bund shall be payable / recoverable as per rate per meter derived as follows	
	1 Cost of Approach Bridge = 100 % of cost of Sub work 4	
	2 Rate per m for variation in total length of Approach Bridge = ((quoted price of sub work 4) / 120	

5. Detailed breakup for Sub-work 5: Construction of Approach Bund (120 M)

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 5
1	Earthwork in Embankment	96 %
2	Pointing and Pitching	4 %
	Total Percentage -	100 %
3	The variation in the length of Approach Bund shall be payable / recoverable as per rate per meter derived as follows	
	1 Cost of Approach Bund = 100 % of cost of Sub work 5	
	2 Rate per m for variation in total length of Approach Bund = ((quoted price of sub work 5) / 120	

6. Detailed Breakup for Sub Work 6: Raw Water Pumping Machinery

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 6
1	Mechanical works, pumps valves, flow meter, EOT crane, specials and equipment	46 %
2	Electrical Motors, transformer, 3.3 KV & 33 KV Panels, relay metering panel, Capacitor panel, Works in Sub-Station, Electrification, Cabling etc	47 %
3	Civil works required for Sub Station	7%
	Total Percentage	100 %

7. Detailed Breakup for Sub Work 7: Raw Water Pumping Main from Jackwell to BPT at Warwade

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 7
1	Raw Water Pumping Main (28.5 km)	100 %
	Total	100 %
	Payment for Variation in Length of Pipeline	
2	The variation in the length of pipeline shall be payable / recoverable as per rate per meter derived as follows	
	1 Cost of RWPM (28.5 km) = 100 % of cost of Sub work 7	
	2 Rate per m for variation in length of RWPM = ((quoted price of sub work 7) / 28500	

8. Detailed breakup for Sub-work 8: Construction of Break Pressure Tank (BPT) at Varawade

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 8
1	Break Pressure Tank (BPT) at Varawade	100 %
	Total Percentage -	100 %

Note – Due to unavoidable reason if location of BPT is changed no extra payment is payable/recoverable.

9. Detailed Breakup for Sub Work 9: Raw Water Gravity Main from BPT at Varwade to Soregaon WTP

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 9
1	Raw Water Gravity Main (81.5 km)	100 %
	Total Percentage -	100 %
	Payment for Variation in Length of Pipeline	
2	The variation in the length of pipeline shall be payable / recoverable as per rate per meter derived as follows	
	1 Cost of RWGM (81.5 km) = 100 % of cost of Sub work 9	
	2 Rate per m for variation in length of RWGM = ((quoted price of sub work 9) / 81500	

10. Detailed Breakup for Sub Work 10: Raw Water Gravity Main to Pakni (Tapping the Proposed Gravity Main for Pakni WTP)

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 10
1	Raw Water Gravity Main (0.35 km)	100 %
	Total Percentage -	100 %
	Payment for Variation in Length of Pipeline	
2	The variation in the length of pipeline shall be payable / recoverable as per rate per meter derived as follows	
	1 Cost of RWGM (0.35 km) = 100 % of cost of Sub work 10	
	2 Rate per m for variation in length of RWGM = ((quoted price of sub work 10) / 350	

11. Detailed Breakup for Sub Work 11: Railway Crossings at Modnimb, Mohol and Bale Track (3 Nos.)

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 11
1	Railway Crossings at Modnimb, Mohol and Bale Track 3 Nos. (Length = 130 M)	100 %
	Total Percentage -	100 %
2	Payment for Variation in Railway Crossing Length	
	1 The variation in the length of pipeline shall be payable / recoverable as per rate per meter derived as follows	
	2 Rate per m for variation in length = ((quoted price of sub work 11) / 130	

12. Detailed Breakup for Sub Work 12: Laying of Pipeline along Pune-Solapur National Highway No. 65 and NH Crossings (2 Nos.)

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 12
1	Laying of Pipeline along Pune-Solapur National Highway No. 65 and NH Crossings (2 Nos.) (Length = 120 M)	100 %
	Total Percentage -	100 %
2	Payment for Variation in NH Crossing Length	
	1 The variation in the length of pipeline shall be payable / recoverable as per rate per meter derived as follows	
	2 Rate per m for variation in length = ((quoted price of sub work 12) / 120	

13. Detailed Breakup for Sub Work 13: Laying of Pipeline along various State Highways and SH Crossings (8 Nos.)

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 13
1	Laying of Pipeline along various State Highways and SH Crossings (8 Nos.) (Length = 400 M)	100 %
	Total Percentage -	100 %
2	Payment for Variation in SH Crossing Length	
	1 The variation in the length of pipeline shall be payable / recoverable as per rate per meter derived as follows	
	2 Rate per m for variation in length = ((quoted price of sub work 13) / 400	

14. Detailed Breakup for Sub Work 14: Pipeline crossing MDR, ODR and other Village Roads for Raw Water Rising Main

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 14
1	Pipeline crossing MDR, ODR and other Village Roads for Raw Water Rising Main (Length = 0.48 km)	100 %
	Total Percentage -	100 %
2	Payment for Variation in Length	
	1 The variation in the length of pipeline shall be payable / recoverable as per rate per meter derived as follows	
	2 Rate per m for variation in length = ((quoted price of sub work 14) / 480	

15. Detailed Breakup for Sub Work 15: Pipeline crossing MDR, ODR and other Village Roads for Raw Water Gravity Main

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 15
1	Pipeline crossing MDR, ODR and other Village Roads for Raw Water Gravity Main (Length = 0.46 km)	100 %
	Total Percentage -	100 %
2	Payment for Variation in Length	
	1 The variation in the length of pipeline shall be payable / recoverable as per rate per meter derived as follows	
	2 Rate per m for variation in length = ((quoted price of sub work 15) / 460	

16. Detailed Breakup for Sub Work 16: Canal and Nala Crossings for laying pipeline

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 16
1	Canal and Nala Crossings for laying pipeline (Length = 0.90 km)	100 %
	Total Percentage -	100 %
2	Payment for Variation in Length	
	1 The variation in the length of pipeline shall be payable / recoverable as per rate per meter derived as follows	
	2 Rate per m for variation in length = ((quoted price of sub work 16) / 900	

17. Detailed Breakup for Sub Work 17: Sina River Crossing for laying pipeline

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work No. 17
1	Sina River Crossing for laying pipeline (Length = 0.15 km)	100 %
	Total Percentage -	100 %
2	Payment for Variation in Length	
	1 The variation in the length of pipeline shall be payable / recoverable as per rate per meter derived as follows	
	2 Rate per m for variation in length = ((quoted price of sub work 17) / 150	

SUB-WORK WISE BREAKUP FOR PAYMENT

B) Operation and Maintenance -

Detailed breakup for Sub-work: Operation and Maintenance the scheme for 60 months

Sr. No.	Particular	Percentage to be paid as against price quoted in Sub Work
1	Operation and Maintenance the scheme for 60 months	100 %
	Total Percentage -	100 %
2	Payment	
	1 The payment to contractor during O&M will be on monthly basis as per amount derived as follows	
	2 Amount per month = (quoted price of sub work) / 60	
	3 The monthly payment is on basis of service level performance	
	4 Amount of Maintenance Retention Fund - 10% of O&M cost	

Payment for all above pipeline works shall be as under

- (i) 40 % against delivery at site;
- (ii) 45 % against pipe laying;
- (iv) 10 % against hydraulic testing;
- (v) 5 % against trial run and commissioning.

Payment for all above BPT works shall be as under

On approval of design	2%
Excavation and PCC	2%
On completion of Footing	5%
Staging half height	13%
Staging full height	14%
Bottom slab complete	22%
Vertical wall half height	7%
Vertical wall remaining height	9%
Roof slab	7%
On completion of spiral staircase / M.S ladder	7%
On completion of plastering and finishing	1%
On erection of pipes valves and constructions of chambers	3%
Hydraulic testing	4%
Other Miscellaneous items as per A/T including snowcem, painting water level indicator, lighting Conductor, M.S. ladder and name-plate etc.	4%
Total	100 %

ANNEXURE 3

CHECK LIST FOR THE BIDDER

S.N.	LIST OF DOCUMENTS	REFERENCE NUMBER	BIDDER COMPLIANCE
ENVELOPE A - Tender Fee, Earnest Money Deposit & Technical Bidding Form			
1	Tender Fees for an amount of Rs 5,900/- (Rupees Five Thousand Nine Hundred Only) (non-refundable)	Section 1 : Detailed E-Tender Notice and Guidelines for Submission of E-Tender	
2	Earnest Money Deposit payment: Amount of 1,79,53,000/- (Rupees One crores Seventy Nine Lakh Fifty Three Thousand only) shall be paid in form of Bank Guarantee (BG) from the list of nationalized/scheduled banks as per RBI guidelines	Section 1 : Detailed E-Tender Notice and Guidelines for Submission of E-Tender	

S.N.	LIST OF DOCUMENTS	REFERENCE NUMBER	BIDDER COMPLIANCE
3	Eligibility Criteria Forms	<p>Section 3 Format 1.1 - (Registered Legal Entity) Format 1.2 - (Duration of the Company in Operation) Format 2.1 - (Average Annual Turnover) Format 2.2 - (Net Worth and Working Capital) Format 2.3 - (Bid Capacity) Format 2.4 - (Line of Credit) Format 2.5 - (Blacklist/Debarment) Format 2.6 - (NCLT/CDR) Format 3.1 - (Similar Works) Format 4 - (Physical Criteria)</p> <p>Section 3 Schedule 1 : Joint Bidding Agreement Schedule 2 : Power of Attorney for Lead Member of Consortium Schedule 3 : Power of Attorney for Signing of Proposal Schedule 4 : Statement of Legal Capacity</p>	

S.N.	LIST OF DOCUMENTS	REFERENCE NUMBER	BIDDER COMPLIANCE
4	Technical Bidding Forms	Section 4 : Schedule 1 – Schedule 19	
5	Technical Schedules	Schedule 1 – Schedule 73	
6	Bid Data Sheet	Section 2	
7	Technical proposal and drawing	Employers Requirement and Section 6D	
8	Any other information/data required to be submitted by Bidders in accordance with these ITB		
ENVELOPE B – Financial Bidding Form			
1	Summaries of Prices Schedule	Section 5	
2	Price Schedule 1 – Design and Construction	Section 5	
3	Price Schedule 2 – Operation and Maintenance	Section 5	
4	Details of Sub-works mentioned in Price Schedule 1	Section 5	

SECTION 2

BID DATA SHEET

This section consists of provisions that are specific to each procurement and supplement the information or requirements included in Section 1 - Instructions to Bidders, Section 7 - General Conditions of Contract and Section 8 - Particular Conditions of Contract.

A. Introduction

1. **Employer:** Solapur City Development Corporation Limited
2. **Name of Work:** Augmentation to Solapur City Water Supply Scheme (Ujani Dam as as Source – 110 MLD) on Design, Build, Maintain, Operate and Transfer (DBMOT) basis.

B. Bidding Documents

1. Pre-bid meeting:

Date: 27 / 11 /2018
Time: 12:30 am (IST)
Address: Office of Chief Executive Officer, Solapur City Development Corporation Limited, New Collector Office premises, Near Government Milk Dairy, Saat Rasta, Solapur - 413003

C. Preparation of Bids

1. The language of the bid is: **English**
2. Alternative bids are not permitted. Bids shall be based on the Employer's Requirements and shall be lump sum Bids based on Bidder's designs.
3. The prices quoted by the Bidder shall be adjustable in accordance with the provisions in Sub Clause 13.8 of the General Conditions of Contract (GCC) and the Particular Conditions of Contract.
4. The lump sum price in the bid and rates in Schedules shall be quoted by the bidder entirely in **Indian Rupees (INR)**.
5. The offer/proposal e-tender submitted by the Bidders shall be valid for minimum period of 180 (One hundred and eighty) days from the last date of submission of Bid, i.e. from the date of Tender Closing. The Bid Security shall be for an amount

of Rs. 359,04,28,480/- (Rupees Three Hundred Fifty Nine Crore Four Lakhs Twenty Eight Thousand Four Hundred Eighty Only) and shall be paid through Bank Guarantee (BG) from nationalized bank. Please refer to Clause 17.1 of ITB.

6. The details of SCDCL's Bank for tender fee are given below

Sr. No.	Particulars	Information
1.	Bank Name	Bank of Maharashtra
2.	Branch Name	Solapur Camp
3.	IFS Code	MAHB0000163
4.	Account No.	60255694669

D. Submission and Opening of Bids

1. Bidders shall submit their bids (Envelope A & Envelope B) on Mahatenders e-tendering portal: <https://mahatenders.gov.in>
2. The bid opening shall take place as follows.

Sr. No.	Tender Schedule / Milestone	Bidder Schedule / Milestone	Start Date	End Date
1	Opening Envelope A – Tender Fees, EMD & Technical Bid	–	11 / 12 /2018 – 12:00 am (IST)	
2	Opening Envelope B – Financial Bid	–		To be decided

CONTRACT DATA SHEET:

This Appendix forms part of the Contract.

Sub clause (With Reference to Section - 7 General conditions of Contract of FIDIC 2011 and Section - 8 Particular Conditions of Contract)	Item	Data
1.1.24	Deleted	Deleted
1.1.26	Deleted	Deleted
1.1.32	Employer's name and address: <i>(for the Construction Works Contract Period)</i>	Office of Chief Executive Officer, Solapur City Development Corporation Limited, New Collector Office premises, Near Government Milk Dairy, Saat Rasta, Solapur – 413003
1.1.36	Employer's Representative's name and address <i>(for the O&M Works Contract Period, following issue of the Performance Certificate)</i>	Chief Technical Officer, Solapur City Development Corporation Limited, New Collector Office premises, Near Government Milk Dairy, Saat Rasta, Solapur - 413003 solapurcitydcl@gmail.com

1.1.70	Parts of the Works that shall be designated a Section for the purposes of the Contract:	<p>Part 1: Survey and Investigations</p> <p>Part 2: Intake Works, Raw Water Pumping Station, Raw water Pumping Machinery</p> <p>Part 3: Raw water Pumping Main, BPT, Raw water Gravity Main, Tapping, Crossings</p> <p>Part 4: Trial Run and O & M</p>
1.1.78	Time for Completion of Construction Works including design-build of the Project	30 months (including monsoons)
1.3	Notices and other communications	<p>(1) Work order, agreement and legal notices to be delivered physically through hand delivery and registered post.</p> <p>(2) notices, instructions, general communications - email, and through MIS software.</p>
1.3	Address of Employer for communications:	Office of Chief Executive Officer, Solapur City Development Corporation Limited, New Collector Office premises, Near Government Milk Dairy, Saat Rasta, Solapur - 413003
1.3	Address of Employer's Representative for communications:	Chief Technical Officer, Solapur City Development Corporation Limited, New Collector Office premises, Near Government Milk Dairy, Saat Rasta, Solapur - 413003 solapurcitydcl@gmail.com
1.3	Address of Contractor for communications:	(To be completed by the Bidder before the Bid is submitted)

1.4	Contract shall be governed by the law of:	India
1.4	Ruling language:	English
1.4	Language for communications:	English / Marathi
2.1	From the date of receipt of the Letter of Award by the Bidder, the Bidder shall be given right of access to all or part of the Site within:	Three hundred and sixty (360) Days
4.2	Performance Security (as percentages of the Contract Amount in Currencies):	
	Percent:	2 %
	Currency:	Indian Rupees
4.2	Reduction in Performance Security at the end of the Retention Period:	Only 90% amount of the security deposit shall be refunded along with the payment of the final bill. The amount of security deposit retained by SCDCL shall be released after expiry of defect liability period.
	Time for Submission of Performance Security	The Contractor shall submit to the Employer the Performance Security within twenty eight (28) days from the date of receipt of the Letter of Acceptance
5.1	Period for notification of errors, faults and other defects is:	Forty Five (45) days
	Time for Submission of Construction Program	The Contractor shall submit the construction program to the Employer's Representative within fourteen (14) days of signing the Agreement. The construction program will be subject to the approval of the Employer's Representative, and shall form a part of the Agreement.

5.2	Contractor's Documents requiring approval from SCDCL / Competent Authority:	<ul style="list-style-type: none"> • Surveys and Investigations Reports • Work methodology • All design basis reports • All detailed design documents with appropriate software • Civil Guide Drawings • General Arrangement Drawing • All Good for construction drawings • Procurement plan • QA/QC manual • Work schedules • Environment Management Plan • Safety manual • Purchase and hiring agreements • As Built Drawings • O & M Manual for the Plant and Equipment • Management contract including service level Bench mark • Resources allocated Project Construction schedule • Memorandum of association and articles of association of Special Purpose Vehicle (SPV) • Financial papers of SPV • All subcontracting proposals • Suppliers and vendors • Any other item as may be specified by SCDCL
6.5	Normal working hours on the Site:	7 am to 7 pm or as approved by SCDCL
8.2	Period of the Operation Service	Five (5) years from date of final commissioning of the Project.
9.2	Time for Completion of Design-Build:	Thirty (30) months

9.2	Time for Completion of each Part of work:	
	<p>Part: 1 - Survey and Investigations</p> <p>Time for Completion of Part 1:</p>	<p>Topographical surveys and geotechnical investigations and other relevant investigations for the Project as envisaged by the SCDCL and submission of the aforesaid reports with SCDCL.</p> <p>3 months from the date of issuance of work order</p>
	<p>Part: 2</p> <p>Head Works, Raw Water Pumping Station, Raw water Pumping Machinery.</p> <p>Time for Completion of Part 2:</p>	<p>1. Design, engineering and construction of Head works (Jackwell, Overhead Pump House, Approach Channel, Approach Bridge) and raw water pumping station for lifting of about 300 million litres per day (MLD) raw water from the backwaters of Ujani Dam, situated about 100 km from Solapur City.</p> <p>2. Design, engineering and construction of the raw water Pumping machinery for 110 MLD.</p> <p>15 months from the date of issuance of work order</p>

	<p>Part: 3 Raw water pumping main, Break Pressure Tank (BPT), Raw water Gravity main, Tappings, Crossings.</p>	<p>1. Design, engineering and construction of the raw water pumping main from the Head works up to the proposed Break Pressure Tank at Varawade on Pune-Solapur National Highway No. 65. 2. Design engineering and construction of break pressure tank (BPT) at Varawade Toll Plaza located about 28.50 Km from Head works. 3. Design, engineering and construction of the raw water gravity main from BPT to Soregaon WTP, located at about 81.50 km from the BPT. 4.Provision of tapping to Pakni WTP and Soregaon WTP on Raw Water Gravity Main 5.Provision of tapping to Aherwadi WTP on Raw Water Gravity Main at Soregaon 6. Design, engineering, permission and construction of all (en-route) crossing of railway, National/State Highway, MDR/ODR, river, nala and canal crossings.</p>
	Time for Completion of Part 3:	27 Months from the date of issuance of work order
	Part : 4 Miscellaneous works	<p>1. Commissioning of the Scheme and Trial run for 3 months 2. Operate and maintain the scheme for Five years.</p>
9.6	Delay damages (percent of final Contract Price per day of delay)	0.06%
9.6	Maximum amount of delay damages (percent of final Contract Price):	10%
10.6 a	Maximum compensation payable by Contractor to SCDCL / Any other agency:	10%

10.6 b	Maximum compensation payable by SCDCL:	Nil
10.7	Performance damages	Employer's Requirement under Section 6A.4
10.7	Rights of Employer if failure continues for more than 84 days:	Employer's Requirement under Section 6A.4.
10.7	Minimum production outputs required	As per Part II Section 6 Employers Requirements of Service Level benchmarks
13.5	Percentage rate to be applied to Provisional Sums	10 %
14.1	Contract Price and Payment	The Contractor shall possess minimum financial capacity to carry out and pay for the sub-Works in accordance with the sub-work wise detailed breakup for payment for payment as set out in Annexure 2 to this Contract Data Sheet.
14.2	Amount of Mobilization amount payment	Not applicable
14.2	Currencies of payment if different to the currencies quoted in the Contract	Not applicable
14.3	Percentage of Retention	10% (ten percent) of the amount of all Interim Payment Certificates for the Works Contract portion of the Contract, excluding any Provisional Sums. Retention money will not be retained from payments to be made under the Operations and Maintenance portion of the Contract.

14.6(b)(i)	Plant and Materials for payment when shipped:	Not applicable
14.6(c)(i)	Plant and Materials for payment when delivered to the Site:	As per Payment Schedule
14.7(b)	Minimum Amount of Interim Payment Certificate:	50% subject to verification of certificate by project management consultants engaged by SCDCL.
14.9	Financing charges for delayed payment (percent points above discount rate of RBI):	Nil
14.17	Currencies for payment of Contract Price:	Indian Rupees
14.17	Proportions of Local and Foreign Currencies are:	
	Local	100%
	Foreign	Not applicable
14.17	Rate of Exchange	Not applicable
14.17	Payment of damages shall be:	
	Local - Currency	Indian Rupees
	Proportion	100%
	Foreign - Currency	Not applicable
	Proportion	Not applicable
14.19	Amount of Maintenance Retention Fund	10% of the operation and maintenance cost
17.1	Operation of forces of nature allocated to the Contractor:	(1) Earthquake resistance for seismic Zone IV (2) Flooding as per Rainfall intensity prescribed in CPHEEO Manual
17.8	Total liability of the Contractor shall not exceed	10% of the Contract price

19.2(a)(i)	Permitted deductible limits	Actual premium as prescribed in the contractor's all risks insurance policy and workmen's compensation insurance policy shall be with the Government of Maharashtra insurance fund only If contractor fails to take necessary insurance policy, 1% of contract value will be deductible from the bills payable to contractor.
19.2(a)(ii)	Additional sum to be insured	15%
19.2(a)4	Additional sum to be insured	10 %
19.2(a)5.	Employer's Risks to be insured if different to Sub-Clause 17.1:	5 %
19.2(b)	Exceptional Risks to be insured if different to Sub-Clause 18.1	5 %
19.2(c)	Insurance of Contractor's Equipment (amount required)	10%
19.2(c)	Amount of professional liability insurance required	5%
19.2(d)	Period for which professional liability insurance required	Forty Two (42) months; or twelve (12) months after completion of Project, whichever is later
19.2(f)	Amount of insurance required for injury to persons and damage to property	5%
19.3(a)	Other insurances required from the Contractor (give details):	As per applicable law of land

19.3(d)	Amount of fire extended cover insurance required	5%
19.3(e).	Other insurances required by law from the Contractor (give details)	As per applicable law of land
20.3	Other optional insurances required from the Contractor (give details)	As per applicable law of land
20.8	Language of arbitration	English
	Arbitration	During the course of work if the dispute arises between the contractor and the Employer then it shall be referred to the sole Arbitration of the Chief Executive Officer, SCDCL, Solapur. His decision shall be final and binding. Even if the contractor resorts to approach in the court of law then in order that the work shall proceed, the Employer has full right to hire another contractor to get the work done, and this process shall be applicable for whatever new contractors are employed

SECTION 3

QUALIFICATION AND EVALUATION OF THE BIDDER

1. The eligibility criteria for the bidders shall be as per the prescribed criteria in **Annexure 1** to this Section 3.
2. Bidders not meeting the Technical and Financial Capacity shall be disqualified and their Technical as well as Financial Proposals shall be returned and the Bid Security of the Bidder shall be returned.
3. In case a Bidder is a Consortium, then the term Bidder shall include each Member of such Consortium.
4. The Bidders shall enclose with its Proposal, the documents that are specified in **Annexure 1** below.
5. Except as provided under the Bidding Documents, there shall not be any amendment to the Jt. Bidding Agreement without the prior written consent of SCDCL.
6. The bidders should not be blacklisted by Central/State Government in India for unsatisfactory past performance, corrupt, fraudulent or any other unethical business practices, in past 3 (three) years.

A Bidder including any Consortium Member should, in the last 3 (three) years, have neither failed to perform on any contract, as evidenced by imposition of a penalty by an arbitral or judicial authority or a judicial pronouncement or arbitration award against the Bidder, Consortium Member, as the case may be, nor has been expelled from any project or contract by any public entity nor have had any contract terminated by any public entity for breach by such Bidder, Consortium Member.

Evaluation parameters

- 3.1 The bidders shall follow the instructions on the Mahatenders e-tendering portal for submission of e-tender. Proposals will be submitted online on Mahatenders e-tendering Portal in two separate electronic envelopes, marked as “Envelope A” (Tender Fee, EMD, Technical Bidding Forms) & “Envelope B” (Financial Bidding Forms).
- 3.2 SCDCL will open the Financial Bidding Forms of all Bidders who are declared by SCDCL as qualified in Envelope A at the time and date at the location advised to the Bidders as per the Mahatenders e-tendering portal.

- 3.3 Experience for any activity relating to an earlier Project for claiming and/ or evidencing eligibility (“**Eligible Project**”) shall not be claimed by 2 (two) or more members of the same consortium. In other words, no double counting by a consortium in respect of the same experience shall be permitted in any manner whatsoever.
- 3.4 In addition to the documents submitted by the Bidders, the Bidders shall submit the certificate(s) from its statutory auditors or the concerned client(s) stating the experience of the Bidders in having undertaken and implemented projects of a similar nature as mentioned in the Eligibility Criteria as mentioned in Annexure 1 of this Section. In case a particular job/contract has been jointly executed by the Bidder (as a part of a consortium), he should further support his claim for the share in the work done for that particular job/contract by producing a certificate from its statutory auditor or the client.
- 3.5 The Bidder should furnish the required Project-specific information and evidence in support of its claim of Technical Capacity to the satisfaction of SCDCL. The evidence to be submitted for experience shall include either of the following.
- a. Certificate from the Government Instrumentality for which the project has been developed clearly setting out the nature of project, capacity, location, date of commissioning and if the progress of the project was satisfactory;
 - or
 - b. Certificate from the urban local body for which the project has been developed clearly setting out the nature of project, capacity, location, date of commissioning and if the progress of the project was satisfactory;
 - or
 - c. Certificate from an appropriate statutory authority clearly setting out the nature of project, capacity, location, date of commissioning and if the progress of the project was satisfactory;
- 3.6 The Authority shall form a Bid Evaluation Committee for the evaluation of the bids (the “**Evaluation Committee**”).
- 3.7 The Schedules as annexed in Section 3 shall form the same part of the Technical Bidding Form Section 4(1).

ANNEXURE 1 - ELIGIBILITY CRITERIA

The bidder shall be evaluated based on the Eligibility Criteria mentioned below. The bidder shall submit all the documents as mentioned below as per the formats mentioned in the tender along with all supporting documents:

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements			Documentation	
			Single Entity	Consortium (Existing or Intended) (one lead member + 2 other members)			
	Factor	Requirement		All Members Combined	Other Members	Lead Member	Submission Requirement
1. Eligibility							
1.1	Registered Legal Entity.	The Single Entity/ Lead member and Consortium partners (if any) must be a registered contractor for unlimited/equivalent class from any Government Agency in India.	Must meet requirement	N/A	Must meet requirement	Must meet requirement	Certificate of Registration from concerned organization. (Format 1.1)

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement			All Members Combined	Other Members	Lead Member
1. Eligibility							
1.2	Duration of Company in operation.	Operation for a period of at least 5 years, prior to the last date of submission of bid.	Must meet requirement	N/A	Must meet requirement	Must meet requirement	For Companies incorporated in India, Certificate of Incorporation/Registration under Companies Act, 1956/2013 or partnership firm registered under the Partnership Act. Memorandum and Articles of Association. (Format 1.2)

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member+ other members)			
	Factor	Requirement			All Members Combined	Other Members	Lead Member
2. Financial Criteria							
2.1	Average Annual Turnover	Average annual turnover for last Five financial years. (2013-14, 2014-15, 2015-16, 2016-17, 2017-18)	INR 108 Cr.	INR 108 Cr.	INR 22 Cr.	INR 65 Cr.	Audited Financial Statement for Financial years (2013-14, 2014-15, 2015-16, 2016-17, 2017-18) Statutory auditor's certificate OR certificate from Company Secretary of the bidder clearly specifying the annual turnover for the specified years. (Format 2.1)
2.2	Net Worth & Working Capital	i) The Bidders net worth should be positive for last five consecutive years. ii) The Net Working Capital should be positive. iii) The bidder shall not have Financial Sickness	Must meet requirement	N/A	Must meet requirement	Must meet requirement	Audited Financial Statement for Financial years (2013-14, 2014-15, 2015-16, 2016-17, 2017-18) Statutory auditor's certificate OR certificate from Company Secretary of the bidder clearly specifying the annual turnover for the specified years. (Format 2.2)

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement			All Members Combined	Other Members	Lead Member
2. Financial Criteria							
2.3	Bid Capacity	<p>The bidder's bid capacity shall not be less than: - The Formulation of Bid capacity is as follows. Working Bid Capacity = $(A \times N \times 2) - B$ A = average annual construction turnover of the bidder for last three financial years. N = Number of years prescribed for construction of work for which bids have been invited. B = Value of existing commitments and ongoing works to be completed (for all the clients of the bidder) during the period of completion of work for which bids have been invited.</p>	INR 240 Cr.	INR 240 Cr.	INR 48 Cr.	INR 144 Cr.	<p>Audited Financial Statement for Financial years (2013-14, 2014-15, 2015-16, 2016-17, 2017-18) Statutory auditor's certificate OR certificate from Company Secretary of the bidder clearly specifying the annual turnover for the specified years. (Format 2.3)</p>

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement		All Members Combined	Other Members	Lead Member	Submission Requirement
2. Financial Criteria							
2.4	Line of Credit.	The bidder shall have line of credit from nationalized or a schedule bank.	INR 45 Cr.	INR 45 Cr.	INR 9 Cr.	INR 27 Cr.	Audited Financial Statement for Financial years (2013-14, 2014-15, 2015-16, 2016-17, 2017-18) Statutory auditor's certificate OR certificate from Company Secretary of the bidder clearly specifying the annual turnover for the specified years. (Format 2.4)
2.5	Blacklisting/Debarment	As on date of submission of the proposal, the bidder should not be blacklisted/debarred by Central/State Government or similar agencies globally for unsatisfactory past performance, corrupt, fraudulent or any other unethical business practices, in past Three (3) years.	Must meet requirement	N/A	Must meet requirement	Must meet requirement	Undertaking by the authorized signatory of the Bid. (Format 2.5)

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement			All Members Combined	Other Members	Lead Member
2. Financial Criteria							
2.6	National Company Law Tribunal (NCLT) and CDR	i) As on date of submission of the proposal, the bidder who have applied for Corporate Debt Restructure (CDR) or ii) facing any litigations regarding recovery from any financial institution or approached NCLT or NCLAT in past Three (3) years shall be ineligible to bid	Must meet requirement	N/A	Must meet requirement	Must meet requirement	Undertaking by the authorized signatory of the Bid.
3. Experience of Similar Works (Format 3)							
3.1	Similar Work	Experience of having successfully completed similar works of Design, Execution, Commissioning and Testing of water supply scheme during the last 7 years ending date of invitation. Similar works means-Any Single Water Supply Scheme executed in one or more packages with similar essential components of intake in the submergence of dam/pumping station and pipeline.	Three works each of INR 144 Cr. OR Two works each of INR 180 Cr. OR Single work of INR 251 Cr.	Three works each of INR 144 Cr. OR Two works each of INR 180 Cr. OR Single work of INR 251 Cr.			Work order and Completion Certificate from Client not below the rank of Executive Engineer/ Chief Officer/ City Engineer and equivalent rank, highlighting the parameters specified in the Criteria.

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements			Documentation	
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement		All Members Combined	Other Members	Lead Member	Submission Requirement
4. Physical Criteria (Format 4)							
4.1	Head Works	Contractor should have constructed and commissioned at least one Head Work on the bank of major river or in submergence of dam including construction of Jack well with pump house and approach channel / Slotted pipe gallery / intake well and connecting pipe Under single contract.	Single work of 150 MLD	Single work of 150 MLD			Work order and Completion Certificate from Client not below the rank of Executive Engineer/ Chief Officer/ City Engineer and equivalent rank, highlighting the parameters specified in the Criteria.
4.2	RCC approach bridge	Contractor should have experience of Designing, constructing and satisfactory completion of RCC approach bridge of minimum width 2.50 m and minimum length 60 m in single contract.	Single work of 60 M	Single work of 60 M			

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements				Documentation
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement		All Members Combined	Other Members	Lead Member	Submission Requirement
4. Physical Criteria (Format 4)							
4.3	MS Pipeline	Contractor should have experience of Providing, lowering, laying, jointing and satisfactory hydraulic testing and commissioning of MS pipe line work of minimum 660 mm diameter OD Under single contract.	Single work of 27.50 Km.	Single work of 27.50 Km.			Work order and Completion Certificate from Client not below the rank of Executive Engineer/ Chief Officer/ City Engineer and equivalent rank, highlighting the parameters specified in the Criteria.
4.4	BPT	Contractor should have experience of Designing, constructing, hydraulically testing and satisfactory commissioning of RCC ESR/GSR/BPT/Sump of minimum 2.5 Lakh Lit. capacity in single contract.	Single work of 2.5 Lakh Lit. capacity	Single work of 2.5 Lakh Lit. capacity			

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements			Documentation	
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement			All Members Combined	Other Members	Lead Member
4. Physical Criteria (Format 4)							
4.5	Raw Water Pumping Machinery	Contractor shall have experience of successful and satisfactory completion and commissioning of the works listed below with any Government Department / Organization/ Local Body. 1.Total Installed Capacity – 3.3 kV pumps -2175 HP 2. Individual Capacity 3.3 kV pumps – 375 HP	Work of Vertical Turbine Pumping Machinery <u>under single contract.</u> 1. Total Installed Capacity – 3.3 kV pumps - 2175 HP 2. Individual Capacity 3.3 kV pumps – 375 HP 3. Transformer & substation. Capacity – 1500 kVA, 33/3.3 kV	Work of Vertical Turbine Pumping Machinery <u>under single contract.</u> 1. Total Installed Capacity – 3.3 kV pumps - 2175 HP 2. Individual Capacity 3.3 kV pumps – 375 HP 3. Transformer & substation. Capacity – 1500 kVA, 33/3.3 kV			Work order and Completion Certificate from Client not below the rank of Executive Engineer/ Chief Officer/ City Engineer and equivalent rank, highlighting the parameters specified in the Criteria.

S. N.	Eligibility and Qualification Criteria		Minimum Compliance Requirements			Documentation	
			Single Entity	Consortium (Existing or Intended) (one lead member + other members)			
	Factor	Requirement			All Members Combined	Other Members	Lead Member
4. Physical Criteria (Format 4)							
4.6	Operation & Maintenance (Minimum experience: 2 Years)	The Bidder shall have completed successfully and satisfactorily, Operation & Maintenance of water supply scheme (With Head works, MS Pipe line, High Tension Pumping Machinery) for minimum 2 consecutive years in the last 10 years.	Single work of at least 55 MLD	Single work of at least 55 MLD			Work order and Completion Certificate from Client not below the rank of Executive Engineer/ Chief Officer/ City Engineer and equivalent rank, highlighting the parameters specified in the Criteria.

NOTE TO BIDDERS

The bidders to use these factors for the purpose of evaluation of the completed works in the past and bringing those to the current price level for the above criteria.

2017-18	1.00
2016-17	1.10
2015-16	1.21
2014-15	1.33
2013-14	1.46
2012-13	1.61
2011-12	1.77
2010-11	1.95
2009-10	2.14
2008-09	2.36
2007-08	2.59

(Format 1.1)

<<To be printed on the Company/Lead bidder letter head >>

No.

Date:

To,
Chief Executive Officer,
Solapur City Development Corporation Limited,
New Collector Office premises,
Near Government Milk Dairy,
Saat Rasta, Solapur – 413003
Email - solapurcitydcl@gmail.com

Subject - RFP for Selection of Bidder for Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Built, Maintain, Operate and Transfer (DBMOT) basis.

Ref - RFP No: __Dated _____

We hereby confirm that our company/lead member/any member is a registered legal entity and meets the prescribed requirement as per Clause 1.1 (Registered legal entity) of the Eligibility and Qualification Criteria.

Sr. No.	Eligibility Criteria								Reference Page No.
	Single Entity		Lead Member		First Member		Second Member		
	Name of Organisation	Class of Registration	Name of Organisation	Class of Registration	Name of Organisation	Class of Registration	Name of Organisation	Class of Registration	
1	2	3	4	5	6	7	8	9	10
1									
2									
3									
4									
5									

Sincerely,

(Signature of the Authorised signatory of the Bidder)

Name:

Designation:

Seal:

Date:

Place:

Business Address:

Signature of CA Name:

Name:

CA Registration Number:

(Format 1.2)

<<To be printed on the Company/Lead bidder letter head >>

No.

Date:

To,
Chief Executive Officer,
Solapur City Development Corporation Limited,
New Collector Office premises,
Near Government Milk Dairy,
Saat Rasta, Solapur – 413003
Email - solapurcitydcl@gmail.com

Subject - RFP for Selection of Bidder for Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Built, Maintain, Operate and Transfer (DBMOT) basis.

Ref - RFP No: __Dated _____

We here by confirm that our company/lead member/any member has met the prescribed requirement as per Clause1.2 (Duration of the Company in operation) of the Eligibility and Qualification Criteria.

Sr.No	Eligibility Criteria				Reference Page No.
	Single Entity	Lead Member	First Member	Second Member	
	No. Of Years of Company in Operation	No. Of Years of Company in Operation	No. Of Years of Company in Operation	No. Of Years of Company in Operation	
1	2	3	4	5	6
1					
2					
3					
4					
5					

Sincerely,

(Signature of the Authorised signatory of the Bidder)

Name:

Designation:

Seal:

Date:

Place:

Business Address:

Signature of CA Name:

Name:

CA Registration Number:

(Format 2.1)

<<To be printed on the Company/Lead bidder letter head >>

No.

Date:

To,
Chief Executive Officer,
Solapur City Development Corporation Limited,
New Collector Office premises,
Near Government Milk Dairy,
Saat Rasta, Solapur – 413003
Email - solapurcitydcl@gmail.com

Subject - RFP for Selection of Bidder for Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Built, Maintain, Operate and Transfer (DBMOT) basis.

Ref - RFP No: __Dated _____

We hereby confirm that our company/lead member/any member has met the prescribed requirement as per Clause 2.1 (Average Annual Turnover) of the Eligibility and Qualification Criteria.

Sr. No.	Financial Years	Multiplying Factor	Annual Turnover in Rs. Crore.								Reference Page No.	
			Single Entity / Lead Member		First Member		Second Member		All Members Combined			
			Amount of that year	NPV	Amount of that year	NPV	Amount of that year	NPV	Amount of that year	NPV		
1	2	3	4	5	6	7	8	9	10	11	12	
1	2017-18	1.10										
2	2016-17	1.21										
3	2015-16	1.33										
4	2014-15	1.46										
5	2013-14	1.61										
	Average											

Sincerely,

(Signature of the Authorised signatory of the Bidder)

Name:

Designation:

Seal:

Date:

Place:

Business Address:

Signature of CA Name:

Name:

CA Registration Number:

(Format 2.2)

<<To be printed on the Company/Lead bidder letter head >>

No.

Date:

To,
Chief Executive Officer,
Solapur City Development Corporation Limited,
New Collector Office premises,
Near Government Milk Dairy,
Saat Rasta, Solapur – 413003
Email - solapurcitydcl@gmail.com

Subject - RFP for Selection of Bidder for Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Built, Maintain, Operate and Transfer (DBMOT) basis.

Ref - RFP No: __Dated _____

We hereby confirm that our company/lead member/any member has met the prescribed requirement as per Clause 2.2 (Net Worth and Working Capital) of the Eligibility and Qualification Criteria.

Sr. No.	Financial Years	Multiplying Factor	Net Worth in Rs. Crore.								Reference Page No.	
			Single Entity		Lead Member		First Member		Second Member			
			Amount of that year	NPV	Amount of that year	NPV	Amount of that year	NPV	Amount of that year	NPV		
1	2	3	4	5	6	7	8	9	10	11	12	
1	2017-18	1.10										
2	2016-17	1.21										
3	2015-16	1.33										
4	2014-15	1.46										
5	2013-14	1.61										
Total												

Sincerely,

(Signature of the Authorised signatory of the Bidder)

Name:

Designation:

Seal:

Date:

Place:

Business Address:

Signature of CA Name:

Name:

CA Registration Number:

(Format 2.3)

<<To be printed on the Company/Lead bidder letter head >>

No.

Date:

To,
Chief Executive Officer,
Solapur City Development Corporation Limited,
New Collector Office premises,
Near Government Milk Dairy,
Saat Rasta, Solapur – 413003
Email - solapurcitydcl@gmail.com

Subject - RFP for Selection of Bidder for Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Built, Maintain, Operate and Transfer (DBMOT) basis.

Ref - RFP No: __Dated _____

We hereby confirm that our company/lead member/any member has met the prescribed requirement as per Clause 2.3 (Bid Capacity) of the Eligibility and Qualification Criteria.

Sr. No.	Particular	Financial Years	Multiplying Factor	Rs. Crore.								Reference Page No.	
				Single Entity / Lead Member		First Member		Second Member		All Members Combined			
				Amount of Respective year	NPV	Amount of Respective year	NPV	Amount of Respective year	NPV	Amount of Respective year	NPV		
1	2	3	4	5	6	7	8	9	10	11	12	13	
1	Annual Turnover	2017-18	1.10										
		2016-17	1.21										
		2015-16	1.33										
		Average (A)											
2	Existing Commitment	2018-19											
		2019-20											
		2020-21											
		Average (B)											
3	Bid Capacity	{(A) X 2.5 X 2} – (B)											

Sincerely,

(Signature of the Authorised signatory of the Bidder)

Name:

Designation:

Seal:

Date:

Place:

Business Address:

Signature of CA Name:

Name:

CA Registration Number:

(Format 2.4)

<<To be printed on the Company/Lead bidder letter head >>

No.

Date:

To,
Chief Executive Officer,
Solapur City Development Corporation Limited,
New Collector Office premises,
Near Government Milk Dairy,
Saat Rasta, Solapur – 413003
Email - solapurcitydcl@gmail.com

Subject - RFP for Selection of Bidder for Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Built, Maintain, Operate and Transfer (DBMOT) basis.

Ref - RFP No: __Dated _____

We hereby confirm that our company/lead member/any member has met the prescribed requirement as per Clause 2.4 (Line of Credit) of the Eligibility and Qualification Criteria.

Sr. No.	Financial Years	Multiplying Factor	Line of Credit in Rs. Crore.								Reference Page No.	
			Single Entity / Lead Member		First Member		Second Member		All Members Combined			
			Amount of that year	NPV	Amount of that year	NPV	Amount of that year	NPV	Amount of that year	NPV		
1	2	3	4	5	6	7	8	9	10	11	12	
1	2017-18	1.10										
2	2016-17	1.21										
3	2015-16	1.33										
4	2014-15	1.46										
5	2013-14	1.61										
	Total											

Sincerely,

(Signature of the Authorised signatory of the Bidder)

Name:

Designation:

Seal:

Date:

Place:

Business Address:

Signature of CA Name:

Name:

CA Registration Number:

(Format 2.5)

<<To be printed on the Company/Lead bidder letter head >>

No.

Date:

To,
Chief Executive Officer,
Solapur City Development Corporation Limited,
New Collector Office premises, Near Government Milk Dairy,
Saat Rasta, Solapur – 413003
Email - solapurcitydcl@gmail.com

Subject - RFP for Selection of Bidder for Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Built, Maintain, Operate and Transfer (DBMOT) basis.

Ref - RFP No: __Dated ____

We confirm that our company / any member of our consortium as on the date of submission of the proposal for selection of Bidder for Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Built, Maintain, Operate and Transfer (DBMOT) basis has not black-listed in the past 3 (three) years by Central/State Government/PSU entity in India for unsatisfactory past performance, corrupt, fraudulent or any other unethical business practices.

Sincerely,
(Signature of the Authorised signatory of the Bidder)

Name:

Designation:

Seal:

Date:

Place:

Business Address:

Signature of CA Name:

Name:

CA Registration Number:

(Format 2.6)

<<To be printed on the Company/Lead bidder letter head >>

No.

Date:

To,
Chief Executive Officer,
Solapur City Development Corporation Limited,
New Collector Office premises, Near Government Milk Dairy,
Saat Rasta, Solapur – 413003
Email - solapurcitydcl@gmail.com

Subject - RFP for Selection of Bidder for Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Built, Maintain, Operate and Transfer (DBMOT) basis.

Ref - RFP No: __Dated _____

It is hereby certified that our company / any member of our consortium has not applied for Corporate Debt Restructure (CDR) or faced any litigation regarding recovery from any financial institution or NCLT/NCLAT at any time in the past 3 (three) years.

Sincerely,
(Signature of the Authorised signatory of the Bidder)

Name:

Designation:

Seal:

Date:

Place:

Business Address:

Signature of CA Name:

Name:

CA Registration Number:

(Format 3)

<<To be printed on the Company/Lead bidder letter head >>

No.

Date:

To,
Chief Executive Officer,
Solapur City Development Corporation Limited,
New Collector Office premises,
Near Government Milk Dairy,
Saat Rasta, Solapur – 413003
Email - solapurcitydcl@gmail.com

Subject - RFP for Selection of Bidder for Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Built, Maintain, Operate and Transfer (DBMOT) basis.

Ref - RFP No: __Dated _____

We hereby confirm that our company/Lead member/any member has met the prescribed requirement as per Clause 3.1 (Similar Works) of the Eligibility and Qualification Criteria.

Sr. No.	Name of Similar Work	Financial Years	Cost of Work	Factor	NPV	Reference Page No
1						
2						
3						
		Total				

Sincerely,

(Signature of the Authorised signatory of the Bidder)

Name:

Designation:

Seal:

Date:

Place:

Business Address:

Signature of CA Name:

Name:

CA Registration Number:

(Format 4)

<<To be printed on the Company/Lead bidder letter head >>

No.

Date:

To,
Chief Executive Officer,
Solapur City Development Corporation Limited,
New Collector Office premises,
Near Government Milk Dairy,
Saat Rasta, Solapur – 413003
Email - solapurcitydcl@gmail.com

Subject - RFP for Selection of Bidder for Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Built, Maintain, Operate and Transfer (DBMOT) basis.

Ref - RFP No: __Dated _____

We hereby confirm that our company/Lead member/any member has met the prescribed requirement as per Clause 4 (Physical Criteria) of the Eligibility and Qualification Criteria.

Sr. No.	Particular	No of Work	Unit	Quantity		Reference Page No
				Single Entity	All Members Combined (in case of a Consortium)	
1	2	3	4	5	6	7
1	Head works	1	MLD			
2	RCC Approach Bridge	1	m			
3	MS Pipeline	1	Km			
4	BPT	1	Lit			
5	Raw Water Pumping Machinery	1	kV/HP			
6	Operation and Maintenance	1	MLD			

Sincerely,
 (Signature of the Authorised signatory of the Bidder)
 Name:
 Designation:
 Seal:

Signature of CA Name:
 Name:
 CA Registration Number:

Augmentation to Solapur City Water Supply Project (Ujani Dam as a source – 110 MLD) on Design, Build, Maintain, Operate and Transfer (DBMOT) Basis

Date:

Place:

Business Address:

In the event the parties enter into a Consortium, the parties are required to enter into a Joint Bidding Agreement and other certificates to be submitted on SCDCL's e-tender portal. The following forms are required given below:

Schedule 1 of Section 3: Joint Bidding Agreement

JOINT BIDDING AGREEMENT

In case the Bidder is a consortium, it shall, in addition to forming an SPV as prescribed in Sub-Clause 5.4 above, comply with the following additional requirements

THIS JOINT BIDDING AGREEMENT is entered into on this the day of, 20

AMONGST

1. {..... Limited, a company incorporated under the Companies Act, 1956} and having its registered office at (hereinafter referred to as the "First Part" which expression shall, unless repugnant to the context include its successors and permitted assigns)

AND

2. {..... Limited, a company incorporated under the Companies Act, 1956} and having its registered office at (hereinafter referred to as the "Second Part" which expression shall, unless repugnant to the context include its successors and permitted assigns)

AND

3. {..... Limited, a company incorporated under the Companies Act, 1956 and having its registered office at (hereinafter referred to as the "Third Part" which expression shall, unless repugnant to the context include its successors and permitted assigns)}

The number of Parties will be shown here, as applicable, subject however to a maximum of 3 (Three).

WHEREAS

- A. SCDCL, Solapur represented by its Chief Executive Officer and having its principal offices at Solapur City Development Corporation Limited, Dist. Planning Office, New Collector Office premises, Near Govt. Milk Dairy, Saat Rasta, Solapur (hereinafter referred to as the “**Authority**” which expression shall, unless repugnant to the context or meaning thereof, include its administrators, successors and assigns) has invited Proposal (“**the Proposal**”) by its Request for Proposal No. dated(the “**RFP**”) for qualification and selection of bidders for Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Build, Maintenance, Operate and Transfer (“**DBMOT**”).
- B. The Parties are interested in jointly bidding for the Project as members of a Consortium and in accordance with the terms and conditions of the RFP document and other bid documents in respect of the Project, and
- C. It is a necessary condition under the RFP document that the members of the Consortium shall enter into a Joint Bidding Agreement and furnish a copy thereof with the Proposal.

NOW THEREFORE, THE PARTIES AGREE AS FOLLOWS:

1 Definitions and Interpretations

In this Agreement, the capitalized terms shall, unless the context otherwise requires, have the meaning ascribed thereto under the RFP.

2 Consortium

2.1 The Parties do hereby irrevocably constitute a consortium (the “**Consortium**”) for the purposes of jointly participating in the Bidding Process for the Project.

2.2 The Parties hereby undertake to participate in the Bidding Process only through this Consortium and not individually and/ or through any other consortium constituted for this Project, either directly or indirectly or through any of their Associates.

3 Covenants

The Parties hereby undertake that in the event the Consortium is declared the selected Bidder and awarded the Project, it shall incorporate a special purpose vehicle (the “**SPV**”) under the Indian Companies Act, 2013 for entering into an agreement with the Authority and for performing all its obligations as the contractor through Special purpose vehicle in terms of the Agreement for the Project.

4 Role of the Parties

The Parties hereby undertake to perform the roles and responsibilities as described below:

(a) _____ Party of the shall be the Lead member of the Consortium and shall have the power of attorney from all Parties for conducting all business for and on behalf of the Consortium during the Bidding Process and until the Appointed Date under the Contract Agreement when all the obligations of the SPV shall become effective;

(b) _____ Party shall be the Technical Member of the Consortium;
and

(c) _____ Party shall be the Operation and Maintenance Member/
Other Member of the Consortium.

5 Joint and Several Liability

The Parties do hereby undertake to be jointly and severally responsible for all obligations and liabilities relating to the project and in accordance with the terms of the Bidding Documents and the Contract Agreement, till successful completion for the Project is achieved under and in accordance with the Agreement.

6 Shareholding in the SPV

6.1 The Parties agree that the proportion of shareholding among the Parties in the SPV shall be as follows:

First Party:

Second Party:

Third Party:

6.2 The Parties agree that they shall collectively subscribe to and hold 100% (one hundred percent) of the subscribed and paid up equity of the SPV at all times till a period of 2 (two) years from the Commissioning Date, subject to Sub-Clause 5.7 (f) and 5.9 of the Instruction to Bidders as provided in Section 1 of the Bidding Documents;

6.3 The Parties shall undertake to the Authority that:

(a) that each member shall be individually liable for the performance of its part of the obligations without in any way limiting the scope of collective liability envisaged in the Contract Agreement.

(b) that the members of the consortium shall alone be liable for all obligations of the identified sub-contractor and clearly indemnify Authority and its employees against any losses or third party claims arising due to the sub-contractor/consortium's default.

6.4 The Parties shall nominate _____ Party as the lead member (the "Lead Member"), who shall have an equity share holding of at least 51% (fifty one per cent) of the subscribed and paid up equity of the SPV till first 2 (two) years of operation from the Commissioning Date. After completion of second year from commencement of the O&M Works, the _____ Party, who has been assigned the role of operation and maintenance shall become lead member and shall hold not less than 26% (twenty six percent) of the subscribed and paid-up equity shareholding of the SPV till date of handing over of operation after successful completion of Project.

7 Representations of the Parties

Each Party represents to the other Parties as of the date of this Agreement that:

- (a) Such Party is duly organized, validly existing and in good standing under the laws of its incorporation and has all requisite power and authority to enter into this Agreement;
- (b) The execution, delivery and performance by such Party of this Agreement has been authorized by all necessary and appropriate corporate or governmental action and a copy of the extract of the charter documents and board resolution/ power of attorney in favor of the person executing this Agreement for the delegation of power and authority to execute this Agreement on behalf of the Consortium Member is annexed to this Agreement, and will not, to the best of its knowledge:
 - (i) require any consent or approval not already obtained;
 - (ii) violate any Applicable Law presently in effect and having applicability to it;
 - (iii) violate the memorandum and articles of association, by-laws or other applicable organizational documents thereof;
 - (iv) violate any clearance, permit, concession, grant, license or other governmental authorization, approval, judgment, order or decree or any mortgage agreement, indenture or any other instrument to which such Party is a party or by which such Party or any of its properties or assets are bound or that is otherwise applicable to such Party; or
 - (v) create or impose any liens, mortgages, pledges, claims, security interests, charges or Encumbrances or obligations to create a lien, charge, pledge, security interest, encumbrances or mortgage in or on

the property of such Party, except for encumbrances that would not, individually or in the aggregate, have a material adverse effect on the financial condition or prospects or business of such Party so as to prevent such Party from fulfilling its obligations under this Agreement;

- (c) this Agreement is the legal and binding obligation of such Party, enforceable in accordance with its terms against it; and
- (d) there is no litigation pending or, to the best of such Party's knowledge, threatened to which it or any of its Affiliates is a party that presently affects or which would have a material adverse effect on the financial condition or prospects or business of such Party in the fulfillment of its obligations under this Agreement.

8 Termination

This Agreement shall be effective from the date hereof and shall continue in full force and effect until the successful close of the project is achieved under and in accordance with the Contract Agreement, in case the project is awarded to the Consortium. However, in case the Consortium is either not qualified for the project or does not get selected for award of the Project, the Agreement will stand terminated in case the Applicant is not qualified or upon return of the Bid Security by the Authority to the Bidder, as the case may be.

9 Assignment

Subject to the terms of the Bidding Documents, the Parties shall co-operate throughout the entire period of this agreement on the basis of exclusivity and shall not make arrangement or enter either directly or indirectly with any other firm or group of firms on matters relating to the project except with prior written consent of the parties to this agreement.

10 Miscellaneous

10.1 This Joint Bidding Agreement shall be governed by laws of India.

10.2 The Parties acknowledge and accept that this Agreement shall not be amended by the Parties without the prior written consent of the Authority.

IN WITNESS WHEREOF THE PARTIES ABOVE NAMED HAVE EXECUTED AND DELIVERED THIS AGREEMENT AS OF THE DATE FIRST ABOVE WRITTEN.

SIGNED, SEALED AND DELIVERED SIGNED, SEALED AND DELIVERED

For and on behalf of

LEAD MEMBER by:

(Signature)

(Name)

(Designation)

(Address)

SIGNED, SEALED AND DELIVERED

For and on behalf of

SECOND PART by:

(Signature)

(Name)

(Designation)

(Address)

SIGNED, SEALED AND DELIVERED

For and on behalf of

THIRD PART by:

(Signature)

(Designation)

(Address)

In the presence of:

1.

2.

Notes:

1. The mode of the execution of the Joint Bidding Agreement should be in accordance with the procedure, if any, laid down by the Applicable Law and the charter documents of the executants(s) and when it is so required, the same should be under common seal affixed in accordance with the required procedure.
2. Each Joint Bidding Agreement should attach a copy of the extract of the charter documents and documents such as resolution / power of attorney in favour of the person executing this Agreement for the delegation of power and authority to execute this Agreement on behalf of the Consortium Member.

Schedule 2 of Section 3: Power of Attorney for Lead Member of Consortium

POWER OF ATTORNEY FOR LEAD MEMBER OF CONSORTIUM

Whereas Chief Executive Officer, SCDCL (“the Authority”) has invited proposals from interested parties for the Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Build, Maintenance, Operate and Transfer (“DBMOT”) basis (the “Project”).

Whereas,.....and..... (collectively the “Consortium”) being Members of the Consortium are interested in bidding for the Project in accordance with the terms and conditions of the Request for Proposal (RFP) and other connected documents in respect of the Project, and

Whereas, it is necessary for the Members of the Consortium to designate one of them as the Lead Member with all necessary power and authority to do for and on behalf of the Consortium, all acts, deeds and things as may be necessary in connection with the Consortium’s bid for the Project and its execution.

NOW, THEREFORE, KNOW ALL MEN BY THESE PRESENTS

We, having our registered office at,
M/s. having our registered office at,
M/s. having our registered office at, and

(hereinafter collectively referred to as the “**Principals**”) do hereby irrevocably designate, nominate, constitute, appoint and authorise M/s. having its registered office at, being one of the Members of the Consortium, as the Lead Member and true and lawful attorney of the Consortium (hereinafter referred to as the “**Attorney**”). We hereby irrevocably authorise the Attorney (with power to sub-delegate) to conduct all business for and on behalf of the Consortium and any one of us during the bidding process and, in the event the Consortium is awarded the concession/contract, during the execution of the Project and in this regard, to do on our behalf and on behalf of the Consortium, all or any of such acts, deeds or things as are necessary or required or incidental to the pre-qualification of the Consortium and submission of its bid for the Project, including but not limited to signing and submission of all applications, bids and other documents and writings, participate in bidders and other conferences, respond to queries, submit information/ documents, sign and execute contracts and undertakings consequent to acceptance of the bid of the Consortium and generally to represent the Consortium in all its dealings with the Authority, and/ or any other Government Agency or any

person, in all matters in connection with or relating to or arising out of the Consortium's bid for the Project and/ or upon award thereof till the Concession Agreement is entered into with the Authority.

AND hereby agree to ratify and confirm and do hereby ratify and confirm all acts, deeds and things done or caused to be done by our said Attorney pursuant to and in exercise of the powers conferred by this Power of Attorney and that all acts, deeds and things done by our said Attorney in exercise of the powers hereby conferred shall and shall always be deemed to have been done by us/ Consortium.

IN WITNESS WHEREOF WE THE PRINCIPALS ABOVE NAMED HAVE EXECUTED THIS POWER OF ATTORNEY ON THIS DAY OF, 20 ...

For
(Signature)

.....
(Name & Title)

For
(Signature)

.....
(Name & Title)

For
(Signature)

.....
(Name & Title)

Witnesses:

1.

2.

..... (Executants)

(To be executed by all the Members of the Consortium)

Notes:

The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required, the same should be under common seal affixed in accordance with the required procedure.

Also, wherever required, the Bidder should submit for verification the extract of the charter documents and documents such as a board or shareholders' resolution/ power of attorney in favour of the person executing this Power of Attorney for the delegation of power hereunder on behalf of the Bidder.

Schedule 3 of Section 3: POWER OF ATTORNEY FOR SIGNING OF PROPOSAL

Know all men by these presents, we..... (name of the firm and address of the registered office) do hereby irrevocably constitute, nominate, appoint and authorise Mr/ Ms (name), son/daughter/wife of..... and presently residing at, who is presently employed with us/ the Lead Member of our Consortium and holding the position of, as our true and lawful attorney (hereinafter referred to as the “Attorney”) to do in our name and on our behalf, all such acts, deeds and things as are necessary or required in connection with or incidental to submission of our application for pre-qualification and submission of our bid for the “Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Build, Maintenance, Operate and Transfer (“DBMOT”) basis” proposed or being developed by the SCDCL (the “Authority”) including but not limited to signing and submission of all applications, bids and other documents and writings, participate in Pre-Applications and other conferences and providing information/ responses to the Authority, representing us in all matters before the Authority, signing and execution of all contracts including the Agreement and undertakings consequent to acceptance of our bid, and generally dealing with the Authority in all matters in connection with or relating to or arising out of our bid for the said Project and/ or upon award thereof to us and/or till the entering into of the Agreement with the Authority.

AND we hereby agree to ratify and confirm and do hereby ratify and confirm all acts, deeds and things done or caused to be done by our said Attorney pursuant to and in exercise of the powers conferred by this Power of Attorney and that all acts, deeds and things done by our said Attorney in exercise of the powers hereby conferred shall and shall always be deemed to have been done by us.

IN WITNESS WHEREOF WE,, THE ABOVE NAMED PRINCIPAL HAVE EXECUTED THIS POWER OF ATTORNEY ON THIS DAY OF, 20

For

.....

(Signature, name, designation and address)

Witnesses:

1.

2.

(Notarised)

Accepted

..... (Signature)

(Name, Title and Address of the Attorney)

Notes:

The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required, the same should be under common seal affixed in accordance with the required procedure.

Wherever required, the Bidder should submit for verification the extract of the charter documents and documents such as a board or shareholders' resolution/ power of attorney in favour of the person executing this Power of Attorney for the delegation of power hereunder on behalf of the Bidder.

Schedule 4 of Section 3: Statement of Legal Capacity

(To be forwarded on the letterhead of the Bidder/ Lead Member of Consortium)

Ref:

Date:

To,
Chief Executive Officer,
Solapur City Development Corporation Limited,
New Collector Office premises,
Near Government Milk Dairy,
Saat Rasta, Solapur – 413003
Email - solapurcitydcl@gmail.com

Dear Sir,

We hereby confirm that we/ our members in the Consortium (constitution of which has been described in the Proposal) satisfy the terms and conditions laid out in the RFP document.

We have agreed that (insert member's name) will act as the Lead Member of our consortium.*

We have agreed that (insert individual's name) will act as our representative/ will act as the representative of the consortium on its behalf* and has been duly authorized to submit the RFP. Further, the authorized signatory is vested with requisite powers to furnish such letter and authenticate the same.

Thanking you,

Yours faithfully,
(Signature, name and designation
of the authorised signatory)

For and on behalf of

* Please strike out whichever is not applicable

SECTION 4: TECHNICAL BIDDING FORMS (TBDF)

Preamble

This Section is comprised of Form of Technical Bidding, Schedule of Technical Forms. All portions of this Section should be carefully read and thoroughly understood in the context of all the various conditions of Contract before the Schedules are filled in by the Bidder. Section 6, Employer's Requirements, describes the scope of the Works that are to be taken up under the Contract, and the Schedules listed in Sections 4, confirm to these Works.

For this Schedules, of this Technical Bid, the Employer has requested information on the technical aspects of the Bid that are substantially responsive to the requirements set forth in the bidding documents.

Such information shall cover all work described in, or to be implied from, the Works described in Section 6- Employers Requirements, and shall take into account all conditions of Contract as set out in the Bid Data Sheet. The Bidder shall be responsible to provide any supplementary data and documents wherever these may be required.

The Bidders Technical Bidding Submission Requirements:

Electronic Versions

All information produced electronically shall be submitted as soft copy,

All electronic documents shall be compatible with one or any of the following computer programs as per the case.

Sr. No	Product	Version
1	Microsoft Word	2007 and latter all
2	Microsoft Excel	2007 and latter all
3	Autodesk- AutoCAD	15 and latter all
4	Microsoft Access	2007 and latter all
5	Microsoft Project	2007 and latter all
6	Microsoft PowerPoint	2007 and latter all

(All drawing shall be in Autodesk converted to PDF and updated. All documents should be in PDF/scanned copy etc. the size of the drawings shall be AO/A1/A2/A3 etc. The size of the documents shall be A3/A4).

If any document is not submitted with one of these programs, the appropriate software shall also be provided with the computerized file.

The electronic files shall match the scanned paper documents uploaded. A list of the electronic files showing the name and title of the matching paper document shall be provided. Electronic files shall be organized into folders and sub folders just as their paper version is sorted into files. If there is any discrepancy between the paper document and electronic document the text in the paper documents would prevail.

All above mentioned files can be submitted as PDF format through Mahatenders e-tendering portal, however, they have to supply the said files in the manner mentioned above, in a Pen Drive/ CDs/ Cloud Transfer if demanded by SCDCL during Technical evaluation stage for clarity

The Bidder's attention is directed to the fact that the Technical Bidding Forms contained in this Section 4 are designed to be complementary to the Financial Bidding Forms to Price Proposal contained in Section 5, as well as with the Schedule of Technical forms All of these referenced Forms, and Schedules will form a part of the Contract with the successful Bidder.

In the event that the Bidder discovers any discrepancies or contradictions in these Sections, the Bidder is requested to bring such discrepancies to the notice of the Employer before the Bids are submitted so that any necessary clarifications or addenda can be issued to all Bidders.

The Bidder's attention is directed to the fact that it is responsible to submit, as a part of its Technical Bidding, all information and supporting documentation that is required to be submitted in accordance with the instructions given in Section 1, Instructions to Bidders. For the Bidder's convenience, the following checklist provides a summary of the information that is required to be provided as a part of the Technical Bidding; however, this checklist does not necessarily include all items that are required to be submitted, and the Bidder will be fully responsible to ensure that its proposal complies in all respects with the requirements of these bidding documents.

The Bidders to note that noncompliance / submission of documents listed below shall result in Summary rejection of the Bid.

**FORM OF TECHNICAL PROPOSAL/ TECHNICAL BIDDING FORM
(ON THE LETTER HEAD OF THE BIDDER)**

Name of Contract: Augmentation to Solapur City Water Supply Scheme (Ujani Dam as a source – 110 MLD) on Design, Build, Maintain, Operate and Transfer (DBMOT) basis

Contract No: _____

To,
Chief Executive Officer,
Solapur City Development Corporation Limited,
New Collector Office premises,
Near Government Milk Dairy,
Saat Rasta, Solapur – 413003

Respected Sir

We have examined the Conditions of Contract, Employer's Requirements, Schedules, corrigendum etc. and the matters set out in the Appendix hereto. We have understood and checked these documents and have not found any errors in them. We accordingly offer to design, execute, complete and operate and maintain the said Works and remedy any defects, fit for its purpose in conformity with these documents and the enclosed Proposal.

We further undertake, if invited to do so by you, and at our own cost, to attend a clarification meeting at a place of your choice, for the purpose of reviewing our Technical Bidding and duly noting all amendments and additions thereto, and noting omissions there from that you may require, and to revise technical bid as per the amendments, additions and omissions that you require would alter our price proposal as submitted with our bid.

We hereby undertake to submit the bid in compliance with the tender and further undertake to carry out the work in accordance with the tender conditions.

I hereby submit the schedules attached herewith (Schedule 1 to Schedule 19) along with the check list

Yours Faithfully

Authorized Signatory

Name:

Designation:

Mobile No:

Encl: (1) Check list

(2) Schedules (Schedules 1 to Schedule 19)

SCHEDULES OF TECHNICAL BIDDING

INDEX TO SCHEDULES

Schedule No	Particulars	Page No	Name of the document submitted to establish the Eligibility Condition (Kindly highlight the relevant line/ figure on the sheet with yellow color)	Page numbers of the document submitted to establish the Eligibility Condition (Kindly highlight the relevant line/ figure on the sheet with yellow color)
	Preamble			
1.	Current Contract Commitments / Works in Progress			
2.	Financial Resources			
3.	Statement of Deviation with the Bidding Documents			
4.	Statement of Deviations from the Technical Specifications			
5.	Technical Parameters Proposed by the Bidder (Technical Schedules)			
6.	Personnel			
7.	Site Organization			
8.	Contractor's Plant and Construction Equipment			

9.	Method Statement			
10.	Construction Schedule			
11.	Procurement Schedule for Plant and Equipment to be incorporated into the Permanent Works			
12.	Procurement Schedule for Major Construction Materials			
13.	Manufacturers, Suppliers and Vendors			
14.	Quality Assurance and Quality Control Plan			
15.	Safety Plan			
16.	Environmental Quality Management Plan			
17.	Schedule of Recommended Spare Parts and Tools			
18.	Schedule for Power & Consumables for O & M			
19.	Shedule of Gaurantees			

INSTRUCTION FOR FILLING SCHEDULE

Bidders are required to provide full and complete information in the requested format in the following Schedules. All Schedules are required to be completed, but Bidders should not necessarily restrict themselves to using the space that is provided; Bidders will be responsible to provide additional sheets/pages and/or supplementary information wherever required.

In the event that any particular Schedule or item in the Schedule is not applicable, the same should be clearly indicated. The information provided shall be used for evaluation of the Technical Bidding to assess the overall responsiveness of the Bid to the terms and conditions of bidding, the qualifications of the Bidder pursuant to the requirements of Clause 5 of Section 1, Instructions to Bidders, and the suitability and conformity of the offer to the requirements of Section 6, Employer's Requirements.

However, the Employer wishes to clarify that whatever technical specifications are proposed or considered by the Bidder, all equipment which is to be provided by the successful bidder shall conform in all respects to the specifications of the tender documents, or better, and shall be subject to the approval of the Employer's Representative. No claim for additional payments shall be entertained during the course of the approval process or thereafter on this account.

Wherever the Employer has allowed an alternative (option) to be provided, as described in Section 6, Employer's Requirements, the Bidder shall clearly describe, in these Schedules, the option that he is offering. The Bidder shall be wholly responsible to ensure that his offer is complete in all respects, and that all related Plant, equipment and Works which are required to be provided, and which are deemed to be necessary by the Employer, are incorporated into his offer.

It is expected that the Bidder shall quote for supply of equipment of best makes which conform to the highest international standards. In its offer, the Bidder should only consider makes from reputed manufacturers of equipment corresponding to the state-of-the-art technology and to the latest international / Indian standards.

Acceptance of the Bidder's proposal for the purposes of bid evaluation should not be construed as approval by the Employer. All details will subsequently be subject to approval of the Employer's Representative during execution of the Works based

upon the detailed designs / drawings / data-sheets / specifications / manufacturer's credentials, details of Sub-contractors, agreements with Sub-contractors, necessary resources in terms of personnel, plant and equipment, construction methodology, work plan, safety plan, procurement plan, QA/QC plan, financing plan, etc., that are required to be submitted by the successful bidder in conformity with the terms and conditions of the Contract for independent assessment and approval by the Employer's Representative before execution.

All the schedules shall be on the Bidders letter head required to be signed by Authorized Signatory.

SCHEDULE 1

CURRENT CONTRACT COMMITMENTS / WORKS IN PROGRESS

Bidders, and each partner in a Consortium, should 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.

No.	Name of Contract	Employer's Contact Address, Tel, Fax	Value of Outstanding Work [INR]	Estimated Completion Date	Average Monthly Invoicing Over Last Six Months [INR/ month]
1					
2					
3					
4					
5					
6					
7					

SCHEDULE 2

FINANCIAL RESOURCES

Bidders, and each partner in a Consortium, shall 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 Sub-Clause 5.2 of Section 1, Instructions to Bidders, vis.:

Bidder shall provide documentary evidence of the availability of such financing as may be necessary to support its claims.

No.	Source of Financing	Amount (INR)	Name of the document submitted to establish the Eligibility (Kindly highlight the relevant line/ figure on the sheet with yellow color)	Page numbers of the document submitted to establish the Eligibility (kindly highlight the relevant line/ figure on the sheet with yellow color)
1				
2				

SCHEDULE 3

STATEMENT OF DEVIATIONS WITH THE BIDDING DOCUMENTS

Bidder shall provide a complete statement of any proposed deviations from the Conditions of Contract that are stipulated in the various Sections, General Requirements, giving reference to the Section Number and Clause Number, along with a description of the proposed deviation and the reason for proposing such deviation.

Section & Clause Number	As Mentioned in Bid Document	As Proposed by the Bidder	Reasons for Deviation

The Bidder hereby certifies that the above mentioned deviations are the only deviations proposed to the various Section of General Requirements and that he agrees with all remaining conditions.

SCHEDULE 4

STATEMENT OF DEVIATIONS FROM THE TECHNICAL SPECIFICATIONS

The Bidder shall describe all proposed deviations from the technical specifications set out under Section 6, Employer’s Requirements, and in the Standard Specifications. The Bidder should note that the specifications given in the Bid Document are the minimum acceptable, and that it is free to quote standards that are better / higher than the ones referred to in the Bid Document.

Sub-Section Number	Title of Sub-section	Clause No.	Specification as per Bid Document	Deviation & Specifications Proposed	Reasons for Deviation
Employer’s Requirements					
	Drawings				

The Bidder hereby certifies that the above mentioned deviations are the only deviations from the technical specifications set forth under Section 6, Employer’s Requirements, and the Standard Specifications, and that he accepts all the remaining technical requirements of the Bid Document.

SCHEDULE 5

TECHNICAL PARAMETERS PROPOSED BY THE BIDDER (TECHNICAL SCHEDULES)

The Bidder shall complete separate file named as Part 1 Section 4 Schedule 5 TECHNICAL SCHEDULES in their entirety to demonstrate their relevant experience and compliance with the technical requirements of the Project in sufficient detail so as to enable the Employer to determine the Bidder's responsiveness to the technical requirements of the Augmentation to Solapur City Water Supply Project.

SCHEDULE 6

PERSONNEL

Bidders shall provide the names of suitably qualified key personnel who meet the requirements specified in Section 6, Employer’s Requirements, in the following Form PER-1.

Data on the experience of each candidate should be supplied using the Resume format (Form PER-2) provided on the following page.

The proposed Mobilization/Deployment Schedule for all such key personnel shall be provided in the format provided in Form PER-3, indicating the proposed date of mobilization/ deployment and the total duration of their respective services.

Form PER-1

1.	Title of position*
	Name
2.	Title of position*
	Name
3.	Title of position*
	Name
4.	Title of position*
	Name
5.	Title of position*
	Name
6.	Title of position*
	Name
7.	Title of position*
	Name
8.	Title of position*
	Name

*As listed in Section 6, Employer’s Requirements

Resume of Proposed Personnel

Form PER-2

Position:			
Responsibilities:			
Personnel information	Name	Date of birth	Nationality
	Professional qualifications		
Present employment	Name of employer		
	Address of employer		
	Telephone	Contact (manager / personnel officer)	
	Fax	E-mail	
	Job title	Years with present employer	

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

Mobilization/Deployment of Proposed Personnel

Bidder shall provide the proposed mobilization schedule for each of the key personnel in a bar-chart form, clearly showing the proposed date of mobilization, duration of services, and date of demobilization.

Form PER-3

Sl. No.	Position/Designation	Deployment Schedule (in Months from the Commencement Date)										
		1	2	3	4	5	6	7	---	---	30	

(Note: Bidders should provide the above schedule on a separate sheet showing all months from Month 1 to Month 30 inclusive for the Works Contract Period, and a similar, but suitably modified, format for the Operations and Maintenance Contract Period.)

SCHEDULE 7

SITE ORGANIZATION

Bidder shall describe the roles and responsibilities of each of the personnel proposed under the preceding Schedule IV, and shall describe the roles, relationships and division of responsibilities between the site management and the representative head/branch office that will be responsible for the Project. In particular, the Bidder shall provide details of the technical and financial responsibility and authority of the Project Manager who will be responsible for the day-to-day operations at the Site.

The Bidder shall provide a preliminary organization chart which indicates the relationship between the site management and the representative head/branch office, the direct on-site works operations, the sub-contractors and suppliers, and the Employer's Representative and supervising Engineers.

Details shall be furnished separately for the design and construction phase, and for the operations and maintenance phase.

SCHEDULE 8

CONTRACTOR'S PLANT AND CONSTRUCTION EQUIPMENT

The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key plant and construction equipment listed in Section 6, Employer's Requirements. A separate Form (Form EQP-1) shall be prepared for each item of plant and/or equipment listed, or for alternative equipment proposed by the Bidder.

The overall requirements and mobilization/deployment schedule for each major item of plant and equipment (such as Plant & Equipment to be used for the Pipe Manufacturing Process, Coating Process, Internal Lining Process, Welding Process during manufacturing and Welding Process for jointing, excavators, etc.) shall be summarized in the format (Form EQP-2) provided on the following page.

Form EQP-1

Item of Plant/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	Rented	Leased	Specially manufactured

The following information is required to be provided for the above plant/equipment owned by the Bidder.

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

Deployment Schedule of Major Items of Constructional Plant and Equipment

Bidder shall provide the proposed mobilization/deployment schedule for each major item of constructional plant and equipment described in Form EQP-1 in a bar-chart form, clearly showing the proposed date of mobilization to the Site, duration of deployment, and date of removal from the Site.

Form EQP-2

Sl. No.	Name of Plant/Equipment (Type, Make, Model)	No. of Items	Deployment Schedule (in Months from the Commencement Date)												
			1	2	3	4	5	6	7	---	---	30			
A)	Intake Works														
B)	Raw Water Pumping Station /Pumping Machinery/Sub-station														
C)	Raw Water Pumping main/ Break Pressure Tank														
D)	Raw Water Gravity														
E)	For Other works like , automation,														

(Note: Bidders should provide the above schedule on a separate sheet showing all months from Month 1 to Month 30 inclusive for the Works Contract Period, and a similar, but suitably modified, format for the Operations and Maintenance Contract Period.)

CHECKLIST OF DOCUMENTS COMPRISING THE BID (TECHNICAL BIDDING)

Sr. No	Description of Documents	Name of the document submitted to establish the Eligibility Condition (Kindly highlight the relevant line/ figure on the sheet with yellow color)	Page number of the document submitted to establish the Eligibility Condition (Kindly highlight the relevant line/ figure on the sheet with yellow color)
1.	Technical Bidding Form (TBF) (Please refer the formats in Eligibility Criteria)		
2.	Fully Completed Schedules of Technical Bidding Forms,		
3.	Bid data sheet,		
4.	Information on Eligibility & Qualification; as per Section 3.		
5.	Drawings required to be submitted in Envelope B from BIDDER 1. Layout drawings for all project work components 2. Schematic drawings 3. Hydraulic flow diagram (HFD)		

CHECKLIST OF DOCUMENTS COMPRISING THE BID (TECHNICAL BIDDING)

Sr. No	Description of Documents	Name of the document submitted to establish the Eligibility Condition (Kindly highlight the relevant line/ figure on the sheet with yellow color)	Page number of the document submitted to establish the Eligibility Condition (Kindly highlight the relevant line/ figure on the sheet with yellow color)
	<p>4. Process and instrumentation drawings</p> <p>5. Civil drawings</p> <p>6. Civil general arrangement drawings</p> <p>7. Single line diagrams for electrical installations</p> <p>8. Pipeline alignment drawings</p> <p>9. Pump Installation Drawing</p> <p>10. Substation Layout Drawing</p> <p>11. Drawing for Water Hammer control device</p> <p>12. Design basis reports</p>		

CHECKLIST OF DOCUMENTS COMPRISING THE BID (TECHNICAL BIDDING)

Sr. No	Description of Documents	Name of the document submitted to establish the Eligibility Condition (Kindly highlight the relevant line/ figure on the sheet with yellow color)	Page number of the document submitted to establish the Eligibility Condition (Kindly highlight the relevant line/ figure on the sheet with yellow color)
	<p>13. List of Deviations from SCDCL Tender drawings & design parameters</p> <p>14. Drawing Instrumentation flow chart/drawing etc.</p> <p>15. BPT Drawing</p>		
6.	Any other information/data/drawing required to be submitted by bidders in accordance with the Instructions to Bidders		

SCHEDULE 9

METHOD STATEMENT

The Bidder shall provide a comprehensive statement of the methods that it proposes to adopt for completing the Works under this Project, including descriptions of its proposed work methods, scheduling, mobilization of labor force and resources, quality assurance and quality control programs, etc., in order to demonstrate its overall understanding of requirements for successful completion of the Contract within the stipulated time period, and to demonstrate the Bidder's capability with respect to its construction methodology, proper planning of activities, procurement and deployment of necessary resources.

The Bidder should pay particular attention to describing how he proposes to providing and laying of the MS pipes, Construction of pumping station, Construction of BPT, including providing details on the proposed execution process, the number and types of plants he proposes to use/establish, their production capacity, testing facilities, QA/QC procedures to be used to ensure the quality of the pipes and specials, storage requirements and facilities for the raw materials and finished products, etc.

Similarly, the Bidder should provide full details on his proposed procurement methods for major items of pipe, plant, equipment and materials proposed to be incorporated into the Permanent Works, including design of the plant and equipment, sources of materials, placing of orders, times required for manufacture, tests to be conducted at the supplier's/manufacturer's plant, pre-delivery inspections and testing, delivery, storage, installation, etc.

The Bidder's attention is drawn to the requirements set out in Section 6, Employer's Requirements, and the Bidder is requested to describe how it proposes to achieve the Milestone Targets that have been established to ensure that pro-rata progress is maintained on all sub-components of the Works throughout the execution period.

Details shall be furnished separately for the design and construction phase, and for the operations and maintenance phase.

SCHEDULE 10

CONSTRUCTION SCHEDULE

The Bidder shall submit his proposed construction program in sufficient detail so as to demonstrate: the order in which he proposes to carry out the Works (including each stage of design, procurement, manufacture, pre-delivery inspection and testing, delivery to Site, construction, erection, testing and commissioning); all major events and activities in the production of Construction Documents; the periods for the design reviews and approvals and for any other submissions, approvals and consents specified in the Employer's Requirements; the sequence of all tests specified in the Contract; etc. The Bidder should pay particular attention to ensuring that the proposed schedule for procurement, construction is integrated with the equipment mobilization/deployment schedule (Schedule 8), the procurement schedule for supply and delivery of the raw materials (pipe, pumps, as per Schedule 11) and the proposed works program for project.

Similarly, the Bidder should pay particular attention to demonstrating how his proposed program for supply of major items of plant and equipment to be incorporated into the Permanent Works is to be managed to satisfy the requirements of the Contract, including the time required for design, placing of confirmed orders, manufacturing, pre-delivery inspections and tests, delivery to the Site, storage, installation, etc.

Such construction program shall be developed on a commercially available project management software (such as Primavera, MS Project or equivalent) showing level-3 activities, together with bar charts and CPM diagrams which clearly illustrate the critical path, and the resources required to be provided by the Contractor to achieve the desired results.

The Bidder's attention is drawn to the requirements set out in Section 6, Employer's Requirements, and the Bidder is required to clearly demonstrate how he proposes to meet the Milestone Targets that have been established to ensure that pro-rata progress is maintained on all sub-components of the Works throughout the execution period.

Details shall be furnished separately for the design and construction phase, and for the operations and maintenance phase.

SCHEDULE 11

PROCUREMENT SCHEDULE FOR PLANT AND EQUIPMENT TO BE INCORPORATED INTO THE PERMANENT WORKS

Bidder shall provide the proposed procurement schedule for the major plant and equipment which is required to be incorporated into the Permanent Works in the following Form PEQ-1, clearly showing the total estimated quantities and the proposed quantities to be procured and delivered to the site each month. Bidders should ensure that the proposed procurement schedule is integrated with the requirements of the bidding documents, and matches with proposals described in the preceding Method Statement (Schedule 9) and Construction Schedule (Schedule 10).

The Bidder should pay particular attention to ensuring that the times required for design, placing of orders, manufacturer and testing, delivery, etc., are properly allowed for while preparing their procurement schedules.

Form PEQ-1

Sl. No	Type of Plant and Equipment	Total Qty. Required	Procurement Schedule (in Months from the Commencement Date)													
			1	2	3	4	5	6	7	---	---	30				
A)	Intake Works															
B)	Raw Water Pumping Station/Pumping machinery/Sub-station															
C)	Raw Water Pumping Main/BPT															

Sl. No	Type of Plant and Equipment	Total Qty. Required	Procurement Schedule (in Months from the Commencement Date)												
			1	2	3	4	5	6	7	---	---	30			
D)	Raw water gravity main														
E)	Other works like implementation of instrumentation														
F)	Equipment in the High Tension Substation														

(Note: Bidders should provide the above schedule on a separate sheet showing all months from Month 1 to Month 30 inclusive for the Works Contract Period, and a similar, but suitably modified, format for the Operations and Maintenance Contract Period.)

SCHEDULE 12

PROCUREMENT SCHEDULE FOR MAJOR CONSTRUCTION MATERIALS

Bidder shall provide the proposed procurement schedule for the major construction materials (such a pipes pumps, cement, steel reinforcement, shuttering, MS Plates/coil, PE tapes for coating, electrodes for welding, etc.) required for the Works in the following Form MTL-1, clearly showing the total estimated quantities and the proposed quantities to be procured and delivered to the site each month. Bidders should ensure that the proposed procurement schedule is integrated with the requirements of the bidding documents, and matches with proposals described in the preceding Method Statement (Schedule 9) and Construction Schedule (Schedule 10).

Form MTL-1

Sl. No.	Type of Construction Material	Total Qty. Reqd	Procurement Schedule (in Months from the Commencement Date)																			
			1	2	3	4	5	6	7	---	---	30										
A)	Intake Works																					
B)	Raw Water Pumping Station/Pumping machinery/Sub-station																					
C)	Raw Water Pumping Main/BPT																					
D)	Raw water gravity main																					

Sl. No.	Type of Construction Material	Total Qty. Reqd	Procurement Schedule (in Months from the Commencement Date)									
			1	2	3	4	5	6	7	---	---	30
E)	For Other works like Automation, Environment planning											

(Note: Bidders should provide the above schedule on a separate sheet showing all months from Month 1 to Month 30 inclusive for the Works Contract Period, and a similar, but suitably modified, format for the Operations and Maintenance Contract Period.)

SCHEDULE 13

MANUFACTURERS, SUPPLIERS AND VENDORS

The Bidder shall provide details on the proposed manufacturers / vendors / suppliers of major items of pipes, pumps, motors, transformers, gates, grid screen, ventilation, equipments, control panel, valves, cement, Water treatment plant, materials, plant and equipment (such as Valves, cement, steel reinforcement, shuttering, MS Plates/coil, PE tapes for coating, electrodes for welding, etc.) that are to be incorporated into the Permanent Works.

Sl. No.	Description of Item (Material / Plant / Equipment)	Name and Address of Manufacturer/Supplier/Vendor	Year of Establishment / In Council	ISO Certified (Yes/No)
A)	Intake Works			
1	Pumps and Motors			(Yes/No)
2	Valves			(Yes/No)
3	Control Panel			
4	Transformer			
5	132kV circuit breaker			
6	EOT Crane			
7	Screen			
8	Sluice gate, stop log gate			

Sl. No.	Description of Item (Material / Plant / Equipment)	Name and Address of Manufacturer/Supplier/Vendor	Year of Establishment / In Council	ISO Certified (Yes/No)
B)	Pipeline			
1	Pipe Material			(Yes/No)
2	Air Valves			(Yes/No)
3	Line Valves			
4	Cathodic Protection			
C)	Pumping Station			
	As per A (1-6) above			(Yes/No)
D)	BPT			
1	Valves			Yes/No
2	Chlorination			Yes/No
E)	For Other works like Automation			
				Yes/No
				Yes/No
G)	For Roads & Miscellaneous Civil Works			

SCHEDULE 14

QUALITY ASSURANCE AND QUALITY CONTROL PLAN

The Bidder shall provide his proposed Quality Assurance and Quality Control (QAQC) Plan which describes the type, frequency and procedure of tests to be done on sites; type, frequency and procedure of tests to be done in pipe manufacturing units at site, if applicable; type, frequency and procedure of tests to be done at manufacturers' locations outside the sites; all parameters to be measured in these tests; permissible limits of such parameters; details of laboratories to be established at sites; details of testing equipments & machines and their calibration schedules; details of the Bidder's internal systems for assuring quality control at the manufacturers' outside the sites; details of qualifications and experience of the Quality Control professionals to be deployed for the entire project; and the systems of Quality Audit to be instituted for systematic and professional management as well as adherence with the highest standards of quality of all construction works.

The Bidder shall provide separate descriptions of its proposed QA/QC plan during the design and construction phase, and the subsequent operations and maintenance phase.

The Bidder shall also provide copies of the company's standard rules and regulations regarding quality assurance and quality control procedures for works in general and works of a similar nature.

SCHEDULE 15

HEALTH AND SAFETY PLAN

The Bidder shall describe his proposed Health and Safety Plan which shall be developed to ensure zero fatal accidents and zero hazardous incidents/occurrences in all construction works, including descriptions of the company's standard policies and procedures regarding its site organization and procedures, methods and frequency of conducting safety audits at the Site(s), record keeping and reporting, providing safety training for its personnel, issue and mandatory use of safety equipment, details of the qualifications and experience of the Bidder's safety officers to be deployed at the Site(s), etc.

The Bidder shall provide separate descriptions of its proposed safety plan during the design and construction phase, and the subsequent operations and maintenance phase.

The Bidder shall also provide copies of the company's standard rules and regulations regarding safety procedures.

The Bidder shall provide plans for healthy working conditions for all the workers.

SCHEDULE 16

ENVIRONMENTAL QUALITY MANAGEMENT PLAN

The Bidder shall provide details of its proposed environmental management plan in sufficient detail so as to demonstrate the procedures that will be used to ensure that the environmental concerns and requirements as set forth in Section 6, Employer's Requirements, are satisfactorily met.

The Bidder shall provide separate descriptions of its proposals for minimizing any adverse environmental impacts/effects during the design and construction phase, and the subsequent operations and maintenance phase.

SCHEDULE 17

SCHEDULE OF RECOMMENDED CONSUMABLES, SPARE PARTS AND TOOLS

The Employer has, in other Sections of this bid document, provided lists of mandatory spare parts that the Bidder will be required to supply, and which will form a part of the Bidder's quotation under the Schedule of Prices. The purpose of providing this list of recommended spare parts and tools is to provide the Bidder with an opportunity to indicate what additional spare parts and/or specialized tools it recommends be procured in order to ensure satisfactory and uninterrupted operation of the plant and facilities to be constructed under this Project.

The Bidder shall provide an un-priced list of the recommended spare parts and tools for each type of plant and Equipment intended for use in the permanent works and also the details of the sources of the spare parts and tools, to the extent practicable. The costs of the recommended spare parts and tools are to be provided in Financial Proposal, but will not be considered during bid evaluation. The Bidder shall note, however, that the Employer will not be under any obligation to purchase any or all of the recommended spare parts or tools, and that selection of the type and/or quantity of any of the recommended spare parts or tools will be at the Employer's sole option.

Sl. No.	Description of the Item(s)	Quantity	Replacement Cycle

*This list needs to be exhaustive however this can be modified with mutual consent during Operation & Maintenance of Project

SCHEDULE 18

SCHEDULE FOR POWER & CONSUMABLES FOR O & M

S. No.	Location	KW	No. of units	Installed Load (Kw)	Guaranteed Monthly Power Consumption (KW-Hr)
1	Intake Works & Raw Water Pumping Station				
2	Water Treatment Plant & Treated Water Pumping Station				
3	Raw water pumping & Gravity main				

Note: The bidder may add more rows to the above Table if required.

**SCHEDULE 19
SCHEDULE OF GUARANTEES**

Item No.	Description	Unit	Guaranteed duty
GUARANTEED FOR PUMPSETS			
1.	Duty point Capacity	MLD	
2.	Duty Point head	MWC	
3.	Water kW	kW	
4.	Pump Efficiency at duty point	%	
5.	Power input to pump at duty point	kW	
6.	Motor efficiency	%	
	(Corresponding to power input to pump at pump duty point)		
7.	Power input to motor at pump duty point	kW	
8.	Specific Power Consumption kW/WHP (in kW) (based on 7 and 3)		
9.	Rate speed	RPM	
10.	NPSH required	MWC	
11.	Maximum velocity of vibration	mm/sec.	
	(a) Within range of +10% of rated flow		
	(b) Shut off to maximum flow (excluding the range in (a) above.)		
12.	Noise level inside pumping station with 4 Consecutive pump sets running simultaneously.	dBA	

In accordance with Clause 1.24 & 1.25 of volume 2 we guarantee that the performance of each pumps shall comply with the figures given above. We confirm

that the pump motor efficiency is guaranteed without any negative tolerance whatsoever.

We further guarantee that the pumps will operate satisfactorily in parallel throughout the operating range.

Notes for Pump sets:

1. For definition please refer Clause No.1.24.
2. Water Kilo Watts (WKW) shall be computed as follows:

$$W = \frac{\text{Rated flow (Mld)} \times \text{Total head (MWC)}}{8.8128}$$

(II) **GUARANTEE FOR 3000 kVA & 100 kVA TRANSFORMER**

1.0	Voltage ratio at no load	
2.0	Impedance voltage	%
3.0	No load loss	kW
4.0	Load loss	kW

Notes for transformers:

1. Tolerance limits, if any, on each of the above, shall be indicated separately against each items. In case of inconsistency, values indicated here shall supersede indicated elsewhere.
2. If tolerance limits are not indicated by the Bidder, the values indicated against relevant items, shall be taken as guaranteed values without any tolerance.

We guarantee that the performance of each transformer shall comply with the figures given above.

Signed_____

Date_____

Authorised to sign for and on behalf of_____

EQUIPMENT SHEDULES

MECHANICAL EQUIPMENT

1. **Stop Log Gate**
2. **Screen in Intake**
3. **Lifting Arrangement Monorail for Screen**
4. **Thimble Mounted Sluice Gate in Intake**
5. **Vertical Turbine Pump**
6. **Sluice Valve Electrically Operated in delivery of VT Pump**
7. **Dual Plate Check valve in delivery of VT Pump**
8. **Butterfly valve with Actuator in Common delivery of VT Pump**
9. **Kinetic Air Valve on pump delivery side**
10. **Dismantling Joint in Delivery of V T Pump**
11. **Ventilation System -Air supply at Pump floor for RWPS**
12. **Ventilation System -Air supply at motor floor for RWPS**
13. **Electrically Operated Travelling Crane & Trolley - RWPS**

ELECTRICAL EQUIPMENT

14. **Lightning Arresters**
15. **Isolators**
16. **Potential Transformers (PT)**
17. **Current Transformers (CT)**
18. **V a c u u m Circuit Breakers (VCB)**
19. **33 kV / 3.3 kV Transformers**

20. 3.3 & 3.3 kV Metal Enclosed Switchboards
21. 3.3 kV / 0.415 kV Transformers (Energy Efficient Transformer as per latest IS:2026 & IS:1180)
22. 3.3 kV Power Capacitor and Control Panel
23. Earthing and Lightning Protection System
24. Vacuum Contactor for 3.3 kV Motor Capacitor
25. FCMA for 3.3 kV Motor starters
26. 3.3 kV Motors
27. 415 V Metal Enclosed Switchgears (PCC) /MCC
28. 0.415 kV Power Capacitor and Control Panel (APFC)

INSTRUMENTATION, CONTROL AND AUTOMATION EQUIPMENT

Instrumentation Equipment:

29. Electromagnetic Flow Meters (Full Bore)
30. Electromagnetic Flow Meters (Full Bore)
31. Electromagnetic Flow Meters (Full Bore)
32. Radar Type Level Transmitters
33. Pressure Transmitters (Diaphragm)
34. Pressure Gauges
35. Portable Vibration Meter
36. Junction Boxes for ICA equipment
37. Power Junction Boxes for ICA equipment
38. Alarm Annunciators

- 39. Two & Three Position Selector Switches
- 40. Flow Integrator cum Totalizer
- 41. Digital Panel Meters (DPM)
- 42. Multi-Function Energy Meters (MFM)
- 43. Surge Protection Devices (SPDs)
- 44. Lightning Protection Unit
- 45. Analog Signal Cable for Online Field Instruments
- 46. Digital Cables for ICA
- 47. Power Cables for Online Field Instruments
- 48. Cable Conduits
- 49. Cable Trays for control cable
- 50. Field Enclosures

Control & Automation Equipment:

- 51. Power Supply Modules for PLC CPUs
- 52. Communication modules (for third Party devices integration)
- 53. Digital Input Modules
- 54. Digital Output Modules
- 55. Analog Input Modules
- 56. Analog Output Modules
- 57. Interposing Relays with base terminal
- 58. PLC Programming software

- 59. Industrial Type Ethernet switches
- 60. SMPSs for Control System
- 61. UPS
- 62. Instrumentation Control Panel (ICP) with Internal Wiring
- 63. Fibre Optic Cable (FOC)
- 64. Fire Detection and Alarm System

BPT: Instrumentation Equipment:

- 65. Electromagnetic Flow Meters (Full Bore)

MILD STEEL PIPELINE AND VALVES

- 66. Mild Steel Pipe
- 67. Line Valve (Butterfly Valve) Size
- 68. Flange Adaptors
- 69. Kinetic Air Valve Size
- 70. Washout Valve (Sluice Valve) 300
- 71. Washout Valve (Sluice Valve) 400

ADDITIONAL ELECTRICAL EQUIPMENT

- 72. Low Maintenance Lead Acid Battery for Pump House
- 73. Battery Charger and D.C Distribution Board Pump House

PREAMBLE TO EQUIPMENT SCHEDULES

1. Details called for in the Equipment Schedules shall be fully completed by the Contractor at the time of tender.
2. Manufacturer's literature shall be submitted with the Tender, giving full specifications of equipment offered. Where further details of the Contractor's proposals are submitted in any document accompanying the Tender, such details shall comply with the Specification.
3. Particulars entered by the Contractor in the Schedules shall form a binding part of the Contract and shall not be altered without the approval of the Employer.
4. The Employer may at any time during the progress of the Contract require the Contractor to provide extra details of any part of the Works, and the Contractor shall forthwith provide such details when requested by the Employer in writing.
5. Entries shall be deemed to refer to the specified Works unless explicitly stated otherwise. Any particulars covering other options or alternative proposals shall be entered in similar details either in the places provided in the Schedules or on a clearly labeled separate sheet(s) of paper appended to the Schedules.
6. Where details of materials of construction are called for, material details and the relevant Indian Standard reference shall be given. Where materials are of other international standards, (i.e. ASTM, DIN, BS etc.), the relevant standard with the equivalent Indian Standard shall be mentioned.
7. In respect of the pumps, Characteristic curve showing H-Q, P-Q, Efficiency –Q & NPSHR – Q relationships from shutoff head to at list – 50% of duty head shall be submitted.
8. Bidder to confirm as “Type Test certificates” of electrical items, wherever applicable, shall be submitted after award of work as part of engineering documents.

EQUIPMENT SHEDULES

MECHANICAL EQUIPMENT

1. Stop Log Gate

Total Number		
Manufacturer		
Type		
Applicable IS		
Effective width of Gate	m	
Effective Height of Gate	mm	
Lifting Arrangement structural member frame	No.	
Lifting Arrangement structural member frame size –L X B	m	
Structural members size mm	mm	
Vertical Travel distance	m	
Chain pulley Block –Manufacturer		
Chain pulley Block capacity	MT	
Lifting beam capacity	MT	
Material of Construction - Stop logs - Base frame - Lifting arrangement - Lifting Beam - Structural member material grade		
Design head of stop log (Height of Water Column)	m	

Note: Installation drawing shall be attached

2. Screen in Intake

Total Number		
Type		
Applicable IS code		
Manufacturer		
Model number		
Effective width of screen	m	
Effective height of screen	m	
Total base frame size for screen	mm	

Total distance between consecutive	mm	
Screen bar spacing	mm	
Effective opening	m ²	
Screen bar details: <ul style="list-style-type: none"> • Materials of construction and Grade • Bar dimensions 	mm x mm	
Stiffener details: <ul style="list-style-type: none"> • No. of stiffeners • Materials of construction and Grade • Bar dimensions 	mm x mm	
Proposed method of screen cleaning		

3. Lifting Arrangement Monorail for Screen

Size & Section of I beam	m	
Supporting arrangement for monorail At ends & intermediate points		
Capacity of monorail	MT	
Vertical Travel	m	
Make		
Material of Construction <ul style="list-style-type: none"> - Lifting arrangement - Structural Member material grade 		

4. Thimble Mounted Sluice Gate in Intake

Total Sluice gates	No	
No. of sluice gate per pump bay	No	
Size of sluice gates Length, breadth, height	m	
Manufacturer		
Model number		
Applicable IS		
Design maximum pressure in MWC	m	
Dimensions of clear openings	mm x mm	
Material of construction <ul style="list-style-type: none"> • Frame • Gate 		

• Seals		
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5. Vertical Turbine Pump

Description / Details of item	Unit	RWPS	
Type and number			
Manufacturer			
Model number			
Number of bowl stages			
Number of pumps <ul style="list-style-type: none"> • Duty • Standby 			
Duty point discharge of each pump	M ³ / hr		
Design duty head	M		
Bowl Efficiency			
Pump duty power requirement over entire head range	kW		
Speed in RPM			
NPSHR at duty point	m		
Shut off head	m		
Material of Construction			
Bowl			
impeller			
Pump Shaft			
Line shaft			
Column pipe			
Line Shaft bearing			

Description / Details of item	Unit	RWPS	
Length of each column pipe Diameter of Column Pipes	m		
Diameter of bell mouth	mm		
Make of thrust bearing			
Capacity of thrust bearing			
Life of Bearing (L/10) in hrs			
Any other details			

6. Sluice Valve Electrically Operated in delivery of VT Pump

Description / Details of item	Unit	RWPS	
Size	mm		
Type/ model			
Applicable IS			
Make			
Operating pressure	PN		
Material Body Gate Spindle Nut			
Weight			
Torque requirement	N-m		
Electrical Actuator Make			
Type & model			
Degree of protection			
Rated Power	kW		
Time required for opening	s		

* Data for all required valves shall be filled in separately

7. Dual Plate Check valve in delivery of VT Pump

Description / Details of item	Unit	RWPS	
Size	mm		
Type/ model			
Applicable IS			
Make			
Class of pressure	PN		
Material Body Plate Spindle Seat			
Weight	kg		

* Data for all required valves shall be filled in separately

8. Butterfly valve with Actuator in Common delivery of VT Pump

Description / Details of item	Unit	RWPS	
Size			
Type/ model			
Design Standard			
Make			
Class of pressure			
Material Body Gate Spindle Nut			
weight			

9. Kinetic Air Valve on pump delivery side

Description / Details of item	Unit	RWPS	
Size			
Type/ model			
Design Standard			
Make			
Operating pressure			
Isolating valve make / size / pressure class			
Material of ball			

* Data for all required valves shall be filled in separately

10. Dismantling Joint in Delivery of V T Pump

Description / Details of item	Unit	RWPS	
Size			
Type/ model			
Applicable IS			
Make			
Operating pressure			
MoC for Pipe Fasteners Sealing gasket			

11. Ventilation System -Air supply at Pump floor for RWPS

Description / Details of item	Unit	RWPS	
Type/model of Fan Proposed			
Design Standard			
Make			

Description / Details of item	Unit	RWPS	
Rated Capacity			
No of units working	nr		
Efficiency	%		
Design pressure			
Noise level	dB		
Size of Duct	mm		
MOC of Duct			

12. Ventilation System -Air supply at motor floor for RWPS

Description / Details of item	Unit	RWPS	
Type/model of Fan Proposed			
Design Standard			
Make			
Rated Capacity			
No of units working	nr		
Efficiency	%		
Design pressure			
Noise level	dB		
Size of Duct	mm		
MOC of Duct			

*Data for all required valves shall be filled in separately

13. Electrically Operated Travelling Crane & Trolley - RWPS

Description / Details of item	Unit	RWPS	
Type/Model			
Design Standard			
Make			
capacity			
Distance between floor to hook	m		
Span	m		
Drive motor Power, RPM	kW/*		
Weight of entire crane			
Speed Hoisting	m/min		
Speed long travel	m/min		
Speed cross travel	m/min		

ELECTRICAL EQUIPMENT

14. Lightning Arresters

Description	Unit	RWPS	
General			
Designation			
Make/Manufacturer			
IS 3070 Part-3 and IEC 60099			
Type and model			
Quantity	Nos.		
Installation- Outdoor			
System voltage 33/ 36 kV Nominal and Highest	kV		
Ratings			
Maximum continuous operating voltage	kV		
Rated frequency – 50	Hz		
Nominal discharge current in kA of 8/20 micro second shape (10 kA)			

Basic Insulation level of equipments to be protected			
Impulse withstand (1.2/50 microsecond)	kV(P)		
1 min. Power frequency withstand voltage	kV		
Resistive and capacitive currents of arrester at continuous operating voltage.			
Performance Data			
Virtual steepness of front			
Rate of rise	kV/micro sec.		
Time of spark over	Micro sec.		
Maximum residual voltage at (8/20 microsecond wave) rated nominal discharge current(10kA)	kV (peak)		
(5kA)	Kv(peak)		
(10kA)	kV(peak)		
(20kA)	kV(peak)		
Description	Unit	RWPS	
Steep current impulse withstand voltage at 10 kA with one microsecond front time	kV(peak)		
Arrester housing			
Minimum creepage distance Total - 25 mm/kv	mm		
Minimum cantilever strength of arrester assembly	Kg		
1 min. Power frequency wet flash- over voltage	kV		
Pressure relief class (as per IEC:60099)			
Accessories required			
Conductor size			
Line side terminal			
Earth side terminal			
Energy absorption in kJ/kV(2 SHOTS)	Kj/kV		
Over voltage withstand capacity	kV		
100 Second			
10 Second			

1 Second			
0.1 Second			

15. Isolators

Description	Unit	RWPS	
Rating			
Application			
Make			
Applicable IS/ IEC			
Quantity			
System Voltage - 33/36	kV		
Frequency- 50	Hz		
No of Phases – 3 phase			
Rated current for site conditions	A		
Short time current			
a. Rating- 40 min	kA		
b. Duration – 1 sec	Sec		
Design Requirements			
Ambient temperature	° C		
Insulation level – Full	Full/ Reduced		
Description	Unit	RWPS	
Phase spacing as per IS / CBIP	mm		
Earthing switch required with interlocked with main switch			
Type of break – Horizontal double break			
Type of mounting			
Height of mounting above GL as per IS / CBIP	mm		
Operating device for isolator for earthing switch- Manual with electro mechanical interlock			
Orientation of operating mechanism box W.R.T isolator			
Number of Auxiliary contacts NO – 6 No's NC - 6 No's			
Make before break			
Insulator Data			
Rated voltage 33/36	kV		
Power frequency dry flash-over voltage – 275	kV		

1 min. Power frequency wet flash- over voltage- 230	kV		
Impulse flash-over: Positive wave (1.2*50 micros) – 650	kV(peak)		
Impulse withstand (1.2*50 micros) - 550	kV(peak)		
Creepage distance Total - 25 mm / kV	mm		
Minimum strength Tensional Cantilever	Kg-m Kg		
Bidder to Provide GA drawing Indicating Height, Weight, overall dimensions and mounting arrangement details			

16. Potential Transformers (PT)

Description	Unit	RWPS	
General			
Designation			
Type - Oil immersed			
Make			
Applicable IS / IEC			

Description	Unit	RWPS	
Quantity - As per requirements			
Nominal system voltage- 33	kV		
Highest system voltage - 36	kV		
Frequency - 50	Hz		
System neutral earthing type – Earthed			
Design Equipments			
Metering +Protection			
Rated primary voltage 33000	V		
Rated secondary voltage			
Winding I - $110 / \sqrt{3}$	V		
Winding II - $110 / \sqrt{3}$	V		
Rated burden of P. T			
Winding I – 100	VA		
Winding II - 200	VA		
Accuracy class			
Winding I - 0.5	%		
Winding II- 3P	%		

Tariff metering			
Rated primary voltage	V		
Rated secondary voltage Winding I - $110 / \sqrt{3}$	V		
Rated burden of P. T			
Winding I - 10	VA		
Accuracy class			
Winding I – 0.2	%		
Winding material – Copper			
Method of connection 1. Primary winding 2. Secondary winding			
Rated power factor – 0.8			
Insulation withstand level			

Description	Unit	RWPS	
a) Impulse withstand (1.2*50 microsecond) - 650	kV peak kV rms.		
b) 1 min. Power frequency withstand voltage (dry) primary	kV rms. kV rms.		
c) 1 min. Power frequency withstand voltage (wet) primary	kV rms.		
d) 1 min. Power frequency withstand voltage Secondary			
Rated /Over voltage factor and time - 1.2 continuous			
Class of insulation of winding - Oil immersed			
Max. Wdg. Temp. at 110% excitation rated burden	°C		
Total minimum creepage distance - 25 mm per kV	mm		
Temperature rise at 1.2 times rated voltage with rated burden	°C		

Temperature rise at 1.5 times rated primary voltage for 30 second	°C		
Seismic coefficient			
GA drawing indicating overall dimensions' weight, height and fixing details			

17. Current Transformers (CT)

Description	Unit	RWPS	
General			
Designation			
Type - Oil immersed			
Make			
Applicable IS			
Quantity - As per Requirements			
Nominal system voltage & frequency - 33 & 50 Hz	kV		
Highest system voltage - 36	kV		
Description	Unit	RWPS	
System neutral earthing Type – effective Earthed			
33 kV INCOMER (Power supply authority METERING) Bidder to note the detail specifications shall be given by Power supply authority later on			
Primary current	A		
Secondary current	A		
VA burden & accuracy class	VA		
33 kV INCOMER METERING, PROTECTION & SPARE) Core 1/2 / 3			
Primary current	A		
Secondary current	A		
Rated output and accuracy Core 1 (metering)- 0.2/5 VA Core 2 (protection) 5P/15VA Core 3 (Spare) 5P/15VA	VA %		

Accuracy limit factor (ALF) Core 1 (metering) Core 2 (protection) Core 3 (Spare)			
Minimum Knee point voltage (at highest ratio)			
Core 1 (metering) Core 2 (protection) Core 3 (Spare)			
Resistance of the Secondary winding As per IS			
Core 1 (metering) Core 2 (protection) Core 3 (Spare)			
Instrument Security factor (ISF)- 5 or less at minimum ratio			
Core 1 (metering) Core 2 (protection) Core 3 (Spare)			

Description	Unit	RWPS	
33 kV Transformer, Metering, Relaying, Differential Core 1/2 / 3			
Primary current	A		
Secondary current1-1-1	A		
Rated output and accuracy Core 1 (metering) Core 2 (protection) Core 3 (Spare)	VA %		
Accuracy limit factor (ALF) Core 1 (metering) Core 2 (protection) Core 3 (Spare)			
Minimum Knee point voltage (at highest ratio)			
Core 1 (metering) Core 2 (protection) Core 3 (Spare)			
Resistance of the Secondary winding As per IS			

Core 1 (metering) Core 2 (protection) Core 3 (Spare)			
Instrument Security factor 5 or less at minimum ratio			
Core 1 (metering) Core 2 (protection) Core 3 (Spare)			
Extended primary current rating (As per IS 2705)- 120%	A		
Short time current Rating - Minimum 40 Duration - 1.0	KA Sec		
Dynamic rating - 100	kA(peak)		
Temp rise at rated			
Continuous thermal current over ambient temp at site Oil Winding at the top Exposed current carrying parts Reference ambient temp	°C °C °C °C		
Variation in ratio and Phase angle error due to			
Description	Unit	RWPS	
Variation in Voltage by 1% Frequency by 1Hz			
Current density in Primary winding for Each ratio to be stated clearly	Amp/sq. mtr		
Insulation			
Class of insulation - Class E			
Maximum temp. rise of winding Ambient - 50 Temp rise	°C °C		
1.2/50 micro sec lightning impulse withstand - 650	kV(peak)		
One minute power frequency withstand - 275	kV(rms)		
Make			
Insulator			
Insulating oil			
GA drawing indicating overall dimensions weight, height and fixing details			

18. Vacuum Circuit Breakers (VCB)

Description	Unit	RWPS	
General			
Application			
Quantity			
Make			
Applicable IS / IEC			
Type of circuit breaker – SF6			
Reference Ambient temperature - 50	°C		
Phase System Voltage			
Nominal – 33kV	kV		
Highest – 36kV	kV		
Type of Neutral earthing - Through NGR			
Ratings			
Voltage and frequency 33 kV/ 50 Hz	kV, Hz		
Normal current at site Conditions - 1600/2000	A		
Short Circuit breaking current	KA		
Rate short circuit breaking capacity – 40kA	kA		
Rating Duration - 1	Sec		
Rated Short Circuit Making capacity- 100	kA peak		
Rated short – circuit breaking current capacity Percentage DC component Asymmetrical breaking current (including DC component Rated symmetrical breaking capacity for SF6 CB.	KA (r.m.s.) kA(RMS)) MVA		
Auto Reclosing pole/3 pole) - Not Required			
Maximum rise of temperature over ambient for current rating	°C		
Operating duty O - 0.3sec. – CO -3min - CO			
Clearance :			
(a) phase to phase As per IS	mm		
(b) phase to earth As per IS	mm		
Maximum temperature rise above ambient temperature due to rated current in main contacts measured after breaking test	°C		

Additional Breaking			
Current Ratings			
Maximum Line charging current breaking capacity Without over voltage Exceeding 2.5 phase neutral voltage	Amp		
Maximum Cable charging current breaking capacity And corresponding overvoltage recorded i)on supply side ii) On line side.			
Maximum shunt Capacitor bank switching capacity	MVA		
Withstand Test voltage			
1.2/50 micros lightning impulse	kV(peak		
withstand voltage i)Between line terminal and ground ii)Between terminals with circuit breaker contacts open) kV(peak)		
Dry 1 Minute power frequency test withstand voltage, for complete circuit breaker. i)Between line and grounded parts ii)Between terminals with circuit breaker contacts open	kV(rms)		
Wet 1 Minute power frequency test withstand voltage, for complete circuit breaker. i)Between line and grounded parts ii)Between terminals with circuit breaker contacts open	kV(rms)		
Total interrupting time For interruption of 10% of the rated capacity. For interruption of 30% of the rated capacity. For interruption of 60% of the rated capacity. For interruption of full rated capacity.	(milli-second)		
Arcing time	Milli-seconds		
Making time			
Rated Closing time	Milli-seconds		

Rated opening time	Milli-seconds		
No. of breaks in series / pole			
No. of spare auxiliary contacts 6 NO + 6 NC			
Rated continuous voltage for rated breaking capacity. Maximum Maximum			
Rated transient recovery voltage			
for terminal faults	kV(peak)		
First pole to clear factor	kV(peak)		
Operating Mechanism			
Motor spring charged			
mechanism			
3 pole operation			
Control Voltage – 110 DC			
Spring charging motor rating			
Power requirement of closing and tripping coil			
breaker offered (Outdoor/Indoor)			
Maximum interrupting capacity under phase opposition condition			
Maximum overvoltage			
On switching transformers on no load			
And the charging current			
Supporting insulators			
Make & Type			
Insulation Class			
Visible Corona discharge voltage			
Wet 1-minute power frequency flashover: voltage			
Dry 1-minute power frequency flashover: voltage			
1.2/50 micro-second impulse flashover voltage			
Total creepage distance for heavily Polluted atmosphere 25mm / kV			
Permissible safe cantilever loading on installed porcelain	Kg.m.		

Permissible safe compressive strength of installed porcelain	Kg.m.		
No. of poles per circuit breaker			
Breaks per pole.	Nos.		
Total length of breaks Per phase	mm		
Type of main contacts			
Material of main contacts			
Whether main contacts silver plates			
Contact pressure on main and arcing contacts	Kg.sqmt r		
Details of spring charging motor			
Type			
Rated supply voltage			
wattage			
Maximum time for charging spring			
Tripping and closing circuit voltage			
Power required for trip coil(in watts)			
Power required for closing coil(in watts)			
SF6 gas details			
Rated SF6 Gas pressure (20 degree Celsius)			
IS/equivalent standard			
Applicable for SF6 gas.			
Quantity in each pole			
Total quantity			
Spare gas quantity	%		
Seismic level	g		
GA drawing indicating overall dimensions weight, height and mounting details			

19. 33 kV / 3.3 kV Transformers

Description	Unit	RWPS	
Make			
Type			
Applicable IS / IEC			
Rated output 3000 kVA	kVA		
Quantity required 2 No's		-	

Transformer location – outdoor			
No load transformer ratio 33/3.3 kV	kV		
Number of phases - 3			
Rated frequency 50 Hz	Hz		
Impedance at all taps as per latest IS:2026/(Rev.) & IS:1180 after 2015			
No load loss on principal tap			
Load loss on principal tap and rated kVA			
Dimensions			
Weight			
Number of winding / material of conductor – Two / Copper			
Method of connection Primary winding - Delta			
Secondary winding - Star			
Vector group - Dyn 11			
LV Neutral – NGR			
Type of cooling ONAN			
Tap changer Full capacity, ON-load type on HV side with local marshalling box			
Tap range +10 %, - 10 %			
Tap step 1.25 %			
Terminal connection Bushing for primary and suitable Cable box for secondary side			
Current Transformer On LV On LV Neutral	A		
Neutral earthing Earthed through resistance to limit the earth fault current to 1000 A	A		
Insulation of Windings			
One-minute power frequency withstand voltage (dry and wet) HV -275 Kvr.m.s LV- 27 kV r.m.s	kV		

1.2/50 micro second full wave impulse withstand voltage HV - 650 kV LV -60kV	kV		
Insulation of bushings			
Rated Voltage of bushing HV -33 kV LV -3.3 Kv	kV		
One minute power frequency withstand voltage (dry and wet) HV -275 Kvr.m.s LV- 27 kV r.m.s	kV		
1.2/50 microsecond full wave impulse withstand voltage HV- 600 kV (Peak) LV – 60 Kv (peak)	kV		

Description	Unit	RWPS	
Minimum creepage distance 25 mm/kV on 33 kV and 3.3 kV	mm		
Vacuum withstand capability of transformer main tank with bushings, radiations, fitting and accessories. 250 mm of mercury			
Whether all the above details attached for each rating of transformer - Yes			

20. 33 & 3.3 kV Metal Enclosed Switchboards

Description	Unit	RWPS	
Make			
Type			
Applicable IS / IEC			
Quantity			
Dimensions			
Switchgear cubicles and Bus bar ratings			
Rated voltage, phases and frequency	kV, Hz		
System Neutral Earthing			
Maximum system voltage	kV		
One minute power frequency withstand voltage 10 Kvrms			

12/50 μ sec impulse withstand voltage 40 Kv peak			
Short circuit withstand			
Short time (1 sec) at rated voltage 40 kA for 1 sec	kA		
(ii) Dynamic rating 100 kA	kA		
Maximum temperature of bus bars droppers connectors and contacts at continuous current rating under site reference ambient temperature			
Continuous current rating of bus bar			
Bus bar material – copper			
Bus bar insulation: Fully insulated by encapsulation in epoxy resin with mould caps protecting all joints			
Switchgear constructional Requirement			
Thickness of sheet steel Frame, Frame enclosures, doors, covers and partitions			
Degree of protection IP 5X			
Colour finish shade Interior - Glossy white Exterior - Light grey semi-glossy shade of IS:5			
Earthing bus	i) Material copper		
Description	Unit	RWPS	
Vacuum Circuit Breaker Particulars			
Circuit breaker type - Vacuum (With Surge Suppressor)			
Voltage, phases and frequency			
Rated operating duty O – 3 min – CO – 3 min - CO			

Rated current at reference ambient temperature Incoming breakers			
Outgoing breakers			
Rated breaking capacity - 40 kA(rms)	kA		
Rated making current - 100 kA(peak)	kA		
Short time current withstand for 1 sec duration - 40 kA(rms)	kA		
Total break time- Less than 5 cycles			
Operating mechanism type (Normal) - Motor Charged spring for closing and tripping			
Operating mechanism type (Emergency)- Manual Spring Charged for closing and tripping			
Minimum no. of auxiliary contacts – 6 NO+ 6 NC			
Withstand test voltage			
(i) One minute power frequency			
(ii) 1.2/50 μ sec impulse			
Auxiliary control voltage (i) For closing / tripping coil - 110 V DC	V		
(ii) For spring charging motor - 240 V AC	V		
(iii) For space heaters and lighting - 240 V AC	V		
Anti-pumping feature			
Latching requirement - Tripfree			
Current Transformers			
Type - Cast resin			
Class of insulation - Class E or better			
Rated current ratio and burden (i) Incomers and bus couplers			
(ii) Outgoing feeders			
Accuracy class (i) Metering -1.0 class			

Protection - 5P10 and PS for core connected to Restricted Earth fault relay			
Short time 1 sec current rating			
Dynamic rating			
Voltage Transformers			
Type - Cast resin			
Rated Voltage	V		
(i) Primary - $33000/\sqrt{3}$ V			
(ii) Secondary – S1 - $110/\sqrt{3}$ V	V		
Method of connection			
(i) Primary – P - Star, earthed			
(ii) Secondary – S1 - Star, earthed			
Rated burden -			
Accuracy class Metering 1.0 Protection 3.0			
Insulation class - Class E or better			
Meters - Numerical Type Make			
Accuracy Class			
(i) Indicating Meters- Class 1.0			
(ii) Energy Meter- Class 1.0			
Protective Relays			
Type- Numerical Type- microprocessor based			
Auxiliary supply – 110 V DC	V		
Annunciation provided for 3.3 kV metal enclosed switch board at 3.3 kV Switch gear room. - Facia Type Clustered LED type with dual tone and communicable RS 485 port			
Annunciation provided for 3.3 kV metal enclosed switchgears at Switch gear room near wet well. Facia Type Clustered LED type with dual tone and communicable RS 485 port			

Whether Cubicle Components provided as per Particular Electrical requirement of specification.			
Whether all the above details attached for all Switchgear cubicles.			

21. 3.3 kV / 0.415 kV Transformers (Energy Efficient Transformer as per latest IS:2026 & IS:1180)

Description	Unit	RWPS	
Make			
Type			
Applicable IS / IEC			
Rated output	kV		
Quantity required – 2 nos			
Transformer location - outdoor			
No load T/F ratio 33 / 0.433 kV	kV		
Number of phases - 3			
Rated frequency			
Impedance at all taps as per latest IS:2026/(Rev.) & IS:1180 after 2015			
No load loss on principal tap			
Load loss on principal tap and rated kVA			
Dimensions			
Weight			
Number of winding – two, material of conductor- Copper			
Method of connection HV winding – Delta			
LV winding - Star			
Vector group - Dyn11			
LV Neutral - Solidly earthed			
Type of cooling - ONAN			
Tap Changer -			
Full capacity, OFF-load type on HV side with local marshalling box			
Tap range +-10 %, - 10 %			
Tap step - 2.5 %			

Terminal connection HV terminals Cable box suitable to 3.3 kV, UE, XLPE Al. Conductor, armored cable of size LV terminals – Cable box suitable for 0.415 kV XLPE, Al. Conductor armored cables of size			
Current T/F On LV On LV Neutral			
LV Neutral earthing - Effectively earthed			
Insulation of Windings			.
One minute power frequency withstand voltage (dry and wet) HV - 27 kV (r.m.s) LV - 3.5 kV (r.m.s)	kV		
1.2/50 micro second full wave impulse withstand voltage HV - 60 Kv (peak) LV - 3.5 kV (peak)	kV		
Insulation of bushings			
Rated Voltage of bushing HV – 3.3 kV LV - 1.2 Kv	kV		
One minute power frequency withstand voltage HV -27 kV (r.m.s) LV - 3.5 kV (r.m.s)	kV		
1.2/50 microsecond full wave impulse withstand voltage HV - 60 Kv (peak) LV - 12 kV (peak)	kV		
Minimum creepage distance HV - 25 mm/kV on 3.3 kV LV - 25 mm/kV on 0.415 kV	mm		

Vacuum withstand capability of transformer main tank with bushings, radiations, fitting and accessories. 250 mm of mercury			
Whether all the above details attached for each rating of transformer - Yes			

22. 3.3 k V Power Capacitor and Control Panel

Description	Unit	RWPS	
General			
Make			
Rated Capacity			
Rated voltage – 3.3 Kv	kV		
Rated frequency and phases 50 Hz, 3 Phase	Hz		
Size of cable			
Constructional Requirement			
Thickness of sheet steel. - Frame, Frame enclosures. -Doors covers and partition			
Degree of protection – IP 54			
Colour finish shade Interior: Glossy white Exterior: Light Grey Semi Glossy Shade of IS 5			
Earthing Bus	Material – copper		
Design Requirement			
Insulation level – 7.2 kV	kV		
Capacitor bank connection- Delta			
Short circuit withstand for bus bars i) Short time (1 sec)	kA		
ii) Dynamic - 62.5 kA peak	kA		
Type of switching - Automatic switching responsive to power factor through power factor sensing relay			
Rating of Switching unit for KVAR unit Three times rated capacity of kVAr unit			

Rating of capacitor duty contactor - Three times to suit KVAR unit			
Contactor - Three times rated capacity of total KVAR			
Bus bars- Copper			

23. Earthing and Lightning Protection System

Description	Unit	RWPS	
Main Earthing Grid			
Buried in earth - Mild Steel, rod / flat			
Buried in floor slabs in buildings			
Conductor Leads To Equipment (above ground)– GS			
Transformers			
Transformer neutral to bottom of tank			
From bottom of tank to earth grid			
Transformer tanks and radiator bank			
Diesel Generator Set			
DG Set neutral earthing			
DG Set body earthing			
Fence posts and gates (Flex. braid)			
H.T Metal Enclosed Switchboard, 415V switchgear/ MCC.			
Motors –			
415V Motors – GS			
Fractional horse power motors			
3.3 kV Motor - GS			
Other Items			
Capacitor panel, Battery charger panel, DC distribution board, Main lighting D.B, Control panels and sub-lighting distribution			
Description	Unit	RWPS	
boards etc. – GS			
Hand Rails			
Cable trays			
Tanks			

Junction boxes			
Lighting fixtures, receptacles, lighting conduits			
Push button stations, limit switches			
Crane rail			
Street lighting, flood lighting poles and junctions boxes			
Metallic non-current carrying structures			
Lightning Conductors			
Lightning protection down comers for building			
Lightning protection horizontal roof conductor for building			
Electrodes			
Pipe electrode			

24. Vacuum Contactor for 3.3 kV Motor Capacitor

Description	Unit	RWPS	
Make & Type			
IS /IEC			
Normal/Maximum System Voltage - 3.3 kV / 7.2 kV	kV		
Type of Panel Enclosure - Indoor Panel with IP 54			
Rated Breaking current			
Rated Current Continuous			
LBS Application - Suitable for Capacitor Bank			
Rated Short Time Current			
Maximum Temperature Rise Over Ambient - 40 °C above 45 °C ambient			
Making Capacity			
(i) Short time (1 sec) at rated voltage			
(ii) Dynamic rating			

25. FCMA for 3.3 kV Motor starters

Description	Unit	RWPS	
Make & Type			

Type, Application and criteria for sizing: In Neutral soft starter for motor (Starting current to be limited to 6 to 7 times the rated current of the motor)			
Connection - On neutral side of stator winding			
Quantity			
Rated voltage – 3.3 kV	kV		
Insulation levels - F	°C		
Rated lightning impulse withstand voltage			
Across the isolating distance - kV (peak)	kV		
Phase to phase, between phases and across open switching devices - kV (peak)	kV		
Rated short duration power frequency withstand voltage	kV		
Across the isolating distance - kV (rms)	kV		
Phase to phase, between phases and across open switching devices - kV (rms)	kV		
Installation - Indoor			
Enclosure			
Sheet steel thickness- 2.5 mm.			
Degree of protection – IP 55			
Color finish shade - Light Grey 631-IS5 Glossy white inside			
External cable details- 3.3 kV, 3C x () Aluminum, XLPE, armoured			
Type of cooling - Air cooled			
Bypass arrangement - By Vacuum contactor 3 pole			
Control supply - 110V DC / 230 V AC or Both			
Inductive Coil - Epoxy coated			
Inductive value - mH			
No of poles - Single / three			
Type of connection - Star / Delta			

26. 3.3 kV Motors

Description	Unit	RWPS	
Type - Squirrel cage Induction motor (TEFC or TETV)			
Rating			
Rated voltage -3.3 kV	kV		
Synchronous speed			
Type of mounting- Vertical			
Duty type –S1			
Method of starting – DOL			
Type of system earthing -			
Class of insulation - F	°C		
Design ambient temperature – 50 °C	°C		
Efficiency class Energy efficient Eff1 or Eff2 (Certification required)			
Limits of temperature rise of winding	°C		
- Determination by resistance method - 70°C	°C		
- Determination by ETD method -80°C	°C		
Location - Indoor			
Degree of Protection - IP55			
Cooling designation			
Terminal box- Two terminal boxes (on opposite sides)			
External cable details- 3.3 kV, 3C x () Aluminum, XLPE, armoured			
Space heater for motor As per Rating	°C		
Winding temperature sensors RTD's 6 Nos. Simplex / Duplex	°C		
Bearing temperature sensors- RTD's 2 Nos.	°C		
Vibration sensors - Two Nos.			

27. 415 V Metal Enclosed Switchgears (PCC) /MCC

Description			RWPS	
Make				
415 V Switchgear And Busbar Ratings		V		
Rated voltage phase and frequency - 415 V, 3 Ph, 50 Hz		V , Hz		
Continuous current rating of Busbars under site reference Ambient Temperature and type & material -				
Busbar insulation - Fully insulated encapsulation in epoxy resin with moulded caps protecting all joints				
Short Circuit current withstand for Busbars and droppers (i) Short time 1 sec				
Switchgear Constructional Requirement				
Earthing bus	Material copper			
Minimum clearances in air of live parts (i) Phase to Phase - 25.4 mm		mm		
(ii) Phase to Earth -19.4 mm		mm		

28. 0.415 kV Power Capacitor and Control Panel (APFC)

Description		Unit	RWPS	
General				
Make				
Rated Capacity				
Rated voltage– 415 v		V		
Rated frequency and phases - 50 Hz, 3 Phase		Hz		
Size of cable				
Constructional Requirement				
Earthing bus	Material Copper			
Design Requirement				
Insulation level				

Capacitor bank connection			
Short circuit withstand for bus bars i) Short time (1 sec) -			
Rating of capacitor duty contactor- Three times to suit kVAr unit			
Busbars - copper			

INSTRUMENTATION, CONTROL AND AUTOMATION EQUIPMENT

Instrumentation Equipment:

29. Electromagnetic Flow Meters (Full Bore)

Description	Unit	RWPS	
Make / Model			
Liner Material			
Accuracy			
Quantity followed by Meter Diameters (E.g.: 1: 300, i.e. One number of 300mm meter)	NO		
Service			

30. Electromagnetic Flow Meters (Full Bore)

Description	Unit	BPT Outlet	Pakani WTP Branch
Make / Model			
Liner Material			
Accuracy			
Quantity followed by Meter Diameters (E.g.: 1: 300, i.e. One number of 300mm meter)	NO		
Service			

31. Electromagnetic Flow Meters (Full Bore)

Description	Unit	Soregaon WTP Br.	
Make / Model			
Liner Material			
Accuracy			
Quantity followed by Meter Diameters (E.g.: 1: 300, i.e. One number of 300mm meter)	NO		
Service			

32. Radar Type Level Transmitters

Description	Unit	RWPS	
Make / Model			
Principle of Operation			
Range	Mtrs.		
Accuracy			
Quantity	NO		
Service			

33. Pressure Transmitters (Diaphragm)

Description	Unit	RWPS	
Make / Model			
Principle of Operation			
Accuracy			
Quantity	NO		
Service			

34. Pressure Gauges

Description	Unit	RWPS	
Make / Model			
Diameter of the Gauge	mm		
Accuracy			
Quantity	NO		
Service			

35. Portable Vibration Meter

Description	Unit	RWPS	
Make / Model			
Quantity	NO		
Service			

36. Junction Boxes for ICA equipment

Description	Unit	RWPS	
Make / Model			
M.O.C			
NO. of Terminals of each JB	NO		

37. Power Junction Boxes for ICA equipment

Description	Unit	RWPS	
Make / Model			

M.O.C			
NO. of Terminals of each JB	NO		

38. Alarm Annunciators

Description	Unit	RWPS	
Make / Model			
NO. of windows	NO		
Quantity	NO		

39. Two & Three Position Selector Switches

Description	Unit	RWPS	
Make / Model			

40. Flow Integrator cum Totalizer

Description	Unit	RWPS	
Make / Model			
Size			
Accuracy			
Quantity	NO		
Service			

41. Digital Panel Meters (DPM)

Description	Unit	RWPS	
Make / Model			
Size			
Accuracy			
Quantity	NO		
Service			

42. Multi-Function Energy Meters (MFM)

Description	Unit	RWPS	
Make / Model			
Measurable Parameters			
Accuracy			
Inbuilt RS-485 communication port	Y / N		
Quantity	NO		
Service			

43. Surge Protection Devices (SPDs)

Description	Unit	RWPS	
Make / Model			
Surge Rating	KA		

44. Lightning Protection Unit

Description	Unit	RWPS	
Make / Model			
Clamping Voltage & Current Rating			
Quantity	NO		

45. Analog Signal Cable for Online Field Instruments

Description	Unit	RWPS	
Make / Model			
Size of the Conductor			
NO. of Cores	NO		

46. Digital Cables for ICA

Description	Unit	RWPS	
Make / Model			
Size of the Conductor			
NO. of Cores	NO		

47. Power Cables for Online Field Instruments

Description	Unit	RWPS	
Make / Model			
Size of the Conductor			
NO. of Cores	NO		

48. Cable Conduits

Description	Unit	RWPS	
Make / Model			
M.O.C			

49. Cable Trays for control cable

Description	Unit	RWPS	
Make			

Type			
M.O.C			

50. Field Enclosures

Description	Unit	RWPS	
Make			
M.O.C			
Ingress Protection Class (IP)			
Quantity	NO		

Control & Automation Equipment:

51. Power Supply Modules for PLC CPUs

Description	Unit	RWPS	
Make / Model			
Similar Make of PLC (Yes / NO)	Y/N		
Quantity	NO		

52. Communication modules (for third Party devices integration)

Description	Unit	RWPS	
Make / Model			
Similar Make of PLC (Yes / NO)	Y/N		
Quantity	NO		

53. Digital Input Modules

Description	Unit	RWPS	
Make / Model			
Similar Make of PLC (Yes / NO)	Y/N		
NO. of Channels	NO		
Quantity	NO		

54. Digital Output Modules

Description	Unit	RWPS	
Make / Model			
Similar Make of PLC (Yes / NO)	Y/N		
NO. of Channels	NO		
Quantity	NO		

55. Analog Input Modules

Description	Unit	RWPS	

Make / Model			
Similar Make of PLC (Yes / NO)	Y/N		
NO. of Channels	NO		
Quantity	NO		

56. Analog Output Modules

Description	Unit	RWPS	
Make / Model			
Similar Make of PLC (Yes / NO)	Y/N		
NO. of Channels	NO		
Quantity	NO		

57. Interposing Relays with base terminal

Description	Unit	RWPS	
Make / Model			
Rating			
Quantity	NO		

58. PLC Programming software

Description	Unit	RWPS	
Make / Model			
Similar Make of PLC (Yes / NO)	Y/N		
Licensed Permanent (Yes / NO)	Y/N		
Quantity	NO		

59. Industrial Type Ethernet switches

Description	Unit	RWPS	
Make / Model			
NO. of Ports	NO		
Redundancy (Yes / NO)	Y/N		
Quantity	NO		

60. SMPSs for Control System

Description	Unit	RWPS	
Make / Model			
Similar Make of PLC (Yes / NO)	Y/N		
Redundancy (Yes / NO)	Y/N		
Quantity	NO		

61. UPS

Description	Unit	RWPS	
Make / Model			
Capacity	KVA		
Quantity	NO		

62. Instrumentation Control Panel (ICP) with Internal Wiring

Description	Unit	RWPS	
Make / Model			
Ingress Protection Class (IP)			
M.O.C			
Quantity	NO		

63. Fibre Optic Cable (FOC)

Description	Unit	RWPS	
Make / Model			
Size			
Single / Multi Mode			
Length of cable	Mtrs		

64. Fire Detection and Alarm System

Description	Unit	RWPS	
Fire Detector			
Make / Model NO.			
Type			
Quantity	NO		
Service			

BPT: Instrumentation Equipment:

65. Electromagnetic Flow Meters (Full Bore)

Description	Unit	At Inlet	At outlet
Make / Model			
Liner Material			
Accuracy			
Quantity followed by Meter Diameters (e.g.: 1: 300, i.e. One number of 300mm size	no		

MILD STEEL PIPELINE AND VALVES

66. Mild Steel Pipe

Description / Details of Item	Unit	Raw Water Pumping Main upto BPT	Raw water Gravity Main from BPT to WTP	
Material Grade				
Outside Diameter of Pipe	mm			
Wall thickness of pipe	mm			
Inside Diameter of Pipe	mm			
Length of Pipe	mm			
Thickness of Cement Mortar	mm			
Complying standard for cement mortar lining	mm			
Hydraulic test pressure of individual pipe	Kg/cm ²			
External Coating				
Complying standard for external coating				
Type of coating				
Thickness of each layer	mm			
Total number of layers	mm			
Outside diameter after external Coating	mm			
Field Hydraulic testing pressure of complete pipeline				

67. Line Valve (Butterfly Valve) Size

Diameter	mm			
Manufacturer	No			
Pressure Rating				

68. Flange Adaptors

Manufacturers				
Pressure rating				

69. Kinetic Air Valve Size

Manufacturer				
Pressure rating				

70. Washout Valve (Sluice Valve) 300

Manufacturer				
Pressure rating				

71. Washout Valve (Sluice Valve) 400

Manufacturer				
Pressure rating				

ADDITIONAL ELECTRICAL EQUIPMENT

72. Low Maintenance Lead Acid Battery for Pump House

S. No.	Description	Unit	Particulars	To be Furnished by Bidder
1.1	Make		As per approved vendor list	
1.2	Applicable Standards		As per tender document	
1.3	Overall dimensions (i) Each cell (L x W x H) (ii) Complete battery with rack L x W x H	mm	Bidder to furnish	
1.4	Application		Control, annunciation	
1.5	Type of battery		Low maintenance lead acid	
1.6	Battery banks required		Pump House	
1.7	Ambient conditions		Min.Temp.25 °C Max.Temp.50°	
1.8	D.C. system voltage	V	110	
1.9	Ampere hour capacity of battery at 27 Deg. C	Ah	Bidder to furnish	

	at 10 hour rate to give final cell voltage of 1.75 volts/cell			
1.1.0	No of cells required to give rated D.C. voltage		Bidder to furnish	
1.1.1	No. of spare cells		Bidder to furnish	
1.1.2	Type of cell		Bidder to furnish	
1.1.3	Momentary load/duration	A	Amps for one minute	
1.1.4	Emergency load/duration	A	Amps for two hours	
1.1.5	Continuous load/duration	A	Amps for ten hours	
1.1.6	Cell voltage – initial/final	V	2.00V/1.75 V	
1.1.7	Mounting arrangement		Multi-tier inside panel/battery	
1.1.8	Charging method proposed		Float cum boost charging	

73. Battery Charger and D.C Distribution Board Pump House

S. No.	Description	Unit	Particulars	To be Furnished by Bidder
2. 1	General			
(a)	Make		As per approved vendor list	
(b)	Applicable Standards		As per tender document	
(c)	Dimensions of battery charger Length x Depth x Height	mm x mm x mm	Bidder to furnish	
(d)	Number required	N	Two (including 100% redundancy)- for Outdoor switchyard	
	(i) Battery charger	o	One-for Pump House	
	(ii) D.C. Distribution board	s	Bidder to furnish	

(e)	DC System Voltage (Nominal)	V	110	
(f)	DC System Earthing		Unearthed	
(g)	Ambient Design Temperature	°C	50	
(h)	Busbars		Copper	
(i)	Rating	Amp	Bidder to furnish	
2. 2	DC Bus Load			
(a)	Total continuous DC load	A	Bidder to furnish	
(b)	Short time loads (Additional to continuous loads)		Bidder to furnish	
	(ii) Starting current and duration of Largest Connected DC Motor		Bidder to furnish	
2. 3	Battery Details			
(a)	Float/Trickle charging current of battery	mA	Bidder to furnish	
(b)	Boost Charging Current of Battery (Maximum)	A	Bidder to furnish	
(c)	Boost Charging Voltage of Battery (maximum)	V	Bidder to furnish	
(d)	Maximum Time for Boost charging of Battery	hr	Bidder to furnish	
(e)	Battery capacity & no. of cells	Ah	Bidder to furnish	
2. 4	AC System Data			
(a)	Supply			
	Voltage	V	415	
	Phase		3	
	Frequency	Hz	50	
(b)	(i) Variation in supply Voltage	%	± 10	

	(ii) Variation in supply frequency	%	± 3	
(c)	Short Circuit level	k A	10	
2. 5	Performance			
(a)	DC voltage setting adjustment for float charger		±10% of nominal voltage	
(b)	Voltage stabilization for constant voltage regulator		±1% of set D.C. voltage, with AC input variation and DC load variation from 0 to 100%	
(c)	Maximum permissible variation in DC voltage (no load to full load)		± 1%	
(d)	D.C. voltage setting adjustment for boost charging		70% to 100% of max. boost charging voltage	
(e)	D.C. current adjustment for boost Charging		30% to 100% of max. boost charging current	
(f)	Current stabilization for constant current regulator for boost charger		± 2%	
(g)	Minimum permissible power Factor to rated continuous load		0.8	
(h)	Permissible ripple content at rated continuous load		3% (maximum)	
2. 6	Miscellaneous			
(a)	Cable entry		Bottom	

S. No.	Description	Unit	Particulars	To be Furnished by Bidder
(b)	Cable Sizes (i) Battery	sq.mm	Bidder to furnish	
	(ii)DC output	sq.mm		
	(iii) AC input	sq.mm		
(c)	Relay for auto changeover from Float to boost mode to be		Yes	
2.7	General		Bidder to furnish	
	Provided (in case of float-cum- boost charger)			
	Constructional Features for Battery Charger & D.C. Distribution Board			
(a)	Overall dimensions of D.C.D.B(LXDXH)	mm x mm x mm	Bidder to furnish	
(b)	Thickness of sheet steel i) Frame, Frame enclosures, doors cover and partition	mm	Cold rolled 2.0	
(c)	Degree of protection		IP 4X	
(d)	Colour finish shade		Interior: Glossy white Exterior: Light Grey Semi Glossy, Shade	
(e)	Earthing bus			
	Material		Copper	
	Size-Min.	mm x mm	Bidder to furnish	
(f)	Earthing conductor (Main grid)			
	Material		Copper	
	Size-Min.	mm x mm	Bidder to furnish	

S. No.	Description	Unit	Particulars	To be Furnished by Bidder
(g)	Standard Reference drawing for Battery charger and D.C. distribution board		Bidder to furnish	

SECTION 5

**FINANCIAL BIDDING FORMS
(PRICE SCHEDULES)**

SECTION 5

FINANCIAL BIDDING FORMS (PRICE SCHEDULES)

PREAMBLE TO PRICE SCHEDULES

1. General

1.1 Two price schedules as under are prepared for the BID.

Price Schedule 1 : Design and Construction of Augmentation to Solapur City Water Supply Scheme

(Including Price Schedule 1A)

Price Schedule 2 : Operation and Maintenance of Augmentation to Solapur City Water Supply Scheme for 5 years

The Bidder shall quote a single lump sum price for all activities and items required for Design and Construction of Water Supply scheme in Price Schedule 1 and lump sum price for each item in price schedule 1A. In case of any variation in total quoted price in Price Schedule 1A and 1, the lowest amount mentioned will prevail.

As regards Schedule 2, the bidder shall quote a single Lump sum price for year wise operation and maintenance.

1.2 The quoted price shall include excavation in all types of strata including rock, dewatering and all the leads, and lifts of all material. No extra payment for change in variation of strata for any item shall be admissible.

1.3 The price quoted shall be inclusive of;

1. All applicable taxes, levies, insurance and royalties.

2. All survey and all investigation works.

- 1.4 The price quoted in Price Schedule 2 shall be inclusive of consumables, oil, lubricants, spares, Supervisory and & O & M staff, and all things necessary for O & M. and all training and advisory services specified in the Employer's Requirements, but exclusive of charges for drawl of raw water and power consumption's cost.
- 1.5 The bidder is bound to submit the detailed breakup of his Lump Sum quoted price in the Price Schedules including breakup of taxes included therein for evaluation / comparison purposes, if requested by the Employer. However, such details shall be kept strictly confidential by the Employer.
- 1.6 The successful tenderer shall maintain complete records of duties, taxes, levies, royalties payable and paid to various authorities in respect of this project and submit the details / records in case demanded by the Employer.
- 1.7 The scope and extent of the works are to be ascertained by reference to the requirements of the contract document as a whole and shall not be limited in any manner whatsoever by the indicative descriptions of the sub work given in this price Bid.

2. Payment Schedule

- 2.1 Payment for items in respective Price Schedule shall be made in accordance with Annexure 2 to this Preamble. Such payments shall be subject to deductions in respect of repayment of any advance payment granted by the SCDCL and deductions in respect of retention money pursuant to the Conditions of Contract.

3. Payable rate for quantity variation

Payable rate for variation in quantity of pipe line and other works only shall be on the basis of formulae given under applicable "Detailed break up of respective sub-work."

4. Currency of payment

The lump sum price to be quoted by the tenderer in Price Bid shall be in Indian rupees only and shall be paid accordingly.

5. The Contractor shall be fully responsible to ensure that the whole of the works and system including each individual component, is designed and constructed in a manner so that the system as a whole operates as a fully integrated system which is capable of achieving the required output in an efficient and economical manner, and include all plant, equipment and accessories required for the safe and satisfactory operation of the facilities. To achieve this, the Contractor shall ensure that each individual component performs in a manner which is complimentary to that of all other components. Any accessories which are not specifically mentioned in the specifications, but which are usual or necessary for completion of the works and successful performance of the system and facilities shall be provided by the Contractor within the tendered cost. The Contractor shall to the maximum extent practical and feasible, endeavor to standardize on the manufacture and supply of plant and equipment so as to minimize the operation and 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.
6. In operation and maintenance period payment will be made against cost put to subsequent year. No price escalation will be given in operation and maintenance period.

PRICE SCHEDULE

1.0 Summary of Prices (On Bidders Letterhead)

Particulars	Amount (Rs in Crore) in Figure	Amount (Rs in Crore) in Words
Quoted Price Schedule 1 - [M]	"[A]"	"[A]" in words
Total of NPV Quoted Price Schedule 2 - [N]	"[B]"	"[B]" in words
Total Price quoted - [M+N]	{"[A] + [B]"}	{"[A] + [B]" in words

Bidding Criteria {[A]+[B]} in words or {[A]+[B]} in figures, whichever is lowest amongst the two shall be subject to compliance as per Section 1, Clause 38

Date

Authorized Signature

Name

Designation

Tenderer's Name & Address

Telephone, Email & Mobile No.

Employers ID Code / Aadhar Card No.

Note:

1. The summation of price Schedule – 1A, (17 items) shall match – [A] in figures and in words with Price Schedule -1
2. The bidder shall mention the same price in figures and in words in the summary of prices.
3. The bidder shall mention in price Schedule - 2 the NPV of 5 years in figures and in words and this shall match with the figures and words mentioned in Summary of Prices.
4. If any discrepancies are observed, SCDCL reserves the right to ask for clarification / reject the bid / consider the lowest amount mentioned, at the risk and cost of the bidder.

2.0 Price Schedule – 1: Design and Construction (On Bidders Letterhead)

Particulars	Unit	Amount (Indian Rupees) in Figures	Amount (Indian Rupees) in Words
Augmentation to Solapur City Water Supply Scheme. (Ujani dam as a source – 110 MLD) Design, build, testing and successful commissioning of water supply Scheme abide by all tender conditions of contract.	Lump Sum	“[A]”	“[A]” in words

Date

Authorized Signature

Name

Designation

Tenderer’s Name & Address

Telephone, Email & Mobile No.

Employers ID Code / Aadhar Card No.

3.0 Price Schedule – 1A: Detail of Sub - work. Mentioned in Price Schedule 1

Sub Work number	Name of Sub-work	Unit (Lump Sum)	Related Sub-Section of Part II	Amount (Indian Rupees) in Figures	Amount (Indian Rupees) in Words
1	Survey, Investigation including Geo-tech Investigation and Design		6A, 6C.1		
2	Construction of Jackwell with over head Pump house		6A, 6C.1, 6C.2, 6C.7		
3	Construction of Approach Channel		6A, 6C.1, 6C.2		
4	Construction of Approach Bridge (120 M)		6A, 6C.1, 6C.2		
5	Construction of Approach Bund (120 M)		6A, 6C.1, 6C.2		
6	Raw Water Pumping Machinery		6A, 6C.1, 6C.2, 6C.7		
7	Raw Water Pumping Main from Jackwell to BPT at Varwade		6A, 6C.1, 6C.3		
8	Construction of Break Pressure Tank (BPT) at Varawade		6A, 6C.1, 6C.5		
9	Raw Water Gravity Main from BPT at Varwade to Soregaon WTP		6A, 6C.1, 6C.3		
10	Raw Water Gravity Main to Pakni (Tapping the Proposed Gravity Main for Pakni WTP)		6A, 6C.1, 6C.4		

Sub Work number	Name of Sub-work	Unit (Lump Sum)	Related Sub-Section of Part II	Amount (Indian Rupees) in Figures	Amount (Indian Rupees) in Words
11	Railway Crossings at Modnimb, Mohol and Bale Track (3 Nos.)		6A, 6C.6		
12	Laying of Pipeline along Pune-Solapur National Highway No. 65 and NH Crossings (2 Nos.)		6A, 6C.6		
13	Laying of Pipeline along various State Highways and SH Crossings (8 Nos.)		6A, 6C.6		
14	Pipeline crossing MDR, ODR and other Village Roads for Raw Water Rising Main		6A, 6C.6		
15	Pipeline crossing MDR, ODR and other Village Roads for Raw Water Gravity Main		6A, 6C.6		
16	Canal and Nala Crossings for laying pipeline		6A, 6C.6		
17	Sina River Crossing for laying pipeline		6A, 6C.6		
	Total of 17 Item			“[A]”	“[A]” in words

4.0 Price Schedule – 2 : Operation and Maintenance (On Bidders Letterhead)

Particulars	After completion of scheme	Unit (Lump Sum)	Amount (Indian Rupees) in Figures	Amount (Indian Rupees) in Words	Discounting factor to calculate Net Present value (NPV)	Net Present Value (Indian Rupees) in Figures	Net Present Value (Indian Rupees) in Words
1	2	3	4	5	6	7= (4x6)	8
Augmentation to Solapur City Water Supply Scheme. (Ujani dam as a source – 110 MLD) Lump sum amount for Operation & Maintenance of water supply project for each year after commissioning of the Scheme abide by all tender condition.	Year 1				0.794		
	Year 2				0.735		
	Year 3				0.681		
	Year 4				0.630		
	Year 5				0.583		
Total of 5 years						“[B]”	“[B]” in words

Date

Authorized Signature

Name

Designation

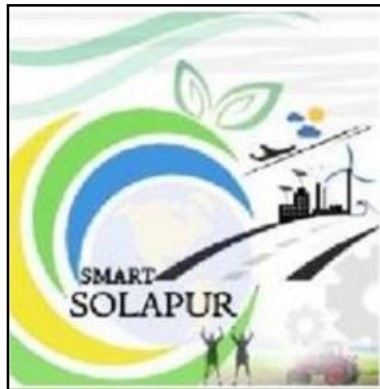
Tenderer’s Name & Address

Telephone, Email & Mobile No.

Employers ID Code / Aadhar Card No.



Solapur City Development Corporation Limited



Tender No.

Augmentation to Solapur City Water Supply Project (Ujani Dam as a source – 110 MLD)

On

**Design, Build, Maintain, Operate and Transfer (DBMOT)
Basis**

Part - II: EMPLOYERS REQUIRMENTS

Section 6A : GENERAL REQUIREMENTS

NOVEMBER 2018

SUB-SECTION 6A.1

PROJECT REQUIREMENTS

SUB-SECTION 6A.1: PROJECT REQUIREMENTS

1.1 Project Region

Brief History of Solapur:-

Solapur is an ancient historical place dating back to year 90 BC. Solapur is one of the important city in Maharashtra state. It is an important trading place with fusion of four linguistics viz., Marathi, Kannada, Hindi and Telugu.

Geographical Location and Communication

The city Solapur is spread approximately between 17° 0' 36" to 17° 0' 42" N latitude and 75° 0' 50" to 75° 0' 58" E longitude. (Survey of India, toposheet, No. 47-O/14). It is well linked by Rail, Pune - Hyderabad broad gauge line to Pune, Mumbai and Hyderabad, Gadag, Hubli. The road linkage is through four lane National Highway No. 65 from Pune and Mumbai. It is connected to Hyderabad by National highway. It is also connected to Vijaypur and Kalburgi in Karnataka as NH-52. NH-9 also passes through the city. The city is situated 475 km South East of Mumbai. The city has an airport, however, no regular commercial air services are flying.

Economic Drivers

The Solapur city has following historical economic drivers

- The textile manufacturing particularly towels, bed sheets and chaddars
- The Bidi manufacturing
- Cement plants at about 8 Km

Large trading center for the South Maharashtra, North west Andhra Pradesh and north east Karnataka.

Apart from the above, the recent development are the 1350 MW power plant of NTPC being set up at @ 18 Km from Solapur. The work is partially commissioned

in 2017. Two more cement factories are lined up by the side of it. M/S Kalyani forge is setting up its forging plant nearby. The city is also developing as education hub with Solapur University, Government medical college, several engineering colleges and other institutes like Sinhgad and two such groups. Good hospitals are developing in the city which will provide health facility to adjoining areas stated above. The MIDC has two Industrial areas in the city. An airport is coming up at Boramani for Solapur.

1.2 Augmentation to Solapur City Water Supply Project

1.2.1 Project Background

Solapur Municipal Corporation has proposed to supply water to Solapur City through piped water supply scheme on bulk supply basis. The project is designed to supply 110 MLD raw water from Ujani dam to WTP at Pakni and Soregaon of Solapur City. The project has been funded by Solapur City Development Corporation Limited, Solapur (SCDCL) and NTPC. The proposed source of the project is under submergence of Ujani dam which is 100 Km from Solapur City.

It is proposed to construct Head works of capacity 300 MLD at Ujani dam with Approach Channel, with Pump House and Approach Bridge. Water will be pumped through Vertical Turbine pumps of appropriate capacity to proposed BPT at Varawade of suitable capacity through MS Pipe Raw water rising main of length 28.50 Km. Water from BPT will be gravitated through MS Pipe to proposed WTP at Pakni and at Soregaon (Both WTP Proposed in Phase II of Project) of length 81.50 KM. The raw water gravity main designed for the capacity 110 MLD up to Soregaon WTP. Necessary Road/Railway/ River/ Nala crossings are proposed in the scheme with 3 months trial run and 5 years O&M.

1.2.2 Objectives of the Project

The broad objective of the Aug. to Solapur Water Supply Project is to lift adequate raw water from Ujani Dam to meet the water demand of Solapur City for the year 2035.

1.2.3 Guidelines

Guidelines in following manuals and Institutions shall be generally followed for designing the project components and framing the project.

- Manual on Water Supply and Treatment by CPHEEO
- WHO guidelines for drinking water quality

The system design, selection of process and material of construction for various components shall achieve the following objectives as per guidelines in CPHEEO Manual on Water Supply and Treatment.

- Supply safe and clear water treated to acceptable standard as per WHO Standards / IS 10500
- Adequate quantity
- Economical pumping and transmission system aiming at conservation of energy
- Water conservation, low leakage and reuse wherever feasible
- Design life as given in Manual on Water Supply and Treatment published by CPHEEO and in this section

1.3 Source and location of Jackwell

1.3.1 Ujani dam

The Ujani dam is constructed in 1980. In summer/draught conditions the river flow reduces then it became essential to release water from Ujani dam to sustain the River Bhima water supply scheme. Therefore a water supply system of 80 MLD capacities was planned from Ujani dam and was completed and commissioned in 1998. The Ujani dam is located at village Ujani on River Bhima at a distance of @100 Km from Solapur. The dam has a very large capacity and 54% of total storage is below MDDL of canal and hence it is highly reliable for drinking water supply systems of the size of Solapur.

The salient features of Ujani dam are presented in below table

Table - Salient features of Ujani dam

S.N.	Particulars	Details
1	Dam name	Ujani, Taluka - Madha, Dist - Solapur
2	River name	River Bhima
3	Location	At Ujani 100 Km north east of Solapur
4	Project start and completion dates	1968 - 1980
5	Catchment area	14856 Sq. Km.
6	Length of dam	2534 m
7	Type of dam	Earthen with central concrete spillway
8	River Bed Level	462.50 m
9	MDDL	491.03 m
10	FRL	496.83 m
11	MWL	497.58 m
12	Gross Storage	3320 Mm ³
13	Live storage	1521 Mm ³
14	Dead storage	1799 Mm ³
15	Overflow section capacity	15717 m ³ /sec
16	Ownership of dam	Irrigation Department, GoM

1.3.2 Location of Jackwell

It is proposed to lift water at Ujani Dam by constructing Jackwall with rose pieces and sluice gates, Pump House and Approach channel, Approach Bridge and Approach bund. This proposed Head works is starting point of the project. The location is about 100 km from Solapur city.

1.4 Location of BPT

Proposed Break Pressure Tank (BPT) is located near Varwade Toll Plaza on Pune to Solapur National Highway No. 65. Incorporation of BPT is of paramount importance as due to BPT, downstream lines function as gravity main and are free from transient pressures and thus frequency and extent of maintenance and repairs are significantly reduced.

Suitable location is available at high ground located near Varwade Toll Plaza on Pune to Solapur National Highway No. 65. Due to introduction of BPT, almost entire 81.50 km long raw water transmission system shall function as gravity main

1.5 Brief Description of Water Supply Project

Location of source and Head works, Breaks Pressure Tank (BPT) and water treatment plant are discussed in paragraphs 1.3, and 1.4 above. Pumping mains and gravity mains are planned by shortest and feasible transmission routes along roadside.

Overall working requirement of the system are as under:

- i) Daily operation period - 22 hours / day
- ii) Daily Water Demand - 110 ML/day

Capacities of Jackwell are accordingly designed with due allowance for leakage losses.

Components from Jackwell to BPT are shown in Flow Diagram in tender drawings and are as follows:

- i) Head works which includes , Approach Channel, Approach Bridge, Approach bund and raw water pumping station over .
- ii) 28.50 km long raw water pumping main along NH -65 including water hammer control device for protection of the pumping main from water hammer pressures.
- iii) Break pressure tank near Varwade Toll plaza.
- iv) Raw water gravity main from BPT to WTPs at Pakni and Soregaon L=81.50 KM
- .v) Additional following crossings are involved

- Railway track Crossing near Modnimb Railway Station, Mohol Railway Station and Bale Railway Station which will be done by pushing MS casing pipe under railway track and pipeline within MS casing pipe. Preparation of proposals, taking necessary permission from Railway department and execution of work is under this contract.
- Crossing on NH-65 at Pakni and Kegaon which will be done by pushing MS casing pipe under National Highway and pipeline within MS casing pipe. Preparation of

proposals, taking necessary permission from National Highway Authority and execution of work is under this contract.

- Crossing of 8 No. en-route State Highway which will be done by pushing MS casing pipe under State Highway and pipeline within MS casing pipe. Preparation of proposals, taking necessary permission from State Highway Authority and execution of work is under this contract.
- River, Canal and Nala crossings comprising crossing below bed level for Seena River. In addition, number of minor crossing for Canals, nala and small water courses are encountered. Most of the crossings shall be by laying pipeline below bed level. Preparation of proposals, taking necessary permission from concerned Authority and execution of work is under this contract.

1.6 Scope of Contract

1.6.1 Activities Included

The contract is for Design, Build, Maintain, Operate and Transfer (DBMOT) for the works and components included in description of water supply project and scope of the works. The scope of contract includes following activities for entire works.

- Raw water analysis, survey and geotechnical investigation
- Design
- Manufacture, Inspection of material, plant and equipment at factories and supply
- Storage, erection or build and pipeline laying
- Trial run and pre-commissioning tests and checks
- Commissioning of the work and performance test
- Any activity not listed above, but is essential for the completion of works
- Training to employer's staff
- Operation and maintenance of works for 5 years.

1.6.2 Detailed Scope

The scope of the work for the Contractor who will execute the works and guarantee plant and process performance will include, but will not be limited to the following:

- All preparatory work including clearing and leveling of site, site grading/ dressing of site as per specified formation or finished ground level (FGL), provision of access roads etc., excavation, dewatering as required and disposal of all surplus earth to a suitable location;
- Carrying out required raw water analysis;
- Necessary topographic survey and geotechnical investigation and any other investigation(s) as considered necessary for pipeline profile, layout of Jackwell, BPT, deciding foundation level, type of foundation and profile, bridge foundations etc. and reconfirming hydraulic levels at Ujani dam.
- Prepare process and hydraulic design with layout and hydraulic flow diagram of the complete water treatment plant, with wastewater reuse to minimize losses, to meet the treated water quality parameters;
- The entire Project shall be green, clean and sustainable (energy efficient).
- The Headwork site shall be under CCTV coverage.
- Undertake complete detailed engineering design and development of the water supply system including civil structural works, pipeline work, mechanical, electrical and instrumentation equipment and allied works with construction drawings, to ensure performance, and before approval of Employer it should be checked and recommended by Indian Institute of Technology, Bombay (IITB) and shall include;
 - Design, drawings, data sheet, samples etc. and specification;
 - General arrangement drawing and architectural drawings of structures, buildings etc.
 - Structural design and drawings including reinforcement details
 - Detailed working drawings on basis conceptual design and plan approved

- After approval of the designs and drawings by the Employer's representative or the Employer, the Contractor will commence implementation of civil, mechanical, electrical and instrumentation and allied works;
- Execution will include setting out and complete execution as per approved civil construction drawings to suit equipment requirement;
- Placing of order, manufacture, third party inspection report, testing at place of manufacture, inspection by the Employer or Employer's representative, supply after painting and packing, transport, delivery, storage, erection/ installation, testing and commissioning of the plant;
- Expenses for the inspection by the Employer or his Representative at place of manufacture in India or abroad should be borne by the contractor.
- Providing as built drawings for all components in soft and hard copy;
- After satisfactory testing and commissioning of the complete scheme, to meet the performance requirement, the Contractor shall maintain and operate the scheme for a period of 5 years including defects liability period stated in condition of contract;
- Contractor shall provide the operation and maintenance manuals in Marathi and English language for the scheme and shall update them regularly;
- Contractor shall provide all services including manpower as designated in the bid documents, tools and spares etc. required to operate the scheme successfully to meet the required product water quantity;

1.6.3 Other Incidental Works

The contract also includes following incidental works and cost of all such works shall be borne by the contractor.

- i) Setting up of suitably equipped / manned field offices for supervision of the works for the Contractor's staff and the Employer's Representative and Engineers.
- ii) Development of suitable storage spaces for construction material and equipment to be received for the works.

- iii) Identification of suitable quarries/sources for construction material and get them approved from the Employer's Representative.
- iv) Setting up, and staffing with qualified engineers / technicians, of suitable laboratories for observing the Quality Standards.
- v) Setting up of suitable labour camps with all water and sanitation arrangements and other facilities required under the relevant Labour Laws.
- vi) Disposal of surplus excavated material, muck and water etc. to identified and approved site.

1.6.4 Completeness of the Works and Project

The Contractor shall be fully responsible to ensure that the whole of the works and system including each individual component, is designed and constructed in a manner so that the system as a whole operates as a fully integrated system which is capable of achieving the required output in an efficient and economical manner, and include all plant, equipment and accessories required for the safe and satisfactory operation of the facilities. To achieve this, the Contractor shall ensure that each individual component performs in a manner which is complimentary to that of all other components. Any accessories which are not specifically mentioned in the specifications, but which are usual or necessary for completion of the works and successful performance of the system and facilities shall be provided by the Contractor within the tendered cost. The Contractor shall to the maximum extent practical and feasible, endeavor to standardize on the manufacture and supply of plant and equipment so as to minimize the operation and 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.

The works, plant and item shall be selected, designed, manufactured, erected and commissioned to meet following essential requirements.

- Suitable for design life specified in Sub Section 1.8

- Energy conservation shall be of vital importance. Particularly high energy consuming equipment e.g. pumps, motors and transformer, cables etc. shall be selected such that the equipment operates at optimum efficiency level and energy consumptions are minimum
- Maintenance and repair requirement shall be minimized
- Access to all components of plant / equipment / item shall be feasible
- Adequate clear space shall be provided for staff to attend the component for maintenance of any component of plant and equipment

1.7 Design Life

“Design life” means the period for which an item or works is designed to operate at full design output without major overhaul involving extensive dismantling, serious erosion and corrosion or necessity for substantial renewal of any anti corrosion system, reduction of efficiency in excess of 5%, or replacement of major components essential to the functioning of the item etc. except for consumables and for any limited life components explicitly agreed at the time of contract award.

Minimum design lives shall be as follows:

a)	Roads, structure of concrete, brick or block work	- 60 years
b)	Pipelines and valves	- 30 years
c)	Pumps, motors, electric actuators	- 15 years
d)	Lifting equipment, control panels, generating sets, transformers, switchgear, cabling, air blowers, compressors, process plant, electrical installations, building services etc.	- 20 years
e)	Chlorination equipment	- 10 years
f)	Instrumentation, control and automation	- 10 years
g)	Computer systems	- 5 years

All items and systems shall be designed to allow replacement or major overhaul at the end of the design life without requiring major work or dismantling of other items which interrupt operation of independent items and systems.

1.8 Defect liability period -

1	Pumping machinery and other allied mechanical, electrical installation (excluding those in the treatment plant contract), surge arrestors, water hammer control devices, chlorinators (excluding those provided in the treatment plant contract)	Five Years
2	WTP/ESR/GSR/BPT, Sump and Pump House, Balancing Tank Etc. head works, approach bridge	Five Years
3	Pipe Lines - Pumping Mains, Gravity Mains, Leading Mains including all the fixtures	Five Years

Note :- Ten percent amount will be withheld from performance security depending upon the nature of work, till the defect liability period is over.

SUB-SECTION 6A.2

CONTRACT ADMINISTRATION

SUB-SECTION 6A.2: CONTRACT ADMINISTRATION

2.1 General

The Contractor shall be responsible for administration of the Contract from award of Contract through design, manufacture, manufacturer's works testing, and delivery of Plant to Site, installation, commissioning, testing and performance providing to final take over.

The employer lays great importance on all aspects of contract administration including setting up design and field offices deployment of Contractor's key staff, their qualifications and experience, duties, responsibilities and authorities defined and delegated to them, and all aspects of works management including finalization of vendors and subcontractors, with prior approval of Employer placement of work orders and purchase orders, pre- delivery third party inspection and testing, storage, erection and commissioning.

The Contractor shall submit to the Employer's representative a diagram showing the structure of the organization for administration of the Contract. This structure shall include a project managing organization as part of the Contractor's organization.

The structure diagram shall state the names of the firms to be employed to carry out the following portions of the works:

- Process plant;
- Mechanical plant;
- Electrical plant;
- Instrumentation, control and automation systems;
- Civil works

Designs, drawings and documents that are required to be submitted to the Employer's representative for approval shall be considered as bonafide by him only if

they have been submitted by the Contractor’s representative. Prior to submission, IIT Bombay will review and recommend for approval of design, drawing and document submitted by Contractor. Each item submitted shall be stamped “checked by name and designation”, dated and shall be clearly identified as to its final location and function.

2.2 Contractor’s Design Office in Project Area

The Employer requires a high level of input for the initial investigation and design phase and requires the Contractor to be prepared with all necessary inputs so as to not lose time at the beginning of the Contract in these activities including approval of various designs and drawings. It is expected that the Contractor shall mobilize the necessary Design engineers as stipulated in these documents and equipment and base them at a location approved by the employer immediately after receipt of the Letter of Acceptance issued. The Contractor shall make the office functional within two weeks. The office will have required furniture, computer hardware required Design software packages with valid licenses, printers, plotters, projection system with screen and other office requirements. It shall have design team of qualified personnel for preparing and submitting the necessary design and drawings for all activities.

2.3 Project Management Team

Table 2.1: General Management

GENERAL MANAGEMENT (FOR 2.50 + 5 YEARS)				
S. NO.	POSITION	NO	QUALIFICATION	REMARKS
1	Project Manager	1	BE/ ME, MBA	20+ Years
2	Assistant Manager (Execution/Operations)	1	BE/ ME Civil, MBA	10 years
3	Assistant Manager (Planning & Co-ordination)	1	BE/ME, MBA	10 years
4	Assistant Manager (Civil Engg)	1	BE/ME Civil	10 years
5	Senior Engineer (Electro-Mechanical Engg.)	1	BE/ME Electrical/ Mechanical Engg	10 years
6	Statutory Auditor/Accountant	1	M.com	10 years

The staff will be deployed after approval of their CVs by the Employer. Initially the CVs of key personnel to be deployed will be submitted in the bid. The staff as mentioned above shall be deployed well in advance when the works on the relevant field are being actively carried out. The Contractor will be expected to arrange and maintain experienced workers and foremen and other support staff as required on sites in sufficient numbers.

2.3.1 Contractor's Representative

The Contractor's representative shall be minimum a graduate in engineering with at least 10 years of experience in contract management in field of water supply.

Specific responsibilities of the Contractor's Representative shall be:

- (a) The sole representative on behalf of the Contractor in all discussion, correspondence and matters related to the Works.
- (b) He shall be delegated with power of attorney to sign on behalf of contractor on all issues related to contract and payments.
- (c) The co-ordination and monitoring of Contract progress, which shall include the preparation of the Contract programme, monitoring of progress and submission of monthly progress reports. At the discretion of the Employer's representative, regular meetings shall be called at which the Contractor's Representative shall give a full account of the Contract progress and programme.
- (d) The Contractor's Representative shall be responsible for co-coordinating the design, technical information and data between sub-contractors. All calculations, drawings and information submitted to the Employer's representative shall be checked by the Contractor's Representative and certified as having been checked before submission.

- (e) The Contractor's Representative shall attend all meetings involving the Contractor and the Employer's representative
- (f) The co-ordination and programming of inspection and testing at manufacturer's works and the submission of test certificates.
- (g) The co-ordination and programming of Plant delivery.
- (h) The co-ordination and programming of the installation of Plant on the Site, all tests and commissioning.
- (i) The Contractor's Representative shall be responsible for the various sub-contractors. At the discretion of the Employer's representative regular site meetings will be held during which the Contractor's Representative shall give full account of site progress and programme.
- (j) The Contractor's Representative shall also be responsible for producing in advance of the work being undertaken, detailed method statements of any work, which involves or affects the performance of existing equipment, processes, or disruption to existing water supplies.
- (k) The co-ordination and preparation of As-Built Drawings and operating and maintenance manuals.
- (l) The preparation and co-ordination of training.
- (m) The submission of applications for payment.

The Contractor at his discretion may delegate some duties and authority to the Project Manager with prior approval of the Employer.

2.3.2 Key Staff of Contractor

a) Project Manager

Project Manager shall be a person deployed by the JV/Consortium/Contractor as an overall in-charge for the works and shall be deployed at project office. He should be a senior level staff member of the Lead firm of the consortium. He shall be minimum graduate in engineering with at least 20 years of experience in execution of works in water supply sector.

He shall be responsible for day to day progress of works at site and all matters related to site works.

He may perform some of duties and responsibilities of the Contractor's representative with prior approval of the Employer.

b) Assistant Managers

There shall be one or more Assistant Manager for each of the major components of the Contract – Jackwell, Water Treatment Plant, Pipelines, ESRs, Mechanical, Electrical and ICA Works. The Assistant Manager shall have minimum following qualifications:

Education: B.E. (relevant discipline)

Experience: Minimum 10 years of general field supervision of Contracts and minimum 8 years experience in supervision in construction/erection of similar works.

c) Supervisory Staff

There shall be supervisory staff with the following minimum qualifications deployed in sufficient numbers to ensure day to day quality supervision of the work:

Education: B.E. in relevant discipline with minimum 8 years experience in relevant field or Diploma Holder in relevant discipline with 15 years field experience in relevant field. Safety Engineer shall be qualified in Safety Engineering.

Table 2.3: Construction & Execution phase

CONSTRUCTION & EXECUTION PHASE (2.50 YEARS)				
Sr	POSITION	NOs	QUALIFICATION	REMARKS
1	Senior Construction Engineer Civil	1	ME Env. Engg., ME Struct.Engg.	10 – 15 years
2	Engineers Civil	6	BE in Civil/Env Engg	5 – 10 years
3	Engineers Mech/Elect.	1	ME / BE Mech/Elect	5+ Years
4	Safety Engineers	1	Bachelor in relevant field	3+ years
5	Support Engineers and Staff		As required and approved by the Owner	

2.4 Programme

In accordance with Clause 8.3 of the Conditions of Contract, the Contractor shall within a time specified in the Appendix to the Tender, submit a detailed contract programme for approval, which shall include details of survey and geotechnical investigation works, all temporary and permanent works, construction procedures and methodologies.

In addition to the requirements set down in the Conditions of Contract, the programme shall include the following details:

- (a) Contractor's organisational structures for the Contract including details of all key staff and their responsibilities;
- (b) A statement giving the numbers and categories of supervisory staff and skilled and unskilled labour to be employed on the Works;

- (c) A list and type details of major constructional plant (including vehicles) which the Contractor proposes to employ on the Works, including programmed dates for order and delivery;
- (d) Details of the Contractor's methods of working for all operations;
- (e) A statement giving the proposals for location or locations and sizes of offices, workshops and stores at the Site, pipe manufacturing units and labour camps;
- (f) A complete resource allocation showing the number of units and allotted times for each unit of constructional plant, materials and labour allocated to each part of the Works;
- (g) Particulars to be shown on the programme shall include:
 - Submission of designs, drawings and documents
 - Employer's representative's approval procedures / review procedures
 - Re-submission of drawings etc. as necessary and review
 - Civil construction of each major structure
 - Placing of orders for Plant
 - Plant manufacture
 - Plant tests at place of manufacture
 - Plant deliveries to site
 - Plant erection
 - Plant tests at site
 - Tests on completion (commissioning tests)

The programme shall be co-ordinated to take into account the requirements of climatic, groundwater and other conditions to provide for the completion of the Works in accordance with the Contract.

The programme shall be prepared using MS Project software such as primavera or equivalent and shall be submitted in both soft (editable and PDF) and hard copies.

The programme shall be updated every month and as and when requested by the Employer’s representative to show actual progress and required revisions.

2.5 Milestones

Consistent prorata progress on all components of the Contract during the entire Contract period shall be achieved. The key milestones set out in Table 2.3, or such other Milestones as may be proposed by the Contractor and agreed by the Employer at the time of bidding, are proposed to be adopted for periodic review of the progress of various components. These milestones will be the stages when the decisions regarding any delay in the implementation will be taken with a view towards the application of the provisions of Clause 8.0 of the Conditions of Contract.

Table 2.3: Milestones of Works Description

S. N.	Work Description	Time from Date of Notice to proceed (months)							
		4 months	8 months	12 months	16 months	20 months	24 months	28 months	30 months
1	Mobilization								
	Establish site & Design offices	100%							
	Set up laboratory	100%							
	Site surveys and investigations	100%							
	Finalization of work plan	100%							

S. N.	Work Description	Time from Date of Notice to proceed (months)							
		4 months	8 months	12 months	16 months	20 months	24 months	28 months	30 months
2	Jackwell & raw water pumping station								
	Design	100%							
	Civil works		50%	75%	100%				
	Mechanical Works					50%	75%	100%	
	Electrical works					50 %	75%	100%	
	Campus development		100%						
	Trial Run and Commissioning								100%
3	Raw water pumping main from Jackwell to BPT								
	Design	100%							
	Supply of pipes valves and allied equipment's		100%						
	Work completion			50%	50%				
	Surge control system					100%			
	Hydraulic testing						100%		
	Trial Run & Commissioning								100%
4	Break pressure tank								
	Design	100%							
	Civil works		25%	50%	75%	100%			
	Supply of pipes, valves and allied equipment's		100%						
	Testing						100%		
	Trial Run & Commissioning								100%

S. N.	Work Description	Time from Date of Notice to proceed (months)							
		4 months	8 months	12 months	16 months	20 months	24 months	28 months	30 months
5	Raw Water Gravity Main from BPT to Pakni and Soregaon								
	Design	100%							
	Supply of pipes, valves and allied equipment's		100%						
	Laying & valve chambers			20%	40%	65%	80%	100%	
	Hydraulic testing							100%	
	Trial Run & Commissioning								100%
6	Crossings (Railway, NH, SH, MDR, ODR, Canals, River, Nallas)								
	Design	100%							
	Supply of piping and allied valves		25%	50%	75%	100%			
	Laying & encasing			25%	50%	75%	100%		
	Hydraulic testing							100%	
	Trial Run & Commissioning								100%

S. N.	Work Description	Time from Date of Notice to proceed (months)							
		4 month	8 month	12 months	16 months	20 months	24 months	28 months	30 months
7	33 kV/3.3 kV/415 V Substations								
	Design	100%							
	Supply of material & equipments				100%				
	Work completion					50%	100%		
	Trial Run & Commissioning							100%	
8	Instrumentation								
	Design	100%							
	supply			50%	100%				
	Work completion				25%	50%	75%	100%	
	Trial Run & Commissioning								100%

2.6 Monitoring of Progress, Progress Reports and Meetings

Each month the Contractor shall submit to the Employer's representative six copies of a written detailed progress report as per Clause 4.21 of GCC and showing the stage reached in the execution of the Works. The report shall show progress to the end of the preceding month with respect to the approved Contract programme and output of project management software. The reports shall be accompanied by such additional information in approved form as may be required by the Employer's representative. The reports shall be forwarded promptly so that on receipt the content is not more than seven days out of date.

The report shall show status of all activities required by the Contract such as design, drawings, procurement, manufacture, works tests, delivery, erection, testing and commissioning of all items of Head Works, pipeline, BPT, WTP, ESR and all other works.

Delays shall be detailed by the Contractor, with the proposed action to overcome it.

The Employer or Employer's representative may call meetings in his office, at the Contractor's office, or at the Site, to review the progress of the Contract. The Contractor's representative shall attend such meetings.

In addition to the above, the Employer shall Engineer convene periodical meetings with Contractor and Employer's representative for reviewing progress and for necessary co-ordination among all parties for smooth construction implementation and maintain the time schedule.

2.7 Photographs / Videography

The Contractor shall arrange to take photographs with digital soft copy and video films of all important activities. These will include (but not be restricted to) virgin sites and levels, existing trees and other buildings, obstacles and utilities across /

along the alignment of pipelines and /or plant structures of this project. The video films shall be submitted for record in duplicate to the Owner's designated representative.

In accordance with the requirements of Clause 4.21 of the Conditions of Contract the Contractor shall submit negatives of photographs and unmounted positive colour prints not less than 250 x 200 mm of such portions of the Works, in progress and completed, as may be directed by the Employer's representative and specified herein. The digital copy and prints shall not be retouched. The digital copy of each photograph shall be the property of the Employer and shall be delivered to the Employer's representative with the prints. No prints of these digital copy shall be supplied to any other person without the written permission of the Employer's representative.

The photographs shall be of two categories:

progress photographs

record photographs

Both categories of photographs shall be properly referenced to the approval of the Employer's representative and on the back of each print shall be recorded the date and time of the photograph, an identifying description of the subject and the reference.

Photographs taken for record purposes as ordered by the Employer's representative or as specified herein shall be supplied with three prints, having the reverse of one subscribed with the signatures of the Contractor and the Employer's representative (or their authorised representatives) for the purpose of attestation. If required, the Contractor may at his own expense have an additional print similarly attested for his retention.

The Contractor shall supply digital soft copy and three prints of each progress photograph ordered by the Employer's representative. The Contractor shall

supply two additional prints of progress photographs selected by the Employer's representative for incorporation in albums. The Contractor shall supply two sets of albums, mount the prints, and title the prints and albums all to the approval of the Employer's representative.

The Contractor shall also conduct video recording of important activity at least once in a month and shall furnish the same.

The taking of photographs of the Works by the Contractor for any other purpose whether for use in India or in any other country shall not be carried out without written approval from the Employer's representative.

2.8 Details and Data by the Employer

The Employer has the following data and used these in formulation of the design and bid elements. They are listed below and shall be used only as guideline. The Employer does not, however, guarantee either the sufficiency or accuracy of the data provided. Contractor shall carry out fresh survey, investigation and particular testing/and all other details necessary for proper planning and detailed design.

The Contractor will be required to provide full details of the investigations and analysis for approval of the Employer's representative. It is expected that the surveys will be carried out with Total Stations and necessary software will be used for creating the required drawings.

The employer's details and data are as below;

- Topographical surveys conducted and also established bench marks along the transmission route.
- The corresponding L-Sections are enclosed in tender drawing (Section 6D)

- Key plan
- Flow diagram
- Details of Head works
- Contour plan of Head work site

2.9 Sub-letting

The Contractor shall not sub-let the whole of the Works. If required, finalization of vendors and subcontractors shall be with prior approval of Employer. Where any design or manufacture is sub-let, the Contractor shall not be relieved of his obligation under the Contract. The Contractor shall be responsible for the acts, defaults and neglect in manufacture or design of any sub- contractor, as if they were his own.

Where the Employer's representative has consented to supply of Plant or execution of work by manufacturers or sub-contractors proposed by the Contractor, such manufacturers or sub-contractors shall not be changed without the prior approval in writing of the Employer's representative.

A copy of every order shall be sent to the Employer's representative at the time the order is placed each clearly marked with the title of the Contract and the Contract number.

2.10 Minimum Construction Equipment to be brought by Contractor on Site

The Contractor is required to assign minimum equipment on site for ensuring quality and timely progress of works. The minimum equipment in adequate numbers, including but not limited to the equipment described in this Subsection, shall be mobilized by the Contractor on site in working condition. The Contractor should submit the equipment mobilization program in the bid schedules.

Table 2.4: Minimum Equipment to be mobilized by Contractor on Site

S. No.	Description of Equipment	Minimum number
A	Excavation, Transportation, Handling and Erection	
1	Dozer	3
2	JCB	3
3	Crawler crane	2
4	Crane – 10 T Hydra	2
5	Excavators	3
6	Tipping Trucks	1
7	Licensed Blasting Facility	2
8	Rock Breaker with Excavators	2
9	Ripper	4
10	Compressors and jack hammers	4
11	Tripods and Chain Pulley Blocks	1
12	Dewatering Pumps	8
B	Concreting	
1	Concrete Batching Plant	1
2	Concrete Mixers	1
3	Needle Vibrators	2
4	Plate Vibrators for Bedding	1
C	Portable welding and Gas cutting Equipments	
1	Welding set	3
2	Diesel Generating set	3
3	Gas cutting set	3
D	Pipe Manufacturing Equipment	
1	Pipe forming Machinery	As required
2	Welding Equipment for submerged arc welding for Pipe Fabrication	As required
3	Hydro Testing Equipment	As required
4	Gamma Ray Equipment	As required
5	Hydraulic testing equipments	As required
E	Pipe Coating Equipment	
		As required

2.11 Field Laboratories

The Contractor shall establish a field laboratory as approved by the Employer's representative, suitably equipped to carry out tests as stipulated in the QA/QC Manual, including all specialized equipment which will be required for testing the material and equipment being supplied under the Contract. Suitable trained laboratory staff will have to be posted with full facility of computerized record keeping. The minimum equipment to be provided in the laboratory shall be as listed below. Additional equipment as may be deemed necessary may be added to the same in due course on requirement of the Employer/or Employer's representative.

The laboratory shall have the following facilities required for sampling and testing materials and concrete in the field. All such facilities shall be provided by the Contractor at no extra cost to the Employer. The following equipment with operators shall be made available at Employer's representative request.

Table 2.5: List of Equipment to be provided for Laboratory by the Contractor

S. No.	Description	Quantity
1	Hydraulic Compression Testing Machine, hand operated 100 tonnes capacity. Conforming to the requirements of IS: 516-1959, IS:14858-2000 calibrated to an accuracy of $\pm 1\%$ indicated load within range.	1 No.
2	Cube moulds 150x150x150 mm size conforming to IS: 516-1959, IS: 10086-1982.	24 nos.
3	Cube moulds 100x100x100 mm size conforming to IS: 516-1959, IS: 10086-1982.	12 nos
4	Slump apparatus conforming to IS: 7320.	1
5	Test sieve set IS: 460-1972, 30 cm dia frame of size 40mm, 20mm, 12.5mm and 10 mm and 20 cm dia frame of size 4.75mm, 3.35 mm, 2.36mm, 1.18mm, 600 microns, 300 microns, 150 microns, 90 microns and 75 microns.	1 set

S. No.	Description	Quantity
6	Bulk density measure 3 and 15 liters' capacity as per IS: 2386 (Part-III)- 1963.	One each
7	Thickness and length gauge as per IS: 2386 (Part-I)- 1963.	One each
8	15 cm dia aggregate crushing value apparatus as per IS: 2386 (Part-IV)- 1963.	1 No.
9	Graduated cylinder of glass 100, 250 and 1000 ml capacity.	3 nos. each
10	Balances 1 kg, 5kg and 15 kg capacity.	One each
11	Electric oven, thermostatically controlled upto 200 ⁰ C, chamber space about 40x40x40 cm.	1 No
12	Concrete Test Hammer (rebound hammer) of impact energy 2.207 N. m (0.225 Kgm) as per IS : 1331 (Part-2)- 1992.	1No.
13	Chemicals for water content determination of fresh concrete sodium chloride, nitric acid, nitrobenzene, ferric alum, silvernitrate, potassium thiocyanate, sodium hydroxide and HCl.	As required
14	Vicat apparatus as per IS: 4031	1No.
15	Vibration machine with 6 moulds as per IS: 4031	1No.
16	Hot Plate	1No.
17	Apparatus (HCl heat of solution method) for estimation of cement content of fresh concrete	1No.
18	Glass ware for testing of S.No. 17	1 set
19	Pycnometer.	1No.
20	Elongation index gauge	1No.
21	Glass flasks and metal container	1 set
22	Sedimentation pipette	2No.

Arrangement can be made by the Contractor to have the cubes tested in an approved laboratory in lieu of a testing machine at site at his expense, with the prior consent of the Employer's representative.

The outside laboratory shall also be used for routine testing of cement, reinforcement, coarse and fine aggregate and other items.

In addition to the equipment in the laboratory, the Contractor will also provide field testing equipment as directed by the Employer's representative on the various sites where work is in progress.

2.12 Materials: General Requirements and Manufacturer's Experience

The term materials shall mean all materials, goods and articles of every kind whether raw, processed or manufactured and equipment and plant of every kind to be supplied by the Contractor for incorporation in the Works.

Except as may be otherwise specified for parts of the Works in Employer's requirements / particular specifications, the provision of the Standard Specifications shall apply to materials general requirements for any part of the Works.

All materials shall be new and of the kinds and qualities described in the Contract and shall be at least equal to approved samples. The Contractor shall as far as possible use materials available in India for the completion of the Works, subject to compliance with the Specification. Materials shall be transported, handled and stored so as to prevent deterioration, damage or contamination.

The Contractor shall procure pipes, specials, pumps and other electrical equipments from approved manufacturers specified in tender document with proven experience in the supply of similar items for at least 10 years. Employer reserves the right to demand an additional security upto 5% of the supply and construction value for considering experience in manufacturing of less than 10 years.

2.13 Substances and Products

Substances and products used in the Works which may be applied to or introduced into water supplied for drinking, washing or cooking shall not contain any matter which could impart taste, odour, colour or toxicity to the water or otherwise be objectionable on health grounds. Only substances and products which have been approved by a national or international regulatory body shall be used.

After award of Contract, from time to time, the Contractor shall submit for the approval of the Employer's representative a schedule of substances and products he proposes to use in the Works giving the following information as applicable:

- Item of plant;
- Substance/product in contact with water;
- Manufacturer of plant/substance/product;
- Point of use in the Works;
- Name of the regulatory body if applicable, which has approved the substance/product;

2.14 Delivery and Storage of Plant

2.14.1 Packing and Protection

Before any plant is despatched from a manufacturer's factory it shall be adequately protected and packed to ensure that it will arrive on the site in an undamaged condition. The methods employed for protection and packing must be suitable for rough handling and withstanding the conditions which may be experienced during shipment, delivery to the site and prolonged periods of storage in the open, whether the items are shipped in packing cases, crates or only partially protected according to their nature. Packages containing dangerous or breakable goods shall be packed and marked in accordance with any statutory rules and orders applicable.

Bright parts and bearing surfaces shall be protected from corrosion by applying a rust preventive lacquer, high melting point grease or similar temporary protection. A sufficient quantity of solvent shall be supplied with the plant to enable this coating to be removed on the site.

Electrical equipment shall be suitably protected against corrosion and incidental damage to the satisfaction of the Employer's representative. Temporary leads shall be fitted to electrical equipment to enable anti- condensation heaters to be energized when the plant is in store. The heaters shall be energized by the Contractor when conditions require.

All machined flanges and other mating surfaces shall be protected by means of wood templates. The bolts for securing these templates shall not be reused in the final installation.

No crate or package shall contain items of plant intended for incorporation in more than one part of the works.

All items of plant shall be clearly marked for identification against the packing list, which shall be placed in a waterproof envelope inside every packing case or crate. Every packing case and crate shall be indelibly marked to show its weight, serial number, top and bottom, shipping marks and handling instructions or sling marks.

2.14.2 Delivery to Site

The Contractor shall be responsible for the transporting and handling of all the Plant.

The storage of all equipment and construction items at the Site shall be the Contractor's responsibility.

The Contractor shall check all items against packing lists immediately on delivery to the Site and shall also inspect for damage and shortages. Damages and shortages shall be remedied with the minimum of delay.

The Contractor may, with the prior approval of the Employer's representative and at no extra cost to the Employer, make arrangements for any other contractor or agent to take delivery of, unload and store the Plant on the Site on behalf of the Contractor.

All deliveries shall take place during the Contractor's normal working hours.

2.14.3 Storage

An area and/or building on the Site for use by the Contractor for storage of Plant prior to erection will be subject to the approval of the Employer's representative.

The Contractor shall provide all other facilities for the safe and proper storage of Plant, as recommended by the manufacturers, with particular consideration being given to temperature, rain, sunlight, wind and ground conditions. All electrical equipment for indoor installation shall be kept in store building and dry condition shall be maintained.

The Contractor shall remain responsible to the Employer for the care and insurance of the Plant and the provisions of this Clause shall not relieve the Contractor of any of his liabilities under the Contract.

Stored Plant items shall be laid out by the Contractor to facilitate their retrieval for use in the programmed order.

Stacked Plant items shall be protected from damage by spacers on load distributing supports and shall be safely arranged. No metal work shall be stored directly on the ground.

Small Plant items shall be held in suitable bins, boxes or racks and be clearly labelled. Items of Plant shall be handled and stored so that they are not subjected to excessive stresses and so that protective coatings are not damaged.

The Contractor shall comply with the manufacturer's package and plant markings concerning the use and location of lifting slings, chains and hooks.

2.14.4 Erection, Testing and Commissioning

Please refer a separate sub-section detailing specification for above activities.

SUB-SECTION 6A.3

SITES AND SITE WORKS

SUB-SECTION 6A.3: SITES AND SITE WORKS

3.1 General

Main sites are at Ujani Dam for Jackwell, Near Varwade toll plaza for BPT and entire route of transmission systems up to Pakni and Soregaon WTP.

The Contractor will be allowed to use the spaces available with the Employer after permission of the Employer's Representative. The Contractor will be free to use them for establishing his offices, laboratories, staff quarters, storage spaces and workshop as long as they do not interfere with the layout of the works to be carried out under the Project.

The Contractor will also be permitted to use the skeleton constructions available on these spaces for his use after permission from the Employer's Representative.

There may be some encroachments on some of these spaces and structures which may take some time in clearance, for which the Employer will not be held responsible. However, the Contractor shall settle the issues coming across the way of work. The prospective bidders are advised to familiarize themselves with the existing situation and make their own evaluation / assessment before submitting the bid. All the buildings and compound wall / fencing to be handed over by the Employer will be handed over on as "as-is, where-is" basis.

The Contractor will be responsible to arrange and pay for whatever modifications the structures may require for his use and also for providing necessary facilities like access road, water, sanitation and electricity. He will be responsible to maintain a clean and healthy environment at the locations taken by him and will be responsible for conduct of his personnel there.

The Contractor will have to hand over the spaces and structures in a clean and intact condition at the end of the Contract or at an intermediate stage when they may be required by the Employer's Representative on demand after one-month notice.

There shall be no charge for the use of such space or structures. The Employer however does not undertake to provide any further space or accommodation that the Contractor may require to fulfill his contractual responsibilities. The Contractor will be responsible to arrange the same at his own cost. The Employer may assist the Contractor in making his arrangements by giving suitable recommendation letters.

3.2 Access to the Site

The Employer will provide to the Contractor access to and possession of the Site for carrying out the Works. The Contractor shall be deemed to have inspected the Site including access before submitting his Tender.

The Contractor shall ensure that all the Plant offered is of a size and weight or can be divided into sections of a size and weight suitable for access to the place of installation. Also, the equipment used for installation purposes shall be able to have access and position for such purposes.

The Contractor shall ensure that the operation of the existing facility, MBR and piping should not be hindered any way due to mobilization of the equipment, civil or any contract related work.

3.3 Camp and Campus

The Contractor shall construct and maintain to the Employer's representative satisfaction a camp to provide living accommodation for all contractor's staff who have no other local accommodation. The Contractor's camp shall be located close to the Site itself and at a location approved by the Employer's representative. Responsibility for acquiring land and providing all services to the living quarters and compliance with all sanitary laws and other laws and regulations shall be borne by the Contractor. Security and the fencing of these areas shall be the responsibility of the Contractor.

3.4 Facilities and Offices for Employer's Staff and his Representative

The Contractor shall provide and upkeep the following facilities for the Employer and Employer's Representative. The cost for these facilities shall be borne by the Contractor.

One office having floor area not less than 75 square meters nearby Solapur Smart City office and one site office at Head works having area not less than 50 square meters is to setup. The office nearby Solapur Smart City office shall have conference room and projector for power point presentation.

The layout of the offices shall be submitted to the Employer for approval. The office building shall be equipped with office furniture (at least 3 tables, 8 chairs, two filing and two drawing cabinets at each location). Maintenance and upkeep of the office shall be contractor's responsibility for entire period of the contract.

The construction of all offices shall be completed within 60 days.

For the Employer's representative, two numbers of desktop computers with flat screens loaded with the latest versions of windows MS office, MSP, AutoCAD and Inkjet printer and photocopy machine for A4 & A3 size and a plotter for taking copies of construction drawings. All office shall be provided with adequate stationary for routine office work.

Two cars of INNOVA / SCORPIO or equivalent of 2018 make with drivers shall be provided for use of employer's staff. This shall be provided for 30 months or until completion of the 50% of operation and maintenance works and shall provide for monthly average 5000 k.m. per vehicle. Fuel and maintenance of cars shall be responsibility of the contractor.

In addition to above, the Contractor shall provide suitable temporary offices along the pipe laying works while work in progress.

The offices shall remain as the property of the Contractor at the end of the Contract.

3.5 Areas Outside the Site

In the event of the Contractor making use of any special or temporary wayleave or accommodation acquired by him or any tip for the disposal of surplus materials, or any borrow pit or quarry, he shall obtain the written consent of the owner, occupier or authority having charge of the land in which such way leave, accommodation or tip is situated and shall make agreement with the owner, occupier or authority as aforesaid of the condition of the surface of that land before entering thereon.

The Contractor shall permit the Employer's representative and any person authorised by him access for the purposes of the Contract to any such special or temporary wayleave or additional accommodation.

In the event of the Contractor making use of any special or temporary wayleave or additional accommodation made available to him by the Employer for the purpose of the Contract, the land in which such wayleave or accommodation is situated shall be deemed to be part of the Site.

Under these circumstances the Contractor shall form a Working Area extending 5 m from the edge of the Permanent Works or accommodation on all sides. The Contractor shall restrict his activities to within this Working Area. On completion of the works in this area, the Contractor shall reinstate the area by clearing the stuffs to its original condition to the satisfaction of the Employer's representative.

Private land or other land taken by the Contractor for disposal of debris or other material or for any other purpose must be cleared and made acceptable from health and environmental aspect before.

3.6 Road Works

The Contractor shall obtain all permits required for carrying out works such as excavation along and on NH, SH, MDR, ODR and public roads and shall liaise with the appropriate authorities with regard to the timing and execution of the road works.

The Contractor shall be responsible for establishing and maintaining temporary road diversions for the duration of the road works. The road shall be kept open at all times during the road works period, and the work shall be carried out in such a manner as to minimise the disruption to traffic.

3.7 Maintenance of Existing Access Roads

The Contractor shall only use existing access roads within the Site boundary which are necessary for the execution of the Works. The Contractor shall be solely responsible for the maintenance of the existing site access roads. Such maintenance work shall include general up-keep, and any necessary repairs to damaged road surfaces, pavement, drainage, associated slopes, etc. to original condition. While carrying out such maintenance work, the Contractor shall make arrangements to maintain through passage for the Employer's and his staff's vehicles and also those of other contractors over these access roads, which may comprise temporary diversions all to the approval and satisfaction of the Employer's representative.

The Contractor shall take every precaution while operating tracked or unsprang vehicles on surfaced roads and shall use planking or some other protective material to protect the road surface.

3.8 Clearance of the Site

The Contractor shall clear the Site to the extent required by the Employer's representative for the setting-out. Clearance of the Site shall also include the demolition and removal of all articles, objects and obstructions which are expressly required to be cleared to the satisfaction of the Employer's representative.

The Contractor shall remove the material arising from such clearance and dispose of it in a manner and at a location, on or off the Site, to the approval of the Employer's representative.

The Contractor shall fill and make good with appropriate materials those cavities and losses of soil which result from clearing the parts of the Site not subsequently to be occupied by the Works.

The Contractor shall not clear the Site of any structure without the prior written permission of the Employer's representative. As far as possible big trees shall be saved otherwise replanted at approved location.

3.9 Clearance and Reinstatement of the Site on Completion

On completion of the Works, the Contractor shall clear any temporary works areas and temporary access roads and reinstate the areas to their original condition and to the satisfaction of the Employer's representative.

3.10 Site Records

The Contractor shall make records of the position and extent in the excavations of every type of service, stratum and obstruction encountered during the construction of the Works.

3.11 Access for the Employer's Representative

The Contractor shall permit the Employer and the Employer's representative and any person authorised by the Employer including workmen of the Employer, other contractors or utility undertakings access for the purposes of the Contract to all areas of the Site and to any additional accommodation or temporary wayleave for the duration of the Contract period.

3.12 Water Supply and Disposal on Site

The Contractor shall be responsible for arranging water for the purposes of constructing the Works at his own cost and risk. The Contractor shall ensure the quality of the water remains suitable for the purpose for which it is intended.

Wastewater shall be disposed off clear of the Site to the satisfaction of the Employer's representative so as to cause no damage or complaint.

3.13 Latrines and Washing Facilities

Throughout the period of construction of the Works the Contractor shall provide, maintain and cleanse suitable and sufficient latrines and washing facilities for use by his employees. He shall ensure that his employees do not foul the Site but make proper use of the latrines.

Where practicable the latrines shall be connected to the nearest sewer, or if this is not practicable the Contractor shall provide an adequately sized septic tank and soak away.

The Contractor is also to provide separate latrines for the employer's staff and Employer's representative.

After Completion of the works, the latrines and washing facilities shall be removed, all ground disinfected and the surface reinstated to the satisfaction of the Employer's representative.

3.14 Electricity for Contractor's Use on Site

The Contractor shall be responsible for arranging power supply and distribution of an electrical supply for the purpose of constructing the Works and making payment to the power supply authority.

The installation shall comply with all the relevant regulations, Indian Standards and Codes of Practice, and Health and Safety requirements, etc. The Contractor must take every possible precaution to ensure that his installation is safe and injury to personnel or damage to plant and buildings is avoided. The Contractor shall be fully responsible for all safety and maintenance aspects.

The Contractor shall test the temporary site distribution system including energy meter every 3 months for compliance with the relevant standards.

3.15 Compressed Air Use on Site

The Contractor shall provide the necessary compressed air plant and equipment required for construction of the Works.

Electrically driven compressors connected to the site electricity supply shall not be used. Diesel engine driven compressors shall not be sited within buildings or in a location that may cause a health hazard to personnel owing to exhaust fumes or noise.

3.16 Refuse Disposal on Site

Refuse and rubbish of every kind shall be removed from the Site and disposed off by the Contractor at his own expense, frequently and regularly so as to keep the Site in an approved wholesome and tidy condition to the satisfaction of the Employer's representative.

3.17 Health, Hygiene and Contamination of Water Supplies

The Site shall be an area of 'restricted operation'. Exemptions may be granted at the discretion of the Employer's representative for short term operations involving no risk of contamination. The Contractor shall be responsible to ensure the following:

- All personnel shall be medically accepted.
- Water supplies for drinking, cooking and washing is fit for use and minimum drinking water quality standards
- Strict discipline shall be maintained concerning personal hygiene.
- Vehicles, plant, tools and protective clothing shall be kept clean and may require regular disinfection.
- The Contractor shall be responsible for regular medical check-up and treatment.

- Should any employee is infected with any looseness of bowels, gastric disorder or contagious disease such employee shall be immediately removed from the site.

3.18 Safety and Security on Site

The Contractor shall at all times maintain a safe system of working and shall comply with all enactments, regulations and working rules relating to safety, security, health and welfare of all persons who may be affected by his work.

In particular, he shall ensure that only persons who are properly trained for their duties are employed, and that the correct tools and procedures are used.

Nothing which has been written into or omitted from this Employer's Requirements shall be taken to relieve the Contractor from his obligations under this clause. No clause in this Employer's Requirements shall prevent the Contractor from drawing the attention of the Employer's representative to any feature of the Works which is not consistent with normal safety practices nor prevent him putting forward proposals at any time which would increase the safety of the installations.

Not later than four weeks before work commences on the Site, the Contractor shall submit to the Employer's representative his comprehensive proposals relating to the safety, health and welfare of all his personnel on the Site.

The Contractor shall appoint a suitably qualified representative as Safety Officer who shall be responsible for the implementation of site procedures as per relevant standards which shall include but not be limited to:

- safety;
- working in hazardous areas;
- permit to work;
- fire and smoking regulations;
- first aid;
- warning signs;
- trenching scaffolding and other construction structures;

- safety barriers;
- protective clothing and equipment;
- safety training;
- safety meetings and inspections;
- health and welfare.

The proposals shall be appropriate for all grades of labour and personnel who will work on or visit the Site on behalf of the Employer, Employer's representative or Contractor.

The Employer's representative has the power to stop any activity or work in any area where there is a breach of the published site safety rules such that health or life is put at risk.

The Contractor shall ensure that all employees working on the Site are not working in an unsafe manner so as to endanger themselves, the Contractors personnel, other personnel or the Plant. The Contractor shall bring any violation of Site safety rules by others to the attention of Employer's representative in writing.

3.19 First Aid and Life-saving Apparatus on Site

The Contractor shall provide on the Site such life-saving apparatus as may be appropriate and an adequate and easily accessible first aid outfit or such outfits as may be required in any government ordinances, factories acts, etc., published and subsequently amended from time to time. In addition, an adequate number of persons permanently on the Site shall be instructed in their use, and the persons so designated shall be made known to all employees by the posting of their names and designations in a prominent position on Site.

3.20 Electrical Safety on Site

The Contractor shall be responsible for the electrical safety of all Plant supplied and installed. Whilst any equipment is being installed or tested, the Contractor shall ensure that all necessary precautions are taken to safeguard personnel working on site. If necessary, this shall include fencing off areas which are considered to pose a risk, and erecting warning notices.

The Contractor shall be responsible for ensuring that the electrical installation is carried out by suitably trained competent personnel and that the work is carried out in a safe manner.

The Contractor shall be responsible for the operation on the Site of a permit to work system during the period of electrical equipment installation and testing. This system shall regulate the installation, the energisation and the use of electrical Plant installed and the method of work adopted.

3.21 Noise

The Contractor shall ensure that the operations entailed in the construction of the Works do not cause annoyance to others working on the Site or to persons living adjacent to the Site.

3.22 Warning and Safety Signs

During construction of the Works statutory safety signs, shall be adequately provided throughout the Works, both indoors and outdoors. These safety signs shall cover mandatory, prohibition, warning, emergency, fire-fighting and general notices. All signs shall be positioned around the Works at highly visible points. Provision of signs and the positions of signs shall be subject to the Employer's representative approval. Special attention shall be given to areas designated hazardous.

3.23 Signboards

The Contractor shall supply and erect signboards at locations to be specified by the Employer's representative. The layout and dimensions of the signboards and their construction shall be to the approval of the Employer's representative and the lettering in both Hindi and English shall be black on a white background or any other colour combination for better indications subject to approval of the Employer's representative.

3.24 Advertising

The Contractor shall not use any part of the Site for any form of advertising without the prior written approval of the Employer's representative.

3.25 Fire Safety

All fire safety precautions against fire hazards shall be taken by the contractor as per I.S. Code of practice for fire safety of buildings (general) & National Buildings code of India 2005 as applicable. Accordingly, necessary fire equipments shall be provided in all the buildings and site the fire extinguishers and all provisions shall be suitable for fire fighting for general fire, fire for electrical equipment and fire for chlorine house. Adequate numbers of sand buckets shall be provided.

SUB-SECTION 6A.4

SYSTEM PERFORMANCE PARAMETERS AND LIQUIDATED DAMAGES

SUB-SECTION 6A.4: SYSTEM PERFORMANCE PARAMETERS AND LIQUIDATED DAMAGES

4.1 General

Supply of water of required quantity at optimum energy consumption and optimum leakage losses is essence of the Contract.

This subsection specifies performance parameters for the quality and quantity of water supply system, acceptable variations and tolerances and liquidated damages to be recovered from the Contractor if guaranteed performance parameters are not achieved within acceptable variations and tolerances at the time of (a) Inception of the scheme and (b) during operation and maintenance period.

4.2 Leakage Loss in Transmission System during O&M Period

4.2.1 Establishing Benchmark Losses

Leakage losses in Raw Water Transmission System shall be monitored.

Electro-magnetic flow meters are provided at following locations.

- First flow meter at Head work
- Second flow meter at Raw water pumping main at BPT
- Third flow meter at Pakni WTP
- Fourth flow meter at Soregaon WTP

4.2.2 Monitoring during Operation Period (O&M Period)

The values of above 4 Nos. of flow measuring devices will be monitored on day to day basis.

If the variation from benchmark values is within 1% for raw water main, the same will be deemed within acceptable tolerance.

4.2.3 Liquidated Damages for exceeding losses beyond Acceptable

Raw water main : 1% variation from benchmark value in percentage

Illustrations:

(i) Benchmark value during test run was 4%. If average monthly actual value during O&M is less than or equal to 5%, no liquidated damage shall be applicable. If actual value increases beyond 5%, liquidated damage shall be chargeable.

Liquidated damages shall be at following rates.

For raw water main : Rs. 10 lakhs per 1% overall excess losses per month beyond acceptable tolerance of 1%

If contractor fails to give service at rated capacity mentioned above due to any reasons beyond his control or told by Solapur Municipal Corporation (SMC), then there will not be any penalty to the contractor.

4.3 Power Consumption in Pumping Stations at the time of O&M

(i) The expected power consumption shall be decided initially on the basis of Trial run of Jackwell, Raw water pumping station and complete system for the continuous period of seven days. This test run shall start prior to issuance "Work completion certificate" and the permission from the Employer.

(ii) The expected power consumption shall be calculated initially for running the system to full capacity of water quantity 110 Mld with desired water quality standards. The power consumption during these seven days' test run period shall be taken as benchmark for comparison with the actual power consumption during operation and maintenance period. If the actual power consumption is higher than benchmark consumption with acceptable tolerance of 1%, liquidated damages shall be recovered from the Contractor at the rate of 1.25 times of the charges for the extra power consumed and paid to power supply company (MSEDCL / MSETCL)

Application of liquidated damages for excess power consumption shall not be subject to any upper limit and shall be applicable with consideration for 1% tolerance. Thus if power consumption is less than 101% of benchmark, no LD will be levied. If consumption is 101.5% LD for 0.5% shall be applicable.

4.4 Maintenance of Power Factor during O&M

The Contractor shall maintain power factor above the lowest limit of power supply company which is presently 0.90. Power Supply Company also grant incentive / bonus / benefit if power factor is higher than lowest limit.

Following stipulations shall be applicable.

(i) If any penalty is imposed by power supply company for not maintaining power factor to lowest limit, liquidated damage @ 1.25 times the penalty amount will be imposed.

(ii) If any incentive / bonus / benefit is granted by power supply company, 50% of the amount shall be passed on to the Contractor.

SUB-SECTION 6A.5

DESIGN, DRAWINGS AND DOCUMENTS

SUB-SECTION 6A.5: DESIGN, DRAWINGS AND DOCUMENTS

5.1 General

Following 3 categories of Design and Drawings are involved in the bid process and contract.

- i) Design and drawings furnished by the Employer with bid documents
- ii) Tender drawings and documents furnished by the Tenderer with his tender
- iii) Design, drawings and documents submitted by the Contractor for the works

This sub- section describes intent and implications of three categories of design and drawing and stipulates employer's requirements for design and drawings for the works included in this contract.

5.2 Drawings furnished by the Employer

Drawings submitted as part of the Employer's Requirements are enclosed as Folder 4 – Drawings. The drawings illustrate an overall conceptual layout of the Works, and are not binding on the Contractor. These drawings shall not be taken as the limiting responsibility of the Contractor for the detailed design of the works. The tenderer may also refer paragraph 2.8 of Sub-Section 6A.2.

The Contractor shall carry out such surveys, studies and analyses of any kind as are necessary for the purpose of his general and detailed designs and to verify the information shown on the Tender drawings and other data furnished by the Employer. The Employer shall not be liable for any claim by the Contractor on account of incompleteness or inaccuracy of the data furnished by the Employer irrespective of when the Contractor shall discover such incompleteness or inaccuracy.

All levels indicated except specified as obligatory or mandatory are provisional, and may need to be revised subject to the results of survey and site investigation that may be carried out by the Contractor, in addition to the survey / investigation details furnished with tender documents.

The Contractor shall note the constraint in terms of land available for the works as shown in the drawings. The work including access roads and pipework, shall be located within the area shown on the drawings and in accordance with the overall conceptual design layout shown. No additional land than that shown in the drawing will be provided. The tenderer may also refer site constraints stated in Subsection 2A.3 and various particular specifications.

5.3 Tenderer's Drawings

The Tenderer's drawings and documents are those furnished by a tenderer with his tender for the purpose of illustrating and clarifying his proposals. These include,

- Layout Plans
- Design of Jackwell and selection of raw water pumps
- Design of clear water sump for vortex-free operation of pumps and selection of pumps
- Description of the proposed Water Treatment Plant and Treatment
- Process offered
- Hydraulic and Process Flow Diagram
- Process and Instrumentation Diagram (P&IDs)

- Hydraulic design of pipeline including shell thickness
- Preliminary design of BPT
- Electrical Load list
- Design and drawings for crossings and tapings

Such other drawings and documents so as to illustrate and explain tenderer's proposal

5.4 Design Documents and Drawings by the Contractor

5.4.1 General

The Construction Documents are design and certified from reputed structural consultant, getting checked of the same from IIT at contractors own cost. Drawings submitted by the Contractor to the Employer during the course of the Contract for approval. The Contractor shall supply to the Employer's representative 5 (Five) copies each of the initial design calculations and sizing of all components of the System including architectural, structural, process hydraulic, mechanical, electrical and instrumentation equipment, supported by design calculation (Excel spread sheets), flow diagrams and general arrangement drawings for approval. It is a matter of high priority that the Contractor ensures the submission and finalization of such designs and drawings in the stipulated time schedules as stipulated elsewhere. It is the intention of the Employer to ensure that the approval of such submissions is made expeditiously and in time.

The Contractor shall be fully responsible for the content of all submissions to the Employer irrespective of the source or origin of information contained in such submissions. All submissions irrespective of the source or origin of information shall be checked by the Contractor and endorsed as such before submission to the Employer. The Employer will not accept submissions for review unless these requirements have been met.

Approval by the Employer of a submission by the Contractor shall mean that the Employer has no objection in principle to the content of the submission, drawings, calculations, certificates, samples and the like and that the Employer finds the content of the submission good enough to allow the work relating to the submission to proceed. Approval by the Employer shall not relieve the Contractor of his responsibility under the Contract. Approval will be given only on the basis of information available at the time to the Employer on the understanding that subsequent event may require withdrawal or modification of such approval.

5.4.2 Design

The design of the works shall be an integral part of the Contract. Such design shall include site investigation, temporary works designs and drawings, functional plans and general designs, diagrams, detailed designs and working drawings for all aspects of the works together with any and all other studies, investigations, computations, analyses and evaluations necessary to comply with the requirements of the Specification.

Functional plans and designs shall be based on the proposals submitted with the Contractor's Tender, subject to such modifications as the Employer may require.

5.4.3 Documents in Electronic Format

All documents submitted for approval shall be provided in both electronic format as well as paper copies of sufficient number as specified elsewhere. Each electronic submission shall be provided on read/writable soft copy clearly marked with the project title, submission reference and a description of the contents.

The Contractor shall provide the following electronic formats as a minimum:

Word-processing documents	-	Microsoft Word / Adobe Acrobat
Spread sheet documents	-	Microsoft Excel / Adobe Acrobat

Databases	-	Microsoft Access
Programme of works	-	MSP or Primavera or equivalent
Drawings	-	AutoCAD

The Contractor shall submit details of the proposed software versions for the Employer's approval.

5.4.4 Drawing Standards, Format and Numbering

Drawings submitted by the Contractor shall be clearly printed with black lines on white paper, and shall be resistant to fading on exposure to light. Prints shall be on durable paper of good quality. Sheet sizes shall be in accordance with A series to ISO 216, and be drawn electronically at A1 size unless otherwise stated in the Contract or agreed with the Employer.

All drawings submitted by the Contractor shall use SI units.

All drawings shall be clearly and fully cross referenced to the Specification and the Employer's drawings as relevant.

All drawings shall be prepared using an identical title block format. This shall be approved by the Employer and shall identify the project, drawing title, the Employer, the Contractor, Sub-contractor, if applicable.

A formalised drawing numbering system shall be adopted with digits of each number, referencing location, revision, drawing type and size. The numbering format and allocation of drawing number blocks shall be approved by the Employer's representative. The Contractor shall provide a sequential numbering system for all Construction Documents.

All drawings shall be submitted to a formalised checking procedure prior to submission to the Contractor. Drawings not so checked will not be approved.

Where drawings are revised, the revision letter or number shall be incorporated in the title block and the revision shall be clearly indicated on the drawing with the revision letter or number shown in an adjacent triangle. When drawings are revised, this shall be done electronically and not manually, and softcopies containing the revised files of all drawings, which have been supplied in electronic format shall be submitted at the same time as the paper prints.

5.4.5 Approval of Drawings by the Employer

The Employer representative shall arrange to send observations if necessary within 21 (Twenty-One) days of submission of the design and drawings for modifications to the Contractor. The Contractor shall incorporate all necessary comments in the above design and drawings, if any, and shall re-submit further 5 (five) copies each of the revised design and drawings within 10 (Ten) days for final approval of the

Employer. The Contractor shall thereafter submit 7 (Seven) copies each of the approved design and 7 (Seven) copies each of the approved drawings together with one softcopy. The Employer's will return 2 (two) approved copies to the Contractor and retain 5 (five) for his office and field use.

If the submissions require more than one round of revision on account of incomplete compliance from Contractor, the delay will be on account of the Contractor. If new observations are given by the Employer's representative, the Contractor will be entitled to take an additional 10 (ten) days period for compliance but without any impact on contract period / time limit for completion of works. Further design calculations and drawings shall be submitted in sequence as per a schedule to be drawn and agreed upon mutually, immediately after submission of the general arrangement drawings.

Category for drawing approval as follows shall be adopted.

Category I - Fully approved; no observation

Category II - Good for construction after compliance of observation

Category III - Not approved, need major revision

A blank space 90 x 50 mm shall be provided immediately above the title block for the approval stamp. If required in the document elsewhere, the detailed design and the execution drawings shall be submitted only after verification by an institute approved by the Employer or his representative. The Contractor shall be responsible for preparation of working drawings and the construction documents for works, as specified in the Contract.

The Employer may require the Contractor to submit for approval additional drawings if they are necessary to enable him to satisfy himself that the items are well designed, that they comply with the Employer's Requirements and that they are suitable for their intended purpose. These drawings shall form the agreed basis for the execution of the Works. If an approved drawing is revised, revised copies shall be submitted for approval as above and no such revised drawing shall be used for the purposes of the Contract until it has been approved in place of the earlier issue of the drawing.

Approval of drawings by the Employer shall not be held to relieve the Contractor of his responsibilities under the Contract.

The Employer will not permit construction to start on a part or section of the Works unless Construction Documents for that part or section have been approved.

5.5 Preliminary Drawings

Drawings for approval shall be submitted in two Phases both in hard as well as in soft (editable) formats. The first phase shall be the Preliminary Drawings. Drawings submitted during this phase shall be of sufficient detail for the Employer and his representative to understand outline the Contractor's proposals for the design and construction of the Works.

The Preliminary Drawings shall inter alia comprise:

- Entire system design and hydraulic flow diagram

- General arrangement of Jackwell and raw water pumping station including hydraulic design of pump well and screen, gates etc.
- Control philosophy;
- Process design;
- Preliminary process and instrumentation diagrams (P&ID s); the diagrams shall indicate in symbolic form the process, plant and systems of measurement, control and automation;
- Site layouts for Jackwell, BPT including information on levels detailing the location of:
 - Buildings;
 - Process plant;
 - Storage tanks;
 - 33 kV / 3.3 kV / 415 V transformer substation
 - Roadways;
 - Buried pipelines;
 - Main cable routes;
- Civil works plans, elevations and main sections of all reservoirs and buildings showing location and sizes of plant, equipment and panels etc.;
- Site drainage details;
- General arrangements and main sections of all plant areas;

- Pipeline L-Sections, major and minor crossings, bridge
- details of thrust block
- Electrical Single line diagram based on approved Mechanical and Process load list showing C.T & P.T details, Starter details, Cable sizes, Feeder metering and protection details, Equipment capacity and sizes, Feeder Interlock operation logic, D.G set Starting and Stopping operation logic, Panel cable entry details, Panel Busbar Capacity and Sizes etc.
- A description of building services provisions proposed for the Works;
 - Control system architecture;
 - Load schedule;
 - Instrument schedule;

The Preliminary Drawings shall be submitted by the Contractor for approval preferably as a single or maximum three submissions.

5.6 Construction Drawings

The second phase shall be the detail design phase and shall comprise the submission of the Construction Documents. These shall be submitted after approval of the Preliminary Drawings.

The Construction Documents shall be used for the construction of the Works and shall inter alia comprise:

5.6.1 Civil

The Contractor shall comply with the provisions of the requirement of the Specifications for Civil Works, as applicable.

The civil construction drawings shall comprise the following;

- Site layouts for Jackwell, BPT including information on levels detailing the location of:
 - Buildings;
 - Process plant;
 - Storage tanks;
 - 33 kV / 3.3 kV / 415 V transformer substation
 - Roadways;
 - Buried pipelines;
 - Main cable routes;
- Civil works plans, elevations and main sections of all reservoirs and buildings showing location and sizes of plant, equipment and panels etc.;
- Site drainage details;
- General arrangements and main sections of all plant areas;
- Pipeline L-Sections, major and minor crossings, bridge
- General arrangement drawings showing the location of each Plant item;
- Detail drawings of:
 - Cable and pipework chambers;

- Buried pipework;
- Pipework connections;
- Contract interface;

- Reinforcement drawings;
- Bar bending schedules.

- The structural design calculation with computer input & output files for the design package program such as STAAD etc.

5.6.2 Mechanical

A) Drawings

- i) Vertical Turbine pumps (Both Raw water and Clear water)
 - Sectional Assembly drawing including MOC and dimensions
 - Installation drawing with dimensions and levels
 - pump mounting with sole plate
 - Accessories, valve and instrumentation drawing

- ii) Piping and fabrication items
 - General arrangement of plant and pipe work including valves, sections.
 - detailed drawings of proprietary and fabricated plant items

- iii) EOT Crane and lifting equipments
 - Sectional Assembly drawing including MOC and dimensions
 - Installation drawing with dimensions and levels

- iv) Sluice valves / Non return valves / Butterfly valves
 - Sectional Assembly drawing including MOC and dimensions

- Installation drawing with dimensions and levels

- v) Ventilation system
 - General arrangement drawing
 - Layout & duct mounting

- vi) Stop logs
 - General arrangement of stop logs
 - Frame for stop logs with foundation and grouting details
 - Individual stop log fabrication drawing
 - Lifting arrangement for lifting stop logs with lifting beam and chain pulley block
 - Installation drawing

- vii) Screen
 - Frame for screen
 - Screen drawing with dimensions
 - installation drawing with grouting details for frame with dimensions and levels

- viii) Sluice gates at Jackwell
 - Frames for sluice gates
 - Individual sluice gate fabrication drawing with dimension
 - Installation drawing including Thimble arrangement

- ix) Water hammer control devices
 - Surge analysis without and with water hammer control device.
 - General arrangement drawing with levels
 - Overflow, collection and disposal arrangement
 - Tank and its draining arrangement
 - access to control devices for maintenance
 - Details of devices with MOC

- x) Manual and electric operated actuators for valves, gates

- Sectional assembly drawing with MOC
- Arrangement with on valve mounting

B) Schedules / equipment data sheets

- Pump characteristic Curves
- Selection of combination of pumps (working + standby)
- Plant performance details
- Pipeline Schedules
- Valve schedules

C) Calculations

- Hydraulic design for pump wells and approach bays for vortex free operation of pumps detailing required dimensions kept
- Details of correction measures proposed for preventing vortices e.g. Cone underneath bellmouth, back wall at rear of pump
- Pump sizing
- Pump head calculation and calculations for operating head range
- selection and sizing of motor for pumps, Blowers
- Pipeline sizing
- Air Blower and compressor sizing
- Required ventilation rate for air supply fans and exhaust fans to restrict temperature rise
- Sizing of duct
- Sizing of Air supply fans and exhaust Fans
- Torque calculation for selection of manual and electric operated

Actuator for operating valves, gates

- sizing of lifting equipments
- Dynamic load on pump, blower foundation structural members
- Calculation for G value and power requirement for flash mixer
- Selection and sizing of wash water pump and air blower
- Calculations for chlorinator, chlorine dose, booster pump and leak absorption system

5.6.3 Electrical

General requirements are as follows:

- Schematic drawings shall include a comprehensive schedule of the components used in each switchboard, MCC and control panel including details of the type, manufacturer and rating of each component.
- The external arrangement of each switchboard, MCC and control panel shall show the arrangement of all components including details of panel section, switch and instrument labels.
- Electrical control schematics, loop diagrams and schedules shall where practical be A3 size drawings; all other drawings shall be A1 size.

(a) 33 kV / 3.3 kV / 415 V switchgear

- i) Dimensional Layout Drawing.
- ii) Complete assembly drawings of the Switchgear showing plan, elevation and typical sectional views and location of cable

boxes and control cable terminal blocks for external wiring connections, etc.

- iii) Foundation plan showing the location of channel sills, foundation, anchor bolts and anchors, floor plans and openings.
- iv) Schematic power and control wiring diagrams with control, interlocks, relays, instruments, space heaters, bus bar rating with material, Current transformers, potential transformers etc.

(b) 33 V / 3.3 kV / 415V Transformers

- i) General arrangement drawing shall indicate the overall dimensions, net weights, quantity of oil, crane requirements for assembly and dismantling of transformers and the general constructional features.
- ii) General arrangement drawing of the transformer, showing plan, front elevation and side elevation complete with all accessories and fittings, detailed dimensions, net weights, quantity of, crane lift for un-tanking, size of lifting lugs and eyes, clearances between HV terminals, between LV terminals, between HV and LV terminals, between HV & LV terminals and ground etc.
- iii) Rating, diagram and terminal marking plates, complete with polarity and vector group.
- iv) Control wiring diagram for marshalling box.
- v) Foundation drawing with position of foundation bolts and depth.

(c) RTCC Panel for Main Transformer

- i) General arrangement drawing shall indicate the overall dimensions, net weights, and the general constructional features.

- ii) Wiring diagram with tap position details and logic for on line operation.

(d) Panels, Distribution Boards, Power Control Centres, Motor Control Centres etc.

- i) Dimensional layout drawing.
- ii) Complete assembly drawings of the switchboard/distribution board / MCC showing plan, elevation and typical sectional views and location of cable boxes and control cable terminal blocks for external wiring connections, etc.
- iii) Foundation plan showing the location of channel sills, foundation, anchor bolts and anchors, floor plans and openings.
- iv) Schematic power and control wiring diagrams with control, interlocks, relays, instruments, space heaters, starter details Bi-metallic relay ratings and contactor ratings, bus bar rating with material, current Transformer, potential transformer etc.

(e) Capacitor bank with Automatic Power Factor Correction Relay

- i) Dimensioned general arrangement drawings of capacitor and capacitor control panel.
- ii) Justification for number of steps for switching.
- iii) Fully dimensioned general arrangement drawings of capacitor and capacitor control panel with elevation, side view, sectional view and foundation details.
- iv) Complete schematic and wiring diagrams for capacitor control panel.

(f) Diesel Generator

- i) Dimensional layout drawing.
- ii) Complete assembly drawings showing plan, elevation and typical sectional views and location of cable boxes and control cable terminal blocks for external wiring connections, etc.
- iii) Foundation plan showing the location of channel sills, foundation, anchor bolts and anchors, floor plans and openings.
- iv) Schematic power and control wiring diagrams with control, interlocks, relays, instruments, space heaters, starters with Bi-metallic relay ratings and contactor ratings, busbar rating with material, start stop philosophy etc.
- v) Exhaust system with piping layout.
- vi) Day oil tank sizing with mounting arrangement details.
- vii) Fuel bulk storage tank sizing with mounting arrangement details.
- viii) Fuel supply system with pipe arrangement.

(g) Battery and Battery Charger with D.C. Distribution board

- i) Dimensioned general arrangement drawings.
- ii) Fully dimensioned general arrangement drawings of battery and battery charger with elevation, side view, sectional view and foundation details.
- iii) Complete schematic and wiring diagrams.

(h) Cabling System

- i) Details of Installation of Cables in Trenches, on cable trays, directly buried etc. at all locations inside the treatment plant.
- ii) Cable routing lay out inside and outside the plant.
- iii) Bill of quantities of cables, lugs and glands.
- iv) 33 kV / 3.3 kV Cable termination and mounting kit Layout drawing.

(i) Lighting system

- i) Detailed Room Wise Lighting Layout with Type of fixture details and Circuit diagram showing phase wise load distribution and interconnection between switches, fixtures, Lighting panel, receptacles etc.
- ii) Conduit layout showing room wise routing of wires from lighting panel to lighting fixtures, receptacles etc.
- iii) Internal road Lighting and area lighting layout with type of mounting details and fixture details.
- iv) Street Light pole details with Foundation details.

(j) Earthing System

- i) Details such as material, sizes, etc. of the earth conductor and electrode pits.
- ii) Earthing layout drawing showing natural ground resistor, routing of main grid inside and outside the plant with interconnection of equipment earthing to the grid and earth pits.

iii) Substation Building Layout showing Panel locations, Transformer locations and Trench Layout.

iv) Electrical Equipment and Panel Layout inside and outside the plant.

(k) Schedules

- cable schedules;
- load and power consumption schedule;
- junction box schedule;
- protection relay setting schedule

(l) Calculations for:

- Cable sizing;
- Fault level and Voltage drop Calculations;
- Co-ordinated protection study;
- Standby generator sizing based on equipments finalized by Mechanical and Process;
- Transformer Sizing Based on equipments finalized by Mechanical and Process;
- Room wise Lighting Calculation as per Lux level given in the specification;
- Earthing Sizing Calculation;
- Panel Busbar Sizing Calculation

5.6.4 Control, Instrumentation and Monitoring System

(a) Drawings

- power supply distribution single line and schematics diagrams for each control panel;
- internal and external general arrangement for each control panel (dimensional);
- control and instrumentation loop drawings ;
- instrument installation detail drawing ;
- cable block diagrams;
- cable routing/installation drawings;
- foundation and fixing details and trenches drawings;
- schematic diagram for system configuration of PLCs, operator stations, engineering stations, large screen, multiplexer, training station, report station, printers etc.;
- screens of process flows, diesel generator set and HV power incoming panels etc.;
- format of reports, alarms etc.

(b) Schedules

- cable schedule;
- cable interconnection schedule;
- control and instrumentation load schedule for each control panel;

- I /O schedule for each PLC;
- control and monitoring item schedule for each PLC and operator station
- alarm schedule
- junction box schedule;
- instrument schedule;
- instrumentation, process control set point schedule;
- instrument data sheets;
- (c) Documentation
 - functional design specification (FDS);
 - factory acceptance test document (FAT);
 - site acceptance document (SAT)

5.7 As-Built Drawings

These drawings shall be compiled by the Contractor and shall constitute a permanent record of the Works as executed. These shall include all such drawings, schedules, documentation and calculations as necessary for a complete understanding of the Works design, operation and maintenance.

Draft As-Built Drawings shall be submitted 60 days prior to the commissioning. The Employer will signify his approval or disapproval of the As-Built Drawings within 28 days of submission.

The Contractor shall supply to the Employer 5 (Five) copies of the As-Built drawings. The Contractor shall incorporate all necessary comments of the Employer in the above drawings, if any, and shall re-submit further 5 (five) copies each of the revised drawing within 10 (Ten) days for final approval of the Employer. The Contractor shall thereafter submit 7 (Seven) copies each of the

approved As-built drawings with softcopies. The Employer will return 2 (two) approved copies to the contractor and retain 5 (Five) for the Employer's office.

A3 and smaller sized As-Built Drawings shall be provided on durable paper for reproduction by photocopier. As-Built Drawings larger than A3 shall be provided as a paper copy and also produced in the form of black lines on a durable translucent film from which further paper prints can be taken by others as required. In addition, drawings shall be provided as an AutoCAD Revision (latest version) software copy (Editable).

Text shall be provided in an industry standard word processing, spreadsheet or database format as appropriate

5.8 Operating and Maintenance Manual

5.8.1 General

The Contractor shall compile, operating, maintenance and overhauling instructions for the whole of the Plant, and shall consist of separate volumes. The manual shall consist of:

(a) general descriptive text (including drawings for illustration) of the Works described section by section.

(b) comprising the complete operational instructions for the system, equipment and plant. This shall be termed the Operators Manual. It shall be aimed at the operational staff and shall be written in clear unambiguous text complete with drawings where necessary for clarification of any issues. The manual shall comprehensively detail what to do on a day to day basis and also what to do in the event faults developing. It shall in addition provide a complete list of the maintenance tasks the operator should carry out including the intervals between these tasks.

- (c) the essential instructions for mechanical and electrical maintenance of the Plant. These instructions shall be short and concise and set out in a consolidated schedule the inspection, lubrication, cleaning and any other type of servicing operations required. The Contractor shall prepare typical maintenance log sheets that the Employer can subsequently use for daily, weekly, monthly or other periodic maintenance and shall form record sheets of plant maintenance operations.

- (d) instructions for use of skilled maintenance personnel in fault location, carrying out routine replacements, withdrawing, dismantling, overhauling, re-assembling and testing the various items of Plant.

- (e) manufacturer's Technical Documentation subdivided into categories for:
 - civil;

 - mechanical;

 - process;

 - electrical;

 - electrical building services;

 - mechanical building services;

 - instrumentation and control.

- (f) civil As-Built Drawings
- (g) comprising the FDS and PLC code

- (h) electrical As-Built Drawings. The electrical drawings shall be complete sets including all information necessary for maintenance and spares replacement
- (i) control and instrumentation As-Built Drawings. The electrical drawings shall be complete sets including all information necessary for maintenance and spares replacement
- (j) mechanical As-Built Drawings. The mechanical drawings shall be complete sets including all information necessary for maintenance and spares replacement
- (k) electrical and mechanical building services As-Built Drawings.

The drawings shall be complete sets including all information including performance curves necessary for maintenance and spares replacement

- (l) Any other requirement stated in Subsection 6A.9:
Operation and Management Requirement

Each volume shall be subdivided (relating to areas of plant) into sub sections or sub-volumes in order to ease the location of plant details. Each volume or sub volume shall be provided with a comprehensive index for the volume or sub-volume concerned and the O & M manual as a whole.

Draft copies of the O & M manuals shall be submitted to the Employer's representative for his approval at least 60 days prior to the commencement of Tests on Completion. The Contractor shall initially supply to the Employer 5 (five) draft copies. The Contractor shall incorporate all necessary comments of the Employer in the above manuals, if any, and

shall resubmit further 5 (five) copies each of the revised manuals within 10 (Ten) days for final approval of the Employer's representative. The Contractor shall thereafter submit 7 (Seven) copies each of the approved manual together with one softcopy. The Employer will return 2 (two) approved copies to the Contractor and retain 5 (Five) for the Employer's representative's office.

Each volume shall be enclosed within A4 and A3 ring binders have tough grease resistant covers suitable for use on site and designed to permit the easy removal and insertion of the contents. The front cover and spine of each volume shall show details of the project, Employer, Employer's representative and a volume title.

Text shall generally be enclosed in A4 ring binders, A3 drawings shall be enclosed within A3 ring binders except where it accompanies A4 text in which case it shall be folded. A1 drawings shall generally be folded and enclose in A4 box files. Where A1 drawings accompany text they shall be folded and enclosed in an A4 plastic wallet, one wallet per drawing.

SUB-SECTION 6A.6
QUALITY ASSURANCE AND QUALITY
CONTROL

SUB-SECTION 6A.6: QUALITY ASSURANCE AND QUALITY CONTROL

6.1 General

The Quality Assurance/Quality Control requirements shall be followed for ensuring strict compliance of the specifications and for ensuring the highest standards of quality of material and work. All Inspections and Testing shall be carried out in accordance with the specifications and in absence of specifications relevant Indian Standard shall be used.

6.2 QC Tests of Material for Civil Works

The tests on the construction material received on site shall be carried out as follows. The test report in triplicate shall be submitted to the Employer's Representative before use. The Employer's Representative shall return one copy to the contractor duly approved or disapproved. Material will be used only after receipt of above approval.

S. No	Material & Tests	Acceptance Criteria			Frequency of Test/Remarks
1	Cement (OPC) [Reference: IS 8112 and IS 12269]				
	i) Initial setting time	Not less than 30 minutes			For each consignment of 50 M.T. or part thereof
	ii) Final setting time	Not more than 600 minutes			
	iii) Fineness by dry sieving	Residue not more than 10% on 90 micron sieve			
	iv) Specific gravity	3.10 to 3.15			
	v) Compressive Strength in kg/cm ²	33 Grade	43 Grade	53 Grade	
	a) 3 days	160	230	270	
	b) 7 days	220	330	370	
	c) 28 days	330	430	530	
	vi) Soundness by Lechatlier apparatus	Expansion not more than 10 mm			

Note: Sulphate resistant cement as per IS 12330 wherever required as per instruction of Employer's representative shall be used. Generally, tests specified for OPC shall be applicable for Sulphate resistant cement with acceptance criteria given in the IS.

S. No	Material & Tests	Acceptance Criteria	Frequency of Test/Remarks	
2	Sand [Reference IS 2116, IS 1542]			
	i) Particle Size		Tests should be carried out in the beginning and if there is a change in source.	
	a) For Masonry Mortar	90-100 % passing through 2.36mm I.S. sieve		
	b) For Walls & Plaster	90-100 % passing through 1.18mm I.S. sieve		
	ii) Silt content	Not more than 4%		
	iii) Fineness modulus	a) For concrete 2.6 to 3.6		
		b) For masonry and first coat of plaster, not more than 3		
		c) For pointing & second coat of plaster shall not exceed 1.6		
	iv) Bulkage	Bulkage will have to be determined for applying correction to the quantity of sand as and when necessary.		
3	Steel (Reference: IS 432 Part1)			
	i) Manufacturer's Test Certificates	Review		-
	ii) Size	Check for actual diameter	Per Lot	
	iii) Mass	Check for theoretical weight in kg/m	Per Lot	

S. No	Material & Tests	Acceptance Criteria		Frequency of Test/Remarks
4	Water for Construction work [Reference IS 3025]			
	i) pH value	Not less than 6		Once for approval of source of supply subsequently every six months
	ii) Sulphate and Chloride content	Sulphate content-500mg/L (Max) Chloride Content-2000mg/L (Max) for PCC, 1000mg/L (Max) for RCC		
5	Coarse Aggregate [Reference IS 383]			
	i) Gradation			One test per 100m ³
	Size of metal	100% passing through sieve size	100% Retained on sieve size	
	80mm	100mm	50mm	
	60mm	80mm	50mm	
	50mm	60mm	40mm	
	40mm	63mm	-	
		40mm (35 to 70%)	40mm (30 to 65%)	
		12.5 mm (0 to 5%)	12.5mm (95to 100%)	
	40mm to 50mm	63mm	25 mm	
	For Bituminous works			
	40mm crushed	50mm	25mm	

S. No	Material & Tests	Acceptance Criteria		Frequency of Test/Remarks
	25mm crushed metal	40mm	20mm	
	20mm crushed metal	25mm	12.5mm	
	12.5mm crushed metal	20mm	10mm	
	10mm crushed metal	12.5mm	6.3mm	
	6.3 mm crushed metal	10mm	4.75mm	
		For Concrete	For Road	
	ii) Impact Value	Shall not exceed 45%	Shall not exceed 30%	
	iii) Crushing value	Shall not exceed 45%	Shall not exceed 17%	
	iv) Los Angeles Abrasion Value	Shall not exceed 16%	Shall not exceed 50% (for WBM) and 17% for (B.T. works)	
	v) Flakiness Index	Shall not exceed 35%	Shall not exceed	
	vi) Water Absorption	Shall not exceed 5%	Shall not exceed 5% for WBM and 1% for BT work	

S. No	Material & Tests	Acceptance Criteria		Frequency of Test/Remarks
6	Bricks [Reference IS 2212			
		Class 1	Class 2	A set of 15 bricks for 50000 consignment or part thereof.
	i) Water Absorption	Shall not exceed 20%	shall not exceed 22%	
	ii) Compressive strength	32.8kg/cm ² minimum	29.52 kg/cm ² minimum	
7	Soil/Earth /Subgrade material [Reference IS 1498, IS 2720]			
	i) Proctor density	Shall not be less than a) 1.52 gm/cc for embankment up to 3 m height b) 1.60 gm/cc for subgrade and earthen shoulders / verges /backfill c) 1.65 gm/cc for top 0.5 m height of embankment		One test per 1000m ³
	ii) CBR value	The Embankment shall be designed on ascertaining the CBR value.		
8	Soft Murum			
	i) Plasticity Index	Below 8		One test for compaction of one layer in 1 km and every change in source or type of Murum

S. No	Material & Tests	Acceptance Criteria	Frequency of Test/Remarks		
9	Hard Murum				
	i) Gradation	95% passing through 80mm sieve size and 2% passing through 25 mm sieve size	One test for compaction of one layer in one km and every change in source or type of Murum		
	ii) Plasticity Index	Below 4			
10	Size Stone		Each lot		
	i) Quality of stone	Visual check			
	ii) Dimension	As per Drawing			
	iii) Water Absorption	Maximum 5%			
	iv) Compressive Strength	Minimum 1530 kg/cm ²			
	v) Specific Gravity	Not less than 3			
11	Cement Flooring Tiles				
	Water absorption	Shall not exceed 10%	6 Tiles shall be tested for a lot of 2000 tiles or part thereof.		
12	Glazed Tiles				
	Water Absorption	Shall not exceed 18%	One set of 5 tiles for every 5000 tiles or part thereof.		
13	Bitumen [Reference IS 1220]				
		Grade			
		30/40	60/70	80/100	Two samples per lot
	i) Softening Point	50-65	40-55	35-50	
	ii) Flash and Fire	175	175	175	
	iii) Specific	0.99	0.99	0.99	

S. No	Material & Tests	Acceptance Criteria			Frequency of Test/Remarks	
	Gravity(Min)					
	iv) Ductility(min)	50cm	75cm	75cm		
	v) Mastic hardness no.	60 to 80 at 25°C without coarse aggregate and 10 to 20 at 25° C after adding coarse aggregate				
14	Cement Mortar Cube [Reference IS 2250]					
	Compressive Strength	Proportion	28 Days Strength		One sample for every 2 m ³ of mortar subject to a minimum of 3 samples per day	
		1:3	127 to 211 kg/cm ²			
		1:4	84 to 126kg/cm ²			
		1:5	56 to 84 kg/cm ²			
		1:6	35 to 56 kg/cm ²			
15	Cement Concrete Cube [Reference IS 516]					
	Compressive Strength	Grade	7 Days (Min kg/cm²)	28 days (min kg/cm²)	Quantity (m³) and minimum number of samples	
		M10	70	100	1-5 m ³	1
		M15	105	150	6-15m ³	2
		M20	135	200	16-30 m ³	3
		M25	170	250	31-50 m ³	4
		M30	200	300	50&abo ve	4 plus
		M35	235	350	Additional samples for each	

S. No	Material & Tests	Acceptance Criteria			Frequency of Test/Remarks
					addition of 50 m ³ or part thereof. (1 sample=6 cubes)
		M40	270	400	
16	Bituminous Mix				
	i) Extraction	To check correct binder content as per the tender. Minimum stability 820kg for SDBC (Semi dense Bituminous Concrete)			2 test for each 100 tonnes of mix subject to a minimum of two tests per day per plant
	ii) Marshall Stability & Flow measurements	Minimum stability 900 kg for DBM/BC (Dense Bituminous Macadam/ Bituminous Concrete) Flow 2-4 mm			For each 100 tonnes of mix produced, a set of 3 Marshall moulds to be prepared and tested

6.3 QC Tests for MS Pipeline - Factory Checks/Tests

The following table on Quality control requirements in factory shall be followed by the Contractor during the project execution. The Checks/Tests shall be conducted in presence of Employer's Representative.

Factory Testing – All Tests

S. No.	Material / Equipment	Tests	Size of Sample/ Frequency of Test/Certificates	Witness to Test/Review by Employer's Representative	Remarks / Acceptance criteria
1	Material for Pipes	i) Identification of grade of material (Fe 410 as per IS 3589)	Each Lot	Review of documents	
		ii) Certificate of Chemical Composition (Ladle Analysis)	Test Certificate Per Heat No.	Review of Test Certificates	As per IS 3589/ IS 5504
		iii) Visual and Dimensional – Checking Shell thickness Tolerance - +20% and -0% (No tolerance negative)	100%	Checking to Witness	

S. No.	Material / Equipment	Tests	Size of Sample/ Frequency of Test/Certificates	Witness to Test/Review by Employer's Representative	Remarks / Acceptance criteria
		iv) Tensile Strength, Elongation test, Guided bend test as per IS 3589 & IS 5504 (Whichever is higher)	One sample per lot of 200MT	Test to be Witnessed	a) UTS - 410MPa b) Elongation - 20% (As per IS 3589)
2	Welding Procedure Qualification	SAW /SMAW for production and SMAW for repair works	Before Production	Examination and Tests will be witnessed	As Stated in IS 817
3	Checks on Fabricated Pipe	i) Edge - bevel angle 30° +5° -0° and thickness of root face 1.5±0.8(mm)	100%	Checks to be witnessed	As per IS 3589/ IS 5504

S. No.	Material / Equipment	Tests	Size of Sample/ Frequency of Test/Certificates	Witness to Test/Review by Employer's Representative	Remarks / Acceptance criteria
		ii) Welding and Dimensional Check.	100%	Checks to be witnessed	Height of inside weld bead shall not exceed 60% of
		iii) Outside diameter at both ends.	100%	Checks to be witnessed	Tolerance $\pm 0.75\%$
		iv) Ovality	100%	Checks to be	Max 1% of
		v) Straightness	100%	Checks to be witnessed	Max 0.2% of Total length.
4	Radiography (Reference: IS 4853)				
	a) Pipes	Weld Defects	10%	Test to be witnessed	As per IS 4853
	b) Fittings	Weld Defects	100%	Test to be witnessed	As per IS 4853
5	Ultrasonic Test (Reference: IS 7343)				
	a) Pipes	Weld Defects	100%	Test to be witnessed	As per IS 7343
	b) Fittings	Weld Defects	100%	Test to be witnessed	Only for seams which are inaccessible to Radiography

S. No.	Material / Equipment	Tests	Size of Sample/ Frequency of Test/Certificates	Witness to Test/Review by Employer's Representative	Remarks / Acceptance criteria
6	Hydro testing of Pipes at Factory	Pressure	100%	Test to be witnessed	As per IS 5504 / Tender document a) 1296Φx14mm b)1321Φx10mm c)1168Φx10mm d) 1296 Φx10mm
7	Internal and External Coating of Pipeline for Buried Length (3LPE)				
	i) Coating material	Review of test certificates of manufacturer for tapes/primers	Each Batch	Review of Documents	As per AWWA C 213
	ii) Surface Preparation	a) Pre cleaning prior to abrasive blasting	100%	Checking	Test as per AWWA C 213
		b) Abrasive Blast Cleaning	100% - 2 locations /pipe	Checking	Test as per AWWA C 213
		c) Surface Roughness	100% - 1 location / pipe	Checking	Test as per AWWAC 213

S. No.	Material / Equipment	Tests	Size of Sample/ Frequency of Test/Certificates	Witness to Test/Review by Employer's Representative	Remarks / Acceptance criteria
	iii) Inner (3LPE)	a) Storage temperature of the Rolls – prior to application	100%	Checking	As per Manufacturer's recommendation.
		b) Usage of Tape Rolls (Time limit)	Each Lot	Checking	As per Manufacturer's recommendation.
	iv) Applying Inner Layer	a) Tensioning Procedure b) Overlap width and length at change of Tape		Checking to Witness	As per IS 3589
	v) Total Coating System	a) Holiday Test	100%	Tests to be Witnessed	No Holiday at 12KV, As per AWWAC213.
		b) Adhesion Test of the inner layer to	One in every ten pipes	Tests to be Witnessed	2190N/m width - As per AWWAC213.
		c) Thickness Test	100% at 4 locations per pipe	Tests to be Witnessed	Min :1.854mm Max :2.235mm, As per
		d) Impact Resistance	One in every ten pipes	Tests to be Witnessed	4370 N/m - As per AWWAC213

S. No.	Material / Equipment	Tests	Size of Sample/ Frequency of Test/Certificates	Witness to Test/Review by Employer's Representative	Remarks / Acceptance criteria
		e) Penetration Resistance	One in every ten pipes	Tests to be Witnessed	25% reduction in thickness and No Holiday - As per AWWAC213
	vi) Checking Whether both ends are free for about 100mm (for Handling)		100%	Checking	-
9	Marking and Stamping	Stenciling	100%	Checking	As per Requirement

6.4 QC Checks for Handling, Transportation and Storage at Factory / Site

Objective of the checks is to ensure that hooks, slings and other attachment used for lifting and lowering during handling does not cause any damage to LINING AND COATING.

Secondly the Pipes in trucks / trailer shall be kept / stacked such that stipulations for cushioning etc. are followed and no damage to coating occurs.

6.5 QC Tests for MS Pipeline – Field Checks / Test

All tests/Checks shall be conducted in presence of Employer's Representative

S. No	Material / Equipment	Tests	Size of Sample	Witness to	Remarks / Acceptance criteria
1	Pipeline Trench				
	i) Check depth with reference to working		Every Day before Pipe Laying		As per Drawing
	ii) Width of trench		Every Day before Pipe Laying		As per Drawing
	iii) Stability of slope		Every Day before Pipe Laying		As per Drawing
	iv) Whether shoring and planking are required and if		Fortnightly Review		
	v) Whether sheet piling is required and if		As per Site Requirements		
	vi) Whether Weld-pits for welding joints are provided and dimensions		Every day		Width of Weld Pit to be D+1500mm. Depth to be 300mm and breadth adequate for access

S. No	Material / Equipment	Tests	Size of Sample	Witness to	Remarks / Acceptance criteria		
2	Checking damage to pipe before lowering		Check damage to Lining and Coating	Checking			
3	Gradient/Slope of Laid Pipe		100%	Checking	Gradient in working drawing		
4	Check for Weld Fit Up	Gap	100%	Checking	Not exceeding 3 mm		
5	Welding	i) Visual inspection both inside and outside	100%	Checking	No Pockets, Voids and discontinuity in weld. Inside Weld bead		
		ii) Radiograp Pipes	10%	Checking	As per IS 4853		
		iii) fittings	100%	Checking	As per IS 7343		
6	Field Joint Coating (Heat Shrinkable)	Holiday Test over entire length of Pipe	100%	Checking	As per AWWAC216		
7	Handling at interior of Pipes		100%	Checking	General finish and thickness		
8	Bedding & Backfilling				Zone1	Zone2	Zone3
	i) Check Concrete base (Wherever		One test for each 100m ² of compacted area	Checking	100mm	-	-
	ii) Check layer				200mm	150mm	250mm
	iii) Proctor Density				95%	95%	95%

S. No	Material / Equipment	Tests	Size of Sample	Witness to	Remarks / Acceptance criteria
9	Valve Chamber				
	i) Size		As per drawing before and during the Construction work.	Checking	
	ii) Depth			Checking	
	iii) Provision and fixing of Ladder/Rungs (Material			Checking	
	iv) Class and fixing of manholes and			Checking	
	v) Provision of Soak pit at			Checking	
	vi) Inside clean			After completion	Checking
	vii) Leakage/Seepage		Zero leakage on completion	Checking	
	viii) Puddle flange in wall			Checking	
	ix) for wash out		Compare with type drawing	Checking	
		a) Disposal pipeline			
		b) outfall arrangement			
	x) Slope on top of Chamber to negotiate with			Check	
10	Road				
	i) Check Road Reinstatement is as per		-	Check	-

6.6 Plant and Equipment

6.6.1 Extent & Procedure for Submission for Pre-Construction Testing & Review Data

All goods and materials to be incorporated into the Works shall be new, unused, of the most recent or current models, and shall incorporate all recent improvements in design and materials.

The Contractor shall place orders for the material and the equipment only after approval of the Employer's Representative. The Contractor shall submit the detailed drawings from the approved Manufacturer and the procedure of submission, review and revision shall be as specification.

6.6.2 Contractor's Quality Assurance System

Major features of the Quality Assurance System practiced by the Contractor and detailed in his Quality Assurance Manual shall include:

(a) The Contractor has defined all staff responsibilities and the QA systems operating within the Organization for the purpose of ensuring adequate quality of the end product.

(b) Regular and systematic programs of testing are carried out for all incoming raw materials.

(c) Regular calibration checks are carried out on all measuring equipment used in the Manufacturing operations.

(d) All production operations and test functions are properly documented and available to any relevant member of the Contractor's workforce.

(e) All checking activities, test results, etc. are recorded on appropriate standardized forms and these are verified, certified, recorded and filed in a systematic manner.

(f) A detailed inspection and test plan is prepared for the whole manufacturing operation.

(g) Statistical analyses are carried out regularly on appropriate test results to confirm that all processes are performing within the specified tolerances.

(h) Adequate procedures are planned for corrective action in the event that quality checks show that performance is not satisfactory.

(i) The Contractor has a senior officer with the authority to resolve matters of quality to the satisfaction of the Employer's Representative.

(j) The Contractor has adequate facilities under the control of properly trained staff to perform the quality control duties.

6.6.3 Inspection Call and Quality Assurance Plan (QAP)

The Contractor shall inform the Employer's Representative about the likely dates of manufacturing, testing, and dispatching of any material and equipment to be incorporated into the Permanent works and notify the Employer's Representative for inspection and testing, at least twenty-eight (28) days prior to packing and shipping and shall submit the following

- Copy of Purchase Order placed on Manufacturer (Prices may be blanked)
- Manufacturer's test results and Quality Control Certificates
- QAP incorporating inspection details and tests to be conducted on basis of relevant IS and requirements stated hereunder subsequently

- Authenticated Characteristics curves for Pump and Motor

The Employer's Representative will decide whether he or his representative will inspect and test the material / equipment or whether he will approve it on the basis of the manufacture's certificate.

6.6.4 Inspection Categories for Plant and Equipments

The following inspection and test categories shall be applied prior to delivery of the equipment, of various categories as indicated in the technical specifications for each type of the equipment:

Category A: -The drawing and QAP (Quality Assurance Plan) for testing has to be approved by the Employer's Representative before manufacture and testing. The material has to be inspected by the Employer's Representative or a third party inspecting agency approved by the Employer's Representative at the manufacturer's premise before packing and dispatching. The Expenses of two Representatives of the Employer for travel and stay will be borne by the Contractor including Air fare. The Contractor shall provide the necessary equipment and facilities for tests and the cost thereof shall be borne by the Contractor.

Category B: - The drawings of the equipment have to be submitted and approved by the Employer's Representative prior to manufacture. The material has to be tested by the manufacturer and the manufacturer's test certificates are to be submitted and approved by the Employer's Representative before dispatching of the equipment. Notwithstanding the above, the Employer's Representative, after examination of the test certificates, reserves the right to instruct the Contractor for retesting, if required, in the presence of the Employer's representative. All cost for visit and travel of Employer's Representative will be borne by the Contractor.

Category C: - Samples of the materials and/or equipment shall be submitted to the Employer's Representative for pre-construction review and approval. Following approval by the Employer's Representative, the material may be manufactured as per the approved standards and delivered to the site.

The categorization of the various material, equipment and plant for purpose of inspections is as below. However, this list can be altered and additions or subtractions done or categories changed in due course during the implementation of the Contract by the Employer's Representative.

6.6.4.1 Mechanical Work / Plant

S.	Items	Category
1.	a) Vertical Turbine Pumps b) Horizontal Centrifugal Pump	Category A Category B
2.	Sluice Valves with / without Actuators a) Diameter 600mm and above	Category A
3.	Butterfly valve with the actuator a) Diameter 600mm and above	Category A
4.	Non –Return Valve/Dual Plate Check Valve	Category A
5.	Pipe work a) Diameter 600mm and above	Category A
6.	Sluice gates	Category A
7.	E.O.T Crane	Category A
8.	Monorail and other lifting equipments	Category B
9.	Air vessel	Category A
10.	Air compressor	Category B
11.	Chlorination Equipment (Except Pump)	Category A
12.	Motor 90kW and above	Category A
13.	Motor below 90kW	Category B
14.	Blower	Category B
15.	Metallic bellows, Expansion Joints	Category A

S.	Items	Category
16.	Air valves	Category A
17.	Drain and dewatering Pump sets	Category B
18.	Ventilation Equipments	Category A
19.	Portable Fire Extinguisher	Category B
20.	Air Conditioners	Category B
21.	Scrubber System	Category A
22.	Screen	Category A
23.	Flash Mixer, Flocculator Equipment, Rotating Bridge, Centrifuge, Tube Modules (For Tube	Category A
24.	Scrubber system for chlorine Neutralisation	Category A
25	Stop log Gates	Category A

6.6.4.2

Electrical Works

S.	Items	Category
1.	HV Outdoor Current Transformer	Category A
2.	HV Outdoor Switch Disconnecter/ Isolator	Category A
3.	/HV Outdoor Lightning Arrester	Category A
4.	Gantry/ Structure for Switchyard/ Transmission	Category A
5.	Power Transformer (including OLTC, RTCC	Category A
6.	MV and LV Capacitors and APFC Panel	Category A
7.	HV, MV and LV switchboards, Relay control panel	Category A
8.	LV Variable Frequency Drive and Soft Starter	Category A
9.	Starters (Other than Soft Starters)	Category B
10.	Battery and Battery Charger and DCDB	Category A
11.	Cathodic protection- Transformer/ Rectifier (T/ R)	Category A
12.	Outdoor 132kV accessories for substation (i.e.	Category B
13.	Cathodic Protection equipment other than T/ R	Category B
14.	Neutral Grounding Resistor	Category B
15.	Sub-Distribution Boards, Lighting Panels and	Category B

S.	Items	Category
16.	Lighting System, illumination	Category B
17.	UPS System	Category B
18.	HV, MV and LV Power and Control Cables	Category B
19.	MV/LV Cable Termination	Category B
20.	Motors MV & LV	Category B
21.	Printers	Category B
22.	Earthing System and lightning protection	Category B
23.	Local Push Buttons, local distribution boards	Category C
24.	Cable tray and accessories	Category B
25.	LV DG Sets, Diesel Storage tank	Category A

6.6.4.3 Instrumentation Control and Automation

S.	Items	Category of Inspection
	Instrumentation Works	
1.	Instrument Control Panel for RWPS comprising of PLC system, digital indicators, digital flow indicator	Category A
2.	Instrument Control Panel for CWPS comprising of PLC system, digital indicator, alarm annunciator,	Category A
3.	Instrument Control Panel with PLC system	Category A
4.	Local PLC system	Category A
5.	Temperature scanners	Category A
6.	Flow switches	Category A
7.	Digital panel meters	Category A
8.	Conductivity level switches	Category A
9.	Control panel for surge protection system	Category A
10.	Full Bore Electromagnetic Flow meters	Category A
11.	Pressure Switches	Category B
12.	Differential pressure Transmitters	Category B
13.	Ultrasonic type level measuring systems	Category B
14.	Float type Level Switches	Category B
15.	Instrumentation and Control cables	Category B
16.	Instrumentation Control Panel	Category A
17.	Radar type level meter	Category B
18.	Pressure transmitter	Category B
19.	Alarm Annunciator	Category A
20.	Open channel flow meter	Category B

S.	Items	Category of Inspection
	Instrumentation Works	
21.	Turbidity meters	Category B
22.	Residual chlorine meter	Category B
23.	PH meter	Category B
24.	Laboratory instruments and equipment	Category B
25.	Pressure Gauges	Category B
26.	Portable temperature monitor	Category B
27.	Portable sound level meter	Category B
28.	Portable vibration meter	Category B
29.	Laptop Computers	Category B
30.	EPABX System	Category A

6.6.5 Conditions for Supply and Inspections

For material/equipment under Category "A" and "B", the Employer's Representative will provide an authorization for packing and shipping after inspection and review of Manufacturer's Certificate for Category A and Category B.

The testing and approval for dispatching shall not absolve the Contractor from his obligations for satisfactory performance of the System.

The Employer or his duly authorized representative shall have access to the Contractor/Manufacturer's premises at suitable time to inspect

and examine inspections (including testing for chemical analysis and physical properties) the material and workmanship of the material, plant and equipment during manufacture. The Contractor will be responsible for obtaining permission for such at the manufacture's premise if he is not the manufacturer. The testing will be carried out by the Contractor/Manufacturer and certificates submitted to the Employer's Representative, who will have the right to witness or inspect the above mentioned inspection/testing at any stage desired by him. The Contractor shall forward to the Employer 3 Nos. duly certified

copies of the Test Certificates and Characteristics Performance Curves for all Equipment.

If any material or any part of the works fails to pass any inspection/test, the Contractor shall either rectify or replace such materials or part of the works and shall repeat the inspection and/or test upon giving a notice. Any fault or short coming found during any inspection or test shall be rectified to the satisfaction of the Employer's Representative without any extra cost before proceeding with further inspection or wiring of that item. Any circuit previously tested, which may have been affected by the rectifications work shall be retested.

Where the Plant and Equipment is a composite unit of several individual pieces manufactured in different places, it shall be assembled and tested as one complete working unit at the Manufacturer works.

Neither the Inspection / Testing of the material or any part of the works, nor the attendance by the Employer's Representative(s), nor the issue of any Inspection Test Certificate shall relieve the Contractor from the responsibilities under the Contract.

The test Equipment, Meters, Instruments etc., used for testing shall be calibrated at recognized test laboratories at regular intervals and valid certificate shall be made available to the Employer's Representative at the time of testing. The calibration instruments used as Standard shall be traceable to National/International Standards. The calibration certificates for the test instruments shall be produced for Employer's Representative consent in advance of testing and if necessary instruments shall be recalibrated or substituted before the commencement of the test.

SUB-SECTION 6A.7

ERECTION, TESTING AND COMMISSIONING

SUB-SECTION 6A.7: ERECTION, TESTING AND COMMISSIONING

7.1 Erection General

The contractor shall obtain all statutory, legal permissions, and Licenses as applicable to Lay out & construction of the complete plant and systems including 33 kV HT Substations from appropriate Central Government, State Government, Municipal Corporations and other agencies. The contractor shall obtain all prior approvals from the concerned authority including lay out drawings before execution and after completion of work of plant wherever necessary.

The cost, fees etc. as applicable for obtaining all the statutory, legal permissions, Licenses, approvals shall be borne by the contractor during the execution and operation & maintenance of project work.

The contractor shall make an agreement with all equipment manufacturer on Rs. 100/- bond paper for providing their assistance at the time of erection of equipment for giving required services during O&M period.

The Contractor's staff shall include adequate and competent (holding license from competent authority) erection engineers with proven, & adequate 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 and with quality. The Contractor shall not remove any supervisor, erector or skilled labor from the Site without prior approval of the Employer's Representative.

The Contractor's key supervisor 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

The contractor shall submit the erection methodology stage-wise and stepwise, QAP (Quality Assurance Plan) and name of the erection engineer with qualification and experience for approval of Employer's Representative. The Contractor shall ensure that no installation or erection work shall commence until full and unconditional approval to working drawings, erection method and QAP signed and stamped by the Employer's Representative are available at Site.

The Contractor shall be responsible for setting up and erecting the plant to the line and levels of reference and of the positions, levels, dimensions and alignment, and provision of 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 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 and pockets for foundation and holding down bolts and other erection aids, anchors, cutouts where the various items of Plants are to be installed and shall bring any deviation from the required position, lines or dimensions to the notice of the Employer's Representative. Plant shall be erected in a neat and workman like 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.

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 and levels before, during and after grouting-in. The contractor shall also ensure that adequate number of air vents are provided so as to ensure no probability of air trapping in the grout. The approval by the Employer's Representative of the Contractor's proposals for rigging and hoisting

any items of the Plant 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, 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 the Employer's Representative will inspect the installation from time to time in the presence and under guidance of the Contractor's Site representative to establish conformity with the requirements of the Specification and good engineering practice. Any deviations flaw and deficiencies found or evidence of unsatisfactory workmanship shall be corrected as instructed by the Employer's Representative.

7.2 Erection of Plants and Equipment

7.2.1 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. Before commencing grouting it shall be conformed that air displaced by pouring grout has way out to atmosphere 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. Block outs shall be closed using cement concrete of the same grade as that of the parent structure.

7.2.2 Vertical Turbine Pumps

- (i) Check the surface of location of pump to be grouted and surface of sole plate for cleanliness and level.
- (ii) Check the foundation bolts for fixing sole plate are rigidly anchored and sufficiently projected above sole plate for rigid tightness.
- (iii) Check the matching of sole plate holes and discharge head plate by assembling before erection of sole plate.
- (iv) Check all the special tools & tackles and lifting arrangement are in working condition.
- (v) Check with high precision spirit level that the sole plate and discharge head plate assembly are at correct horizontal level and the flange at exact vertical level.
- (vi) Check the alignment of pump set for tolerance limit set by manufacturer of pump.
- (vii) Check free rotation of pump.

7.2.3 Electric operated Crane / Manually operated Crane

- (i) Check the horizontal and vertical mounting plates of suitable structural strength perfectly welded to RCC steel bar on Corbel and column.
- (ii) Check all the plates installed on RCC column and corbel are aligned in level by water tube.
- (iii) Check girder level individually and in parallel for perfect horizontal level before welding to plates on corbel and column.
- iv) Check rail level by tack welding to girder and joints for correct horizontal level.
- (v) Check the safety equipments, lifting equipments for placing EOT assembly on rails.
- (vi) Check that longitudinal travel and lateral travel covers all equipment to be handled.
- (vii) Check Crane for rated load capacity after successful erection.

7.3 Records, Procedures and Reports

The Contractor shall maintain records pertaining to the progress and 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 shall be in the approved formats. The Contractor shall submit such records to the Employer's Representative after the erection 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, 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 completion of erection.

7.4 Completion of Erection

7.4.1 Plant Erection

The completion of erection by the Contractor shall be deemed to occur if all the units of the Plant are structurally and mechanically complete and will include, among other such responsibilities, the following:

- Plant in the Scope of the Contract has been erected, installed and grouted as per specifications
- Stage-wise and stepwise erection checks are completed and approved by the Employer's Representative
- Erected Plants 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 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 along with equipment-wise and item-wise check list submitted and instruments and gauges such

as water tube precision spirit level, feeler gauge, dial gauges, torque wrenches, etc. are kept ready for erection checks. The Employer's Representative shall proceed with the inspection of such units within 7 days.

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 pre-commissioning checks. 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 undertakes to complete such outstanding works within an agreed time prior to completion of commissioning. Taking over shall be based on rectification of all deficiencies which are to be completed before acceptance as mentioned in the Punch List.

7.4.2 Safety Procedure and Practice

a) Mechanical

- For all rotating equipment coupling guard shall be provided
- Lifting equipment for various items shall be of suitable capacity
- All floors / tiles at work and other places shall not be slippery
- Safety signboards shall be displayed at works
- At all places for alighting in trenches, passages and deep site works ladders, safety belts shall be used

- Barricading and danger boards shall be provided wherever necessary
- Chain, Wire ropes, other tiding apparatus condition shall be checked

b) Electrical

Following safety procedure and practice should be provided by the Contractor in the switchboard room/substation as per latest edition of I.S. 5216.

- (i) Rubber matting in front of HV, MV and LV switchboard and other panels in switchboard room
- (ii) Shock treatment chart in switchboard / electrical equipment room
- (iii) Caution/Danger Board on –
 - HV, MV and LV switchboard and other LV panels
 - Lighting distribution board
 - Transformer yard
- (iv) Sand bucket in switchboard / electrical equipment room/ transformer yard
- (v) Fire extinguisher in switchboard/ electrical equipment room
- (vi) Four sets of hand gloves in switchboard room of each location
- (vii) First aid box in switchboard / electrical equipment room/ Chlorination plant /pumping plant
- (viii) Fire Safety

The requirement of hand appliance in switchboard room, electrical equipment room shall be as per the latest edition of Fire Protection IS code of practice and National Building code.

7.4.3 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:

- (i) All latest approved L-sections and alignment drawings
- (ii) All up-to-date as built drawings as well as approved drawings in Category I for all mechanical, electrical, instrumentation and civil works
- (iii) Data sheets for instrument specification and selection
- (iv) List of all equipment along with data sheet/ literature
- (v) Erection/ Instruction manual for all equipment
- (vi) Commissioning manual for all equipment
- (vii) Instrument Schedule
- (viii) Electrical cable schedule and inter-connection diagram
- (ix) Instrumentation schedule
- (x) Instrumentation cable schedule
- (xi) Loop drawings for instruments in the field and control panel
- (xii) Instrument test and calibration report
- (xiii) Instrument installation drawings
- (xiv) 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.

7.5 General Preparations for Pre-Commissioning and Commissioning Tests

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 and commissioning 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 period. The Employer's Representative also reserves the right to withhold the cost is 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.

The documents listed in Sub-clauses 7.5.1, 7.5.2, 7.5.3 and 7.5.4 shall be completed in accordance with the Contract schedule before commencement of pre-commissioning and commissioning tests. 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.

7.5.1 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

7.5.2 Procedures

- Mechanical testing procedure
- Electrical testing procedure

- Instrumentation testing procedure
- Detailed pre-commissioning and commissioning procedures and tests
- Detailed Performance Test procedure

7.5.3 General and Coordination Documents

- Detailed organization charts for pre-commissioning and commissioning tests 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 works
- Detailed schedule showing the time sequence which the Contractor anticipates to follow for the various steps in completion of trial run, 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

7.5.4 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.

7.6 Pre-Commissioning Checks and Commissioning Tests

7.6.1 General Requirements

After the completion of erection, pre-commissioning activities listed below shall be carried out to make the Plant 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, 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 is erected in accordance with the Contractor's construction drawings, pipe work drawings, instrument diagrams, etc., issued for the Plant;
- 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 cleanup which do not materially affect the operation or safety of the Plant will be excluded. All these items shall be listed and completed after pre-commissioning but before acceptance.

The Contractor shall prepare and maintain at Site test forms and records, which shall include:

- Check list details in the tests and checks;

- 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 is 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 rectification 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 unit. 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:

7.6.2 Mechanical Equipment

A) Pumps, Piping and Valves and other mechanical plant

- i) Leakage tests shall be carried out on all erected pipe work, pumps and valves and immediately after erection where possible before being built in
- ii) Operating tests shall be conducted on valves and actuators

iii) The pumps shall be tested for mechanical performance.

The vibration and noise levels shall be checked to be within the specified limits

iv) Pump performance tests shall be conducted for all raw water and clear water pump sets. Each pump shall be tested one pump at a time

v) Check and verify efficiency of each pump and vibration of pump

vi) Check the running of different combinations of pump sets and verify the various parameters within permissible limits

vii) To check the sequential start and stop of pumps with level control and automation scheme

viii) Check suitability of dismantling joint by working on nut-bolts and sliding flange

ix) Check whether motor current is within safe limit

x) Check feasibility of access for lubrication and maintenance to all bearings

xi) Check operation of EOT crane current drawn limit and position switch for pendants

B) Stop Log Gates

The frames for stop logs gates shall be properly grouted and level and inner gap suitable to stop log gate shall be checked, stop log gates rubbers shall be checked for rigid fixing with gates. Chain pulley block shall be checked for proper load capacity and load chain travel for required depth. The structural

members for lifting arrangement levels and its grouting foundation shall be checked. The lifting arm for stop logs shall be checked by lifting the gates with lifting arm outside before insertion of gates. Operation, function of complete stop log arrangement shall be checked for water leakage at site

C) Screen and its Lifting Arrangement

Check frame for screen insertion for proper grouting and levels with inside tolerance suitable for screens. Check the dimensions of screen suitable for frame which shall cover complete area for screening function. Check lifting arrangement for removing screen for cleaning and other maintenance purpose. Structural members of lifting arrangement grouting and level of chain /wire rope shall be aligned so that screens can be easily inserted in or removed from location. Chain pulley block shall be checked for proper load capacity and load chain travel for required depth. Operation of all complete screen shall be checked

D) Sluice Gates & Manual Actuators and Lifting Arrangements

Check the erection & level of frames of all sluice gates as per requirements. The shaft of sluice gate shall be checked for intermediate supports for smooth operations. Gearbox / lifting arrangement shall be exactly in vertical position. Operation of all the gates shall be checked one by one. All the gates shall be checked for function open and closure.

E) 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 given in “Employer’s requirement surge control and Break pressure tank” 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 rectify the surge protection system.

F) Load Testing of 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 methodology for testing shall be submitted to Employers representative for prior approval.

7.6.3 Pump Motors

Condition of winding insulation be tested and insulation values shall be restored to required level by suitable heating arrangements locally.

7.6.4 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 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. 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.
- v) 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.

7.7 Electrical

The commissioning engineer shall verify any commissioning tests / completion checks to satisfy him with suitable and calibrated testing kits as required, that the plant 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.

7.7.1 Sub-Station Installation

Installation work should be divided in two broad categories.

- a) Indoor installation work preconditions for commencing
- Civil works should be complete
 - Material, equipment should be available
 - Essential interface work should be complete

Indoor work can be conducted during rainy season

- b) Outdoor work preconditions for commencing
 - Civil work in that area including foundations, cable trenches, approach roads etc. should be complete
 - Material and equipment should be available
 - Planned sequence should be followed
 - Rainy season should be avoided for final assembly work of equipment like circuit breakers, transformers

c) Preliminary Preparation

The preliminary preparations include study of drawings, acceptance reports, checking certificates and test reports of the equipment. Completion of civil engineering works, arranging the tools, lifting gears etc. organizing the labour, prepare the schedule of installation, preparing sequences cards for erection major items etc.

d) Drawings for erection

The drawings include:

- Circuit diagrams of the plant
- Civil engineering plans, foundation plans etc.
- Dimensions drawings of equipment
- Equipment assembly, subassembly, component drawings
- Interface drawings (inter relationship between various auxiliaries)

e) Field Quality Plans (FQP)

Each equipment should have FQP for erection, pre-commissioning and final testing. The instructions for field quality checks, formats for test records etc. shall be prepared for monitoring.

f) Safety Procedures

Procedures and paper works for the following should be enforced from the beginning.

(i) Permit to work

(ii) Access to work

(iii) Entry passes

(iv) Material gate pass etc.

(v) Follow the safety rules faithfully

(vi) Take permission from authorized person for doing specific work

(vii) Place condition notice and danger notices

(viii) Make sure to switch off the supply from both ends

g) Installation

The erection sequence may differ somewhat from site to site depending on various circumstances. After the erection of the steel structures comes the erection of the insulators and the phase conductors, bus bars etc. Thereafter follows excavation for the underground earth mat.

(i) Erection of Galvanized Steel Structures

Structure shall be built by bolting of section from ground to top. Skilled erection personnel shall be provided to build up the upper portion step by step. The construction should be complete and final lightning shall be done after adjustment into straight position.

The structures shall be provided with identification marks to enable proper and speedily assembly at site. The vertical axis shall be maintained. Alignment in vertical position shall be ensured by use of theodolite, plumb line, spirit level on horizontal members.

Cross beams shall be erected on the ground and hoisted up by means of a derrick or a mobile crane.

(ii) Insulators

All insulators shall be checked immediately upon arrival at site.

Post insulators shall be installed on respective support structures by using suitable crane. Correct galvanized hardware and torque spanners of specified torque shall be used.

String insulators shall be then raised up to gantry holding point and installed by using correct galvanized hardware.

The main problem with insulators is protection against damage during transportation, handling and erection. Insulators shall be protected by wooden cages during the entire erection period.

(iii) Rigid Aluminium Tublor or ACSR Busbars

After installing post insulators, the bus bars shall be erected. The length of tubes shall be cut to size, edges are filed for

perpendicularity and removal of byros and sharp corners. Edges are prepared for welding.

The tubular busbars shall be fastened on to the rigid insulators by using correct hardware. Mating surfaces of clamp and tube shall be cleaned by energy paper prior to tightening the nut bolts anti-oxidation jelly shall be applied immediately.

When connecting conductors etc. care must be taken not to introduce stresses such as bending forces, pull etc.

The erection of ACSR conductors of flexible bus is stringing and connection for all conductors. Erection of connectors and clamps is a very critical activity and must be done as per instructions. Necessary quality checks shall be made. Connectors shall be handled carefully to avoid scratches, dirt, damage to threads etc. Preparation for connections and tightening of bolts shall be done carefully.

(iv) CTs, VTs

These shall be installed on respective structures. The porcelain shall be closely observed for cracks. Small chops up to 8 mm diameter shall be rectified by means of epoxy resin. Larger chips shall not be allowed.

When erecting current and voltage transformers, the oil level shall be checked and it should be checked that the insulator etc. has not oil leakage. The connections of secondary earth, primary shall be checked twice.

Lifting equipment, slings etc. must be applied at the correct places. Lifting by slinging on the primary connection must not be done under any circumstances.

The following tests shall be done before the erection to verify the healthiness of CT / VT.

- (i) Ratio test
- (ii) Insulation measurement
- (iii) Continuity
- (iv) DC resistance
- (v) Surge Arrestors

Surge arrestor shall be lifted and assembled on the structure. The correct functioning and protective ability of the surge arrestors shall be ensured by:

- The erection of the arrestor as close as possible to the object to be protected, usually a power transformer
- Connection of the arrestor's lower main earthing terminal shall be made with the shortest possible conductor to the earth mat
- The transformer tank shall be connected to the same ground point as the arrestor lower main earthing terminal
- Separate earthing of arrestor and transformer tank must not be made under any circumstances, as the arrestor cannot protect the transformer in such case

- (vi) Disconnectors (Isolators)

The manufacturer's instructions shall be carefully followed for erection of isolators, operating mechanism etc.

The insulator columns shall be assembled on the structure. The contact arms, operating mechanism, the linkages between three poles shall be assembled. Correctness of alignment, simultaneous closing of all contacts shall be checked by manually and electrically operation.

(vii) Outdoor Circuit Breakers

The breaker shall be assembled by trained personnel of the erector or manufacturer. The breaker is dried out by hot air circulation followed by evacuation. Breaker is kept in vacuum for at least 20 hours to ensure removal of water drop lets and moisture completely. Thereafter SF6 gas is filled. The leakage test shall be carried out by means of soap solution, SF6 leakage detector and by monitoring pressure gauge. Leakage free performance should be ensured before commissioning.

The auxiliary systems of mechanism, gas monitoring system, operating pressures of compressed air or hydraulic mechanism etc. shall be verified. Settings of pressure switches and their functioning shall be verified. The reaction of the circuit breaker is a comprehensive job shall be carried out in accordance with the erection manual.

Outdoor circuit breakers shall be mounted on pre-fabricated galvanized steel structures. Structures shall be supplied by the manufacturer of breakers.

(viii) Installation of Transformers

The tank filled with dry nitrogen gas shall be unloaded near the final plinth or in nearby concreted floor of adequate bearing capacity by sliding on the wooden

sleepers. Sufficient number of hydraulic jack shall be used for unloading.

After unloading the tank on the plinth, the following activities are carried out:

- Assembly of tap changer
- Assembly of bushings
- Installation of control cabinet
- Power cables
- Fitment of accessories

Filtered oil is filled into the transformer tank. The oil is circulated through the filtering plant. The filtration continued till the following is achieved

- Enough breakdown value of the oil sample from the tank
- Enough dryness of oil from the tank
- Designed chemical composition (purity)
- Insulation resistance and polarization index of transformer
- “Tans” measurement

(ix) Earthing System

Earth resistance shall be measured during dry season and wet season. These values shall be within permitted limits.

The earth mat work includes burying of earth rods and earthing copper plates, earthing mat, risers. All recommended parts are connected to earth mat to eliminate the danger of step and touch potentials. The earth mat must be made with great care to ensure personnel safety from dangerous touch potential and step potential. The part of the earthing system above ground must be carefully laid and connected. Follow strictly the erection documentation for:

- Structure earthing
- Tower earthing and earthing of overhead earthing shold
- Apparatus and cabinet earthing
- Earthing switches terminal
- Disconnecter with switch terminal
- Equipment earthing
- Transformer neutral earthing
- Transformer tank earthing
- Surge arrestor terminal earthing
- Cable racks earthing
- Capacitor neutral earthing
- Earthing of fencing, doors, screens, lamp post etc.

(x) Commissioning of substation

Commissioning activity follows erection and involves final checks, subsystem tests, system tests and load tests.

The commissioning organization includes:

- Commissioning incharge
- Control room engineers
- Test engineers for AC yard
- Test engineers for auxiliaries etc.
- Supervisors and electricians, mechanics etc. for quick repairs
- Documentation and field quality engineers

(xi) Documentation

- Test records of every equipment shall be verified and signed
- If test results show abnormal or doubtful values the “hold points” shall be identified and corrective actions are taken before continuing the further work in that apparatus
- After completing all the equipment tests, the subsystem tests shall be carried out. These involve a group of equipments i.e. a switchgear bay with circuit breakers, isolators, earthing switches, CTs, protection system etc.
- Final system tests shall be performed as per agreed schedule and sequence

- Commissioning shall be carried out from control room in liaison with all the sub system engineers

The sequence of operations of earthing switches, isolators, circuit breakers is listed, before commencing the charging operations.

After each operation from control room, the position of indicating mark on mimic board is observed.

Meanwhile, the observers in yard inspect the equipment from nearby location and inform the status about operation to control room engineer over walkie-talkie / phone.

The sequence of operations is completed and the system is energized.

All the equipments in yard are observed for corona, hot-spots leakage, flashovers, sparking etc.

Hot-spots on clamp and connectors are observed by means of remote sensing binoculars.

During commissioning, control board is closely observed for meter readings, indication by relays etc.

If alarm or tripping occurs, investigation and corrective actions are taken before proceeding further.

(xii) Commissioning Tests

These are divided in the following categories:

- i) Equipment functional checks and tests
- ii) Sub system checks and tests
- iii) Complete system tests at low voltage; without voltage
- iv) Commissioning tests before and after system HV energization
- v) Performance tests

(xiii) Equipment Tests

The equipment tests on each individual equipment are performed in accordance with the site testing plan, site tests are with all the associated equipment, auxiliaries, sub system etc.

The equipment tests include the following (as applicable)

- Insulation resistance measurements
- Resistance measurements
- Phase sequence tests
- Polarity tests
- Ratio tests
- Operating timing tests
- Continuity tests
- Insulation resistance of auxiliary circuits

- Mechanical operation tests
- Sequential operation tests
- Applied voltage tests
- Primary injection tests
- Secondary injection tests
- Functional operation tests
- Performance characteristics tests

Site tests shall be carried out on individual equipments as per manufacturers recommendations. The site test results shall be compared with the shop tests results to confirm that the equipment has been assembled correctly and is in proper functioning state.

(xiv) Sub-Systems Tests

The sub-system comprises several equipments, associated electrical and mechanical connections, controls, interlocks etc.

The sub-system tests are performed as per schedule. These include:

- Tests on main circuits
- Tests on auxiliary circuits
- Tests on protective and control circuits

- Tests from local points
- Tests from control room
- Current injection tests
- Applied voltage tests
- Insulation resistance tests
- Functional tests

(xv) Tests on Protection Systems

- Tests before energizing the secondary equipment
- Tests before energizing primary equipments
- Synchronising tests
- Tests on each protection zone
- Tests on overlapping of protective zones
- Test by initiating protection from the control room
- Staging fault tests by artificial fault in protective zone

Secondary Injection Tests:

These tests consist of injecting current through the secondary circuits and checking operation of relays.

Primary Injection Tests:

These tests shall be conducted by injecting currents through primary circuits of CT's.

Tripping and closing tests on circuit breakers

These shall be conducted from:

- Local kiosk near the CB
- By initiating the protective relay from the protection panel
- By initiating the push button from the control panel

Indications and Alarms

- Each indication and alarm on the annunciation panel should be checked

(xvi) Phasing Tests

Before paralleling a transformer, the following shall be checked

- The phase sequence
- The polarity
- The ratio, etc.

(xvii) On Load Tests

The voltage is applied initially for a fraction of second to one second under close observation.

After satisfying healthy installation, the voltage is applied for a little longer duration under close observation. Relay panels, instrumentation panels. Auxiliaries, outdoor

years are observed closely for flashovers, corona, noise etc.

After ensuring no flashovers and tripping, the voltage is applied for a longer period.

During commissioning close observation is necessary for several hours, days etc. as per field quality norms.

After loading, the busbars and connectors should be observed for hot spots if any.

(xviii) Handing over to the operating staff

After successful commissioning and trial period, the installation is handed over to the trained operating staff. Sufficient maintenance spares, consumables, operating instructions and maintenance instructions shall be made available to the trained operating staff.

7.7.2 Commissioning Tests / Completion Checks

7.7.2.1 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
- l) Operation test for all protection relay for protection of motor

7.7.2.2 General Tests

a) **Commissioning Tests of Motor**

- Insulation resistance test of motor windings and cables.
- 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

(LT Motors)

- 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)
- Starting current shall be checked whether its specified limit or not
- 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, and resistivity, Insulation resistance test of windings.
- ii) IR for bushings, before assembly.
- iii) Test the transformer for the following:
 - Winding resistance at all the taps
 - Short circuit impedance (at low voltage)
 - 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
 - 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 (HT / LT):

- 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.
- ix) Earthing Terminals.

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 Energy Meter:

- i) Check calibration (Test certificates).
- ii) Megger all insulated portions.
- iii) Check CT and VT connection with particular reference to their polarities for relevant
- iv) 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 (Test certificates).
- v) Trip free and anti-pumping operation.
- vi) IR Values- resistance
- 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 (LT breakers only)
- 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.

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 (Test certificates).
- 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.

- vii) High voltage test for cables above 1.1kV.

j) Commissioning Checks of Capacitor:

- i) Measurement of capacitance

- ii) Capacitor loss tangent measurement (for above 1000V)

k) Commissioning Checks of Neutral Grounding Resistor:

- i) High voltage test

- ii) Ohmic value test, Insulation resistance measurement test

l) Lightning System

Commissioning tests stipulated in applicable standards and code of practice covering all lightning system equipment

m) 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 Indian Electricity rules (1956). Earth grid resistance value should be not greater than one ohm.

n) Commissioning Checks for Battery:

- i) Specific gravity test.
- ii) Cell voltage test.
- iii) Capacity test.
- iv) Initial charging/ discharging cycle.

o) 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)

Test for Battery and Battery Charger

All tests shall be conducted as per the relevant standards. Tests shall include following:

Type & Acceptance tests.

- i) Type Tests: Performed at manufacturer's works
- ii) Acceptance Tests: Performed at site after installation and commissioning of the battery.

All tests shall be witnessed by the Employer's representative
Commissioning Test.

- a. The following routine tests shall be conducted at site at no extra cost.
 - i. Visual checks for dimensions and general arrangement.
 - ii. Wiring checks
 - iii. Functional checks
 - iv. Voltage regulation for rated input supply for loads from 0-100%.
 - v. Load test to show the charger can serve the rated duty without the current limiter device operating.
 - vi. Calibration of potentiometer vis-a-vis the DC output for float and boost chargers.
 - vii. Ripple and harmonics measurement by oscilloscope at different loads.
 - viii. Demonstration of guaranteed efficiency and power factor.
 - ix. Insulation test (with 500 V megger)
 - x. Hipot test, excluding electronic controller, at 2 kV AC for one min.

- b. The following type tests shall be conducted at the factory. Extra cost, if any, shall be specifically stated by the manufacturer.

Heat run test with both float and boost chargers on full load especially for float and boost charger schemes/systems and if housed in same/adjacent panel/ cubicle with or without dividing partitions.

- c. Vendor shall ensure use of calibrated test equipment having valid calibration test certificates from standard laboratories traceable to National Standards.

Acceptance Test of Batteries

Acceptance tests shall be conducted at site on completion of installation and commissioning and immediately prior to putting the battery in service. These tests shall comprise of:

- i. Visual inspection
- ii. Dimensional check
- iii. Ampere hour Capacity test
- iv. Retention of charge
- v. Insulation resistance

Routine Test

- i. Physical examination.
- ii. Dimension, mass and layout
- iii. Marking
- iv. Polarity.

Test reports

A copy of routine and type test results shall be submitted for approval before the dispatch of batteries. Specified number of bound copies of complete test results shall be furnished with the batteries.

p) DG Set

Acceptance tests shall be conducted at site on completion of installation and Commissioning and immediately prior to putting the DG Set in service. These tests shall comprise of:

- Functionality check:
- Manufacturers standard tests:
- H.V (High Voltage Test)

- Megger test Insulation Megger test

- Phase sequence

- Change over test with LT Auxiliary Transformer along with AMF Panel.

- All functional interlocking test at No-load test shall be done before charging the transformers.

- Indicating, Metering, closing, tripping circuits as per approved drawings.

Load Test

- Run set for 2 hours at full load (all critical Loads as approved)

- step load acceptance and rejection tests using the maximum step loads

q) Building Services

Contractor has to check and test the illumination and ventilation system shall be erected and commission as per approved drawings for point wiring, lighting fixtures exhaust fans, ceiling fans, power sockets, etc.

After installation each point wiring and equipments shall be tested as required before handover.

7.8 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 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

7.8.1 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.

7.8.2 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.

7.8.3 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 bypassing 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.

7.8.4 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.

7.8.5 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.

7.8.6 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.

7.9 Commissioning

After the completion of pre-commissioning activities, the final checks and preparations necessary for startup of the plant 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 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& commissioning data formats.
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. 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 shall be operated at optimum Plant 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 by constantly monitoring operating data.
10. The Contractor shall specify for each discrete part of the Plant 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
13. 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.
14. All checks and tests shall be as per the Manufacturer's drawing manuals, relevant codes of installation and as per commissioning checklists.

15. 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.

7.9.1 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

7.10 Pipeline Works

7.10.1 Hydraulic Testing of Pipeline

7.10.1.1 Testing Procedure

Pipelines and fittings shall be subjected to hydraulic pressure tests in the presence of the Employer's Representative which shall comply with IS 5822 unless otherwise specified.

Testing shall be carried out in two stages:

- Test of sections as pipeline laying proceeds
- Tests on completion of the entire pipeline as-a-whole, including the intermediate sections that were not included under the sectional testing stage

The Contractor shall provide all plant, equipment, fittings and water necessary for the hydraulic tests. The Contractor shall submit to the Employer's Representative, well in advance of the time of tests, details of his proposals, including the supply of adequate quantity of water and its supply arrangement. No connections from the existing pipelines will be allowed, nor will any connections to the pipeline and pipe work be allowed which would involve cutting, offtakes, or otherwise altering the

Permanent Works. Test gauges shall be of approved manufacture having dials of at least **200 mm diameter**, graduated such that the test pressure is at least 75% of the full scale reading. If necessary, different gauges shall be supplied for different pipeline sections. Two gauges shall be provided for the sole use of the Employer's Representative and shall remain in the Employer's Representative's possession for the duration of the Contract. All gauges shall be dead weight tested and calibrated from testing institutions approved by the Employers representative at the commencement of work and at regular intervals as required by the Employer's Representative.

The Contractor's arrangements for testing shall include a suitable means for quick installation and removal of the Employer's Representative' gauges and any replacement gauges required during testing.

7.10.1.2 Sectional Testing

Sectional hydraulic tests shall be carried out after the pipeline section to be tested has been laid, jointed and backfilled to a depth sufficient to prevent floatation, **the sections to be tested shall not be longer 5000 m** unless otherwise approved by Employer's Representative.

In addition to the above requirements, the Contractor shall perform an initial hydraulic test on the first **500 m** length of pipeline to be laid under the Contract. This test shall be undertaken within one month of the Contractor commencing the laying of pipes Should the pipeline fail the test, or should the Contractor fail to undertake the test, all laying and welding work shall come to a halt until that section of pipeline passes the hydraulic test. Any delay which may occur as a result of this will be to the Contractor's account, and will not be a cause for any variation. Each length of the pipeline to be tested shall be capped or blanked off at each end and securely strutted or restrained by means of adequately designed and provided thrust block to withstand the forces which will be exerted when the test pressure is applied. Testing against closed

valves will not be permitted. Washout valves shall be fitted with blank flanges and these, together with in-line valves, shall be left open. Air valves already fitted shall be permitted to function during the test. Proposals for testing where thrusts on structures are involved, even where thrust flanges on the piping are installed, shall be submitted, with the calculations of the forces to be carried, to the Employer's Representative for approval.

The method of filling the pipeline with water shall be approved by the Employer's Representative. The length under test shall be filled making certain that all air is displaced through an air valve installed at the top of the blank flange situated at the high end of the line. The length shall then remain under constant moderate pressure 10 to 20 m head of water, for a period of several hours until the pressure can be maintained without additional pumping. The pressure shall then be slowly increased at a maximum rate of 1 bar per minute to the full test pressure and pumping discontinued for 4 hours or until the pressure has dropped by 10 m, whichever occurs earlier. Thereafter pumping shall be resumed and continued until the test pressure has been restored. The quantity of water pumped to restore the pressure shall be the measure of leakage from discontinuation of pumping until its resumption. In general, the welded MS pipe joints are not expected to show any loss of water.

The pipe length shall pass the test if the leakage is not more than 0.1 liters per mm diameter per kilometer per 24 hours for each 30 m head of pressure applied.

Notwithstanding the satisfactory completion of the hydraulic test, if there is any discernible leakage of water from any pipe or joint the Contractor shall, at his own cost, replace the pipe, repair the pipe or remake the joint and repeat the hydraulic test. No pipeline shall be accepted until the leakage on any length is not more than the rate of leakage specified above and all sources of leakage have been rectified.

7.10.1.3 Test Pressures

The field tests for both sectional testing and testing on completion shall be carried out as per the provisions in the IS 5822 latest revisions. Proposed test pressures shall be determined based on the actual Site conditions, and shall be reviewed and approved by the Employer's Representative.

The field test pressure shall be as under:

- For gravity main :1.5 times maximum static head on the pipeline corresponding to the HGL @ BPT at C=130 + 5m residual head
- For Pumping main: Working pressure + water hammer pressure without water hammer control devices
- Where the field test pressure is less than two-thirds the factory test pressure, the period of test should be at least 24 hours. Test pressures are to be measured at the center of the blank flange situated at the lowest end of the pipeline under test

7.10.2 Tests on Completion of Pipeline Works

7.10.2.1 General

The tests on completion shall be carried out after all the pipeline sections have been satisfactorily tested and the joints between each section completed to provide a continuous test length between the Contract interfaces. The entire length of the pipeline will be subjected to hydraulic testing, in accordance with the preceding procedures, after joining the intermediate portions which did not come under testing of different sections during the sectional testing period.

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 valves in the system will be inspected for proper lubrication, manual / electrical operation as applicable
- 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.

7.10.2.2 Pressure Test

The entire pipeline shall be subjected to a hydraulic test as follows, to the required test pressure as per IS:5822 and as specified in clause 11.2.1 the field test pressure shall be maintained for minimum 6(Six) hours. 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.

7.11 Tests for Water-Retaining Structures

Water retaining structures for water supply purposes shall satisfy the following tests for water tightness, before external finishes are applied (if any). The water for testing shall fill the first 1.25 meters and may be filled as quickly as supply permits. Between this and top water level, the rate of filling shall not exceed a steady rate of 300 mm per 24 hours unless otherwise directed. After filling to top water level no further water shall be introduced for 7 days. After expiry of seven days and after the filling, the level of the surface of the water shall be recorded. The level of water shall be recorded again at subsequent intervals of 24hours over a period of seven days and the structure shall satisfy the test if at the end of this week no leakage is apparent and or the water level does not drop more than 40 mm over the period of 7 days. The Employer's Representative shall decide on the actual permissible nature of this drop in surface level, taking into account whether the tanks are open or closed and the corresponding effect it has on evaporation losses. Foregoing visible leakages and sweating will not be accepted. If the structure does not satisfy the condition of test and the daily drop in water level is decreasing the period of test may be extended for a further seven days and the if specified limit is then reached the structure may be considered as satisfactory.

Following satisfactory completion of the tests the Contractor shall empty the structures and dispose of satisfactorily the contents. He shall clean and disinfect the structures and any equipment therein of all deposits left by the testing.

7.12 Trial Run of the entire System

After individual commissioning tests of components of the works the Contractor shall make trial runs. A continuous operation 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 chemicals 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 supervisors and other operating personnel 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

7.13 Commissioning of the entire System

On completion of the Trial Run, commissioning of the System shall be done by the Contractor. The total time allotted for commissioning of the full system is 90 days. The commissioning of 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 including chemicals used for operation and maintenance of the system during the period of commissioning except electricity consumed during the commissioning period shall be borne by the Contractor. The cost of electricity will be borne by the Employer.

Last 30 days during the commissioning period of the entire system shall be considered as test on completion as detailed below.

7.14 Tests after Completion

7.14.1 Employer's Obligations

The Contractor shall provide the necessary labor, materials, electricity, fuel and water, and shall carry out the Tests after Completion in accordance with the manuals provided by the Contractor and such guidance as the Contractor may be required to give during the course of such Tests.

The Tests after Completion shall be carried out for last 30 days of commissioning period.

The results of the Tests after Completion shall be compiled and evaluated by the Employer and the Contractor. Any effect on the results of the Tests after Completion which can reasonably be shown to be due to the prior use of the Works by the Employer shall be taken into account in assessing such results.

7.15.2 Retesting on Failure

If the Works, or a Section, fail to pass the Tests after Completion, the Employer or the Contractor may require such failed Tests, and the Tests after Completion on any related work, to be repeated under the same terms and conditions. If such failure and retesting result from a default of the Contractor and cause the Employer to incur additional costs, such costs shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due, or to become due, to the Contractor.

7.15.3 Test during Monsoon

After successful completion of the Tests on Completion the Contractor shall carry out, as soon as reasonably possible but over a period of time not exceeding one year, 30 days' operational tests during monsoon. These tests shall be used to prove the operation of the Works at varying flows and with varying raw water quality. During the tests water produced by the Works will be entering the public supply network. The tests after completion shall be undertaken in accordance

with as mentioned above Each part of the Works shall be considered separately as far as the tests are concerned.

The timing of the tests shall be determined by the Employer who shall give notice to the Contractor in accordance with Contract. The total time for carrying out the tests shall not be less than 30 days corresponding to period of high raw water turbidity.

On commencement of 30 days test the Contractor shall allocate a continuous period to complete the test. If the part of the Works fails to pass the test in the 30 days period, the test shall be deemed as a failure and the Contractor shall carry out any necessary remedial work to the satisfaction of the Employer's Representative before the Contractor restarts the test again. During the tests the Contractor shall take samples to demonstrate that the part of the Works is performing in accordance with the Employer's Requirements. Samples shall be taken at locations and intervals as directed by the Employer's Representative. The tests for performance of the system to meet the tender requirements shall be completed in this period and the penalties if any due on the Contractor as per the Contract shall be finalized. The results of the Tests after Completion shall be compared and evaluated by the Employer and Contractor. The Contractor will not be held responsible for interruptions to the water treatment process as a result of power failures (unless as a result of a Plant failure), interruptions in the raw water supply, etc., which are out of his control. However, the Contractor shall be required to demonstrate that the Works can cope with these inevitable interruptions in an orderly fashion and recover to a normal operational state with the minimum of manual intervention. All staff and consumables needed for operation of the Works such as fuels, lubricants etc. and transportation of sludge off site, except raw water and power shall be provided by the Contractor under his operation and maintenance responsibilities. The Contractor shall be required reasonably to co-operate and co-ordinate his activities with those of the Employer and other agencies. The Contractor shall provide all facilities and equipment not supplied under the Contract and which are deemed necessary to carry out and monitor the tests after completion.

SUB-SECTION 6A.8

HEALTH, SAFETY, WELFARE AND ENVIRONMENT

SUB-SECTION 6A.8: HEALTH, SAFETY, WELFARE AND ENVIRONMENT

8.1 Applicable Regulations, Acts etc.

The Contractor shall comply with the relevant requirements of all local and the national health, safety, welfare and environment acts and regulations issued by the Ministry of Labour (MoL).

Compliance with the requirements of acts and regulations by the Contractor shall not relieve the Contractor from responsibility for the safety of his workers and employees and those of his subcontractors.

8.2 Health, Safety and Welfare

8.2.1 Failure to Comply

In the event that the Contractor fails to comply with the requirements of the regulations or with the Specification in respect of safe working conditions or practices on the Site, the Employer's representative will have the authority to instruct the Contractor to stop work in any particular location until the unsafe conditions or practices have been rectified to the satisfaction of the Employer's representative. The Employer's representative will issue safety violation notices to the Contractor, informing him that he is working unsafely and describing the nature of the unsafe working practice, the time and date and the location. In this event, the Contractor shall be responsible for all costs and delays resulting from complying with such instruction by the Employer's representative and for the actual costs incurred on rectification of the unsafe conditions or practices.

8.2.2 Contractor's Health, Safety, Welfare and Security Implementation Plan

The Contractor shall prepare and submit to the Employer's representative for review a Site implementation plan specific to health, safety, welfare and

security practices of the work to be carried out under the Contract. The Contractor shall carry out all work on the Site in accordance with the agreed Site implementation plan. The Contractor's plan shall reflect the requirement of the local and national requirements. It will include a methodology for carrying out risk assessments by the Contractor where these are deemed necessary. The plan will be updated from time to time to reflect any significant changes to laws and regulations or site activities.

8.2.3 Contractor's Health, Safety, Welfare and Security (HSWS) Officer

The Contractor shall appoint a qualified and experienced HSWS officer for the duration of the Contract. The full time duty of the officer will be to implement the site implementation plan, to prevent accidents and enforce the requirements of legislation in force. The name and qualifications of the officer so designated shall be submitted to the Employer's representative by the Contractor for approval within two weeks of the commencement of the Contract. The officer shall attend full time on site during normal working hours and whenever work is in progress during out of hours working, public and national holidays approved by the Employer's representative and available by phone and mobile during non-working hours.

The Contractor shall engage senior site engineers and foremen that are properly trained in the application of correct Health and Safety practices. These individuals shall liaise closely with the HSWS to maintain safety on site at all times. The Contractor shall submit the details of the Health and Safety qualifications of all such site personnel.

The HSWS officer will be responsible for ensuring all relevant information and posters are displayed at locations throughout the site in accordance with the site implementation plan.

The HSWS officer will be responsible for keeping a site accident book to record all site incidents or any major site rescue events. The book will be available for inspection by the Employer's representative or any MOL

authorized person. Record keeping must also be maintained to comply with any other legal or regulatory requirements.

The HSWS officer will be responsible for ensuring that every site worker and regular visitor is given site HSWS procedure training when they first enter the site and refresher training at an appropriate frequency agreed by the Employer's representative. All occasional visitors will be trained on arrival and be provided with the appropriate personal, protective equipment. Records of the training will be kept and available for inspection by the Employer's representative.

8.2.4 Contractor's Health, Safety, Welfare and Security Committee

The Contractor shall set up a safety committee comprising the his full-time HSWS officer, project manager, site engineers and foremen for the Contract. The committee shall meet weekly and minutes shall be recorded and a copy shall be submitted to the Employer's representative. The Employer's representative shall be invited to be present at the meetings.

The purpose of the meetings will be to discuss and resolve health, safety, welfare and security aspects of various parts of the work, including possible areas of conflict or difficulty. Where different contractors are working in the same area or adjacent areas, or where the work of one may impinge upon the work of another, the meetings will consider what action needs to be taken to ensure that each contractor is aware of the safety requirements of others.

8.2.5 Site Health, Safety, Welfare and Security Coordinator

The Employer may oversee the health, safety, welfare and security arrangements of the various contractors working on the Site, to liaise with the Employer's representative and to draw his attention to any breaches of Contract requirements or the approved safety plans of the Contractor.

8.2.6 First Aid Facilities

The Contractor shall provide a complete approved first aid kit in his site office. The kit shall be in the charge of either the Contractor's HSWS Officer or some other responsible person who will also be on the site during all working hours to ensure that the first aid kit is available without delay. The Contractor shall also provide a first aid kit in the office for the Employer's representative. Kits shall also be provided at all remote sites. The HSWS Officer and adequate numbers of other senior members of the Contractor's staff shall be trained in occupational site first aid duties including resuscitation to take account of numbers of site workers located on the permanent site and mobile site operations.

The Contractor will make arrangements with the emergency and rescue services to provide adequate support where on site first aid assistance is inadequate to meet the welfare requirements of all site workers.

The Contractor shall comply fully with all rules and regulations from time to time issued and orders given by the Health Service of the Government or the local medical or sanitary authorities.

8.2.7 Overhead Hazards

Overhead protection shall be provided at any location where there is a hazard of falling objects. This shall particularly be observed around any scaffolding and in excavations.

'Goalposts' shall be erected beneath all overhead lines to prevent the arms or jibs of plant from approaching such lines. No plant shall be trafficked beneath overhead lines until the Employer's representative has inspected and approved the erected goalposts.

8.2.8 Excavations or Underground Hazards

Every excavation or underground space into or through which a person may fall shall be covered by a temporary cover fixed securely in position or guarded by an effective barrier to prevent falls except where free access is required by work actually in progress. In such a case where work is in progress, the barrier shall be maintained in position to the extent possible, and suitable warning signs shall be erected.

8.2.9 Drowning Hazards

Where the work involves filling tanks with water leaving an open surface, the Contractor shall provide at all times and at suitable locations equipment for promptly rescuing persons from the water and resuscitating rescued persons. The Contractor shall take all necessary steps to prevent any such accidents occurring by providing adequate guarding.

8.2.10 Slipping Hazards

The Contractor shall not suffer or permit an employee to use a passageway, or a scaffold, platform or other elevated working surface which is in a slippery condition. Oil, grease, water and other substances causing slippery footing shall be removed, sanded or covered to provide safe footing.

8.2.11 Tripping Hazards

All passageways, platforms and other places of work shall be kept free from accumulations of dirt and debris and from other obstructions that may cause tripping. Sharp projections shall be removed or covered.

8.2.12 Access to workplace

Temporary stairways, ramps or runways shall be provided as the means of access to working levels above or below ground except where the

nature or progress of the work prevents their installation, in which case ladders or other safe means shall be provided. The Contractor shall not assume that access arrangements provided by the Employer will necessarily remain in place after the time that the Contractor commences work in a particular area.

8.2.13 Dust and Gases

Dust and gases shall be controlled by ventilation or otherwise so as to prevent concentrations tending to injure health or obstruct vision or from exceeding safe levels.

8.2.14 Hazardous and Corrosive Substances

All alkalis, acids, gases and other hazardous and corrosive substances shall be so stored and used so as not to endanger employees in accordance with national and state regulations. Suitable protective equipment for the use of such substances shall be provided. Clean water supply shall be readily available for washing off any spillage of any corrosive substance on the employees.

8.2.15 Eye and Ear Protection

Suitable eye protection equipment shall be provided for and shall be used by employees while engaged in welding or cutting operations or in chipping, cutting or grinding any material from which particles may fly, or while engaged in any other operation which may endanger the eyes. The Contractor shall ensure that fully equipped eye washing facilities are available on permanent and mobile site locations. Ear protectors shall be made available for employees when operating noisy machinery.

8.2.16 Respiratory and Resuscitation Equipment

Where required the Contractor shall provide sufficient numbers of respiratory equipment and the employee shall be trained to use

respiratory equipment suitable for the type of operation for which it is to be used. The Contractor shall maintain such respiratory equipment in good condition and shall furnish the means for its continued efficient working condition. The Contractor shall provide regular inspection, cleansing and sterilization of such equipment. Such equipment, when not in use, shall be stored in an accessible, closed container.

The respiratory equipment shall be either of the escape set type, where it is provided for possible emergency use, or working sets where work has to be carried out in conditions where toxic gases are present or where there may be a deficiency of oxygen identified by the HSWS officer or his appointed staff when a risk assessment is undertaken prior to a site operation commencing. Risk assessments will be available for inspection by the Employer's representative immediately on request.

All persons who may be required to use such equipment shall be adequately trained and shall have certificates to that effect. Individual certificates will be available for inspection from all authorized workers by the Employer's representative.

8.2.17 Work in Confined Spaces

Where work is required to take place in a confined space, defined as an enclosed space or excavation with limited access and where there is no natural ventilation, the Contractor shall provide equipment for monitoring the quality of the atmosphere within the space. The equipment will be calibrated to occupational standards to measure the range of gases and atmospheres identified as part of the risk assessment undertake prior to entry. The equipment shall be used to check the atmosphere before personnel enter, and shall remain in place while work is in progress to ensure that the confined space is free of harmful or noxious gases. The Contractor shall not permit anyone to enter or work in a confined space, including personnel from other contractors, the Employer's representative staff or the Employer's staff if harmful or noxious gases are detected. Any personnel inside shall be evacuated immediately.

Prior to the commencement of the work, the Contractor will document a safe system of work which will be available for inspection by the Employer's representative.

All personnel working in such conditions shall be provided with escape sets. The Contractor shall provide a "top-man" who shall be stationed immediately outside the entrance to the confined space, and who shall maintain communication with personnel working inside the confined space. In the event of a transverse entry, this may require additional personnel to be used to facilitate a reliable line of communication if evacuation has to take place. The top man shall have the means to raise the alarm in case of any emergency inside the confined space.

The Contractor shall provide adequate ventilation for workers carrying out work inside a confined space, pipeline or chamber or other enclosed areas by using blowers or other suitable means.

8.2.18 Personal Protective Equipment (PPE)

Every site worker and visitor shall be provided with a full set of personal protective equipment for use at all times including a luminous vest, helmet of a type tested and approved by the MOL, steel toe-capped boots, gloves and other specific work related clothing offering ear and eye protection. All site workers and visitors shall be required to wear PPE while working on the Site, except in the Employer's representative's and Contractor's office. The Contractor shall display a notice on the access to the site stating that entry is for authorized personnel only, and that PPE is to be worn at all times.

Every employee required to work in water, wet concrete or other wet footing shall be provided with suitable safety, waterproof boots.

Every employee required to use or handle alkaline, acid or other corrosive substances shall be provided with appropriate PPE.

8.2.19 Electrical Hazards

Before work commences, the Contractor shall ascertain by inquiry or direct observation, or by instruments, where any part of an electric power circuit exposed or concealed is so located that the performance of the work may bring any person, tool, or machine into physical or electrical contact therewith. The Contractor shall post and maintain proper warning signs to his employees of the location of such lines, the hazards involved and the protective measures to be taken and shall, if practicable, de-energise the electric power circuit.

The Contractor shall not suffer or permit an employee to work in such proximity to any part of an electric power circuit that he may contact the same in the course of his work unless the employee is protected against electric shock by de-energising the circuit and earthing it or by guarding it, by effective insulation or other means acceptable to the Employer's representative. The location of underground powerlines that encroach on the Works shall be confirmed using cable detectors, the path of the cable shall be clearly marked. If such cables are adjacent to excavations, the cable location shall be confirmed by finding the cable using carefully controlled hand-dig methods under the supervision of a senior member of the Contractor's staff. No live cables shall be retained within working trenches or other excavations. Any such cables shall be diverted prior to excavation commencing. The Contractor shall at all times liaise with the local electricity supplier with regard to the locating and diverting of any supplies.

8.2.20 Power Driven Saws, Abrasive Wheels and Grinders

All portable power-driven hand operated saws, abrasive wheels and grinders shall be equipped with guards above the base plate which completely protects the operator from contact with the saw blade when in motion and with self-adjusting guards below the base plate which completely covers the saw to the depth of the teeth when the saw is removed from the cut.

8.2.21 Public vehicular traffic

Whenever any work is being performed over, on, or in proximity to a highway or any other place where public vehicular traffic may cause danger to men at work, the working area shall be so barricaded with fluorescent signs as to direct traffic away from it or the traffic shall be specially controlled by persons designated for that purpose.

8.2.22 Site traffic

All vehicles used at the worksite must be roadworthy and registered with the appropriate authority. No person shall drive a vehicle at the worksite unless they are a holder of the appropriate driving license or certificate.

A site internal access management system including all appropriate road signs will be submitted by the Contractor to the Employer's representative for approval at the commencement of the Contract.

8.2.23 Stability of structures

No section of the plant or other structure or part of a structure shall be left unguarded in such condition that it may fall, collapse or be weakened due to wind pressure or vibration.

8.2.24 Storage of materials and equipment

All materials shall be stored or stacked in a safe and orderly manner so as not to obstruct any passageway or place of work. Material piles shall be stored or stacked in such a manner as to ensure stability. Hazardous materials shall be stored in secure areas and the HSWS shall maintain an up-to-date list of the persons with a key to those areas.

8.2.25 Disposal of debris

Debris shall be handled and disposed of by a method which will not endanger persons. Debris shall not be allowed to accumulate so as to

constitute a hazard.

8.2.26 Excavations

No employee shall be permitted to enter any excavated area, including areas excavated by other contractors on the Site, unless sheet piling, shoring or other safeguard that may be necessary for his protection is provided. In most cases, excavations will be considered to be confined spaces and the appropriate procedures followed.

Where any employee in an excavation is exposed to the hazard of falling or sliding material from any bank or side more than 1.5 m high above his footing, adequate piling and bracing shall be provided against the bank or side to eliminate such hazard. The excavation and its vicinity shall be checked by a designated person after every rain, storm or other hazard-increasing occurrence and the protection against slides and cave-ins increased if necessary.

Shoring adequate to support the overhanging material shall be provided where banks are undercut.

Excavated material and other superimposed loads shall be placed at least 1 m back from the edge of open excavations and trenches and shall be so shored or retained that no part thereof can fall into the excavation, or cause the banks to slip or cause the upheaval of the excavation bed. Banks shall be stripped of loose rock or other materials which may slide, roll or fall upon persons below.

Open sides of excavations where a person may fall more than 1.5 m shall be guarded by adequate barricades, and suitable warning signs shall be put up at conspicuous positions.

No employee shall be allowed to work where he may be struck or endangered by an excavating machine with which his activity is not directly related.

8.2.27 Ladders, step ladders and access platforms

Every ladder, step-ladder and access platform shall be of good construction, sound material and adequate strength for the purpose of which it is used. Ladders, step-ladders and access platforms shall not stand on loose bricks or other loose packing, but shall have a levelled and firm footing. Ladders of over 2m in height shall be securely tied to the structure it is propped against. Free-standing, portable ladders over 4m in height shall not be used.

8.2.28 Working at height

All site workers who work at height shall be provided with appropriate PPE to prevent an accident by slipping or falling.

8.2.29 Positioning of machinery

No person shall be permitted to position or operate machinery in a manner likely to endanger himself or others.

8.2.30 Fixed and mobile cranes

Fixed and mobile cranes shall be so constructed, positioned and operated as to be stable. No crane shall be loaded beyond the safe working load except by an approved person or an inspector for the purpose of testing such machine.

Every crane including all blocks, shackles, sheaves, wire ropes and the various devices on the mast and jib shall be thoroughly inspected by an approved person at intervals not exceeding 12 months. Cranes shall be inspected before being first erected or operated on each job or after any major repair. Inspection and repair of crane jib shall be made only when the jib is lowered and adequately supported.

Outriggers and counter-weights shall be provided and used as specified by the manufacturer of the crane or by an approved person. Counter-weights shall be properly placed and secured. Levelling jacks or other suitable means shall be provided and used with outriggers of truck-mounted mobile cranes.

Firm and uniform footing shall be provided for cranes. When such a footing is not otherwise supplied it shall be provided by substantial timber, or other structural members sufficient to distribute the load so as not to exceed the safe bearing capacity of the underlying material.

Every power-operated crane shall be provided with efficient brake or brakes or other locking devices which will prevent the fall of the load when suspended and by which the load can be effectively controlled whilst being lowered. Hand or foot-operated brakes shall be provided with a substantial locking device to lock the brake in engagement.

No load-bearing part of any crane shall be replaced by another part, and no such machine shall be modified by the addition thereto or removal therefrom of any load bearing part, unless the replacement or modification shall be certified by either the manufacturer or the approved person who tested the crane.

A capacity chart shall be provided for every crane. Such chart shall be posted and maintained in a place clearly visible to the operator and shall set forth the safe loads for various lengths of jib at various jib angles and radial distances. Where outriggers are provided such loads shall be set forth with and without the use of outriggers.

Unless furnished by the manufacturer or builder of the crane, a capacity chart shall be prepared and certified by an approved person. Cranes shall have audible overload warning alarms.

A crane shall not lift any load that exceed the corresponding safe working load specified by its capacity chart.

Every crane having a jib shall be provided with an accurate indicator which shows, clearly to the operator, the radius of the jib and the safe working load corresponding to that radius at all times and gives warning signal when the radius is unsafe.

Before hoisting any load at a new job site, the jib shall be operated to its maximum height.

Crane cabs shall be locked when the operator is not present and no unauthorized person shall enter the cab or remain immediately adjacent to any crane in operation. If locking of a crane cab is impracticable, the operating mechanism shall be locked as to prevent the crane from being operated by an unauthorized person.

No crane shall be operated in such a location that any part of the crane or of its load in any position of jib or swing may come within 3 meters of live power line.

All the lifting equipment used at site shall be registered with the appropriate GOI Ministry and shall have a valid certificate at the time of usage.

All crane operatives should be authorized to operate the particular type of fixed or mobile crane. Valid certificates will be available for inspection by the Employer's representative. All banksmen will be formally trained to undertake their duties and refresher training will be given at an appropriate frequency agreed by the Employer's representative.

8.2.31 Attachment of loads

Where a sling is employed to hoist long-length material, a lifting beam shall be used to space the sling legs for proper balance. When load is suspended at two or more points with slings, the eyes of the lifting legs of the slings shall be shackled together and this shackle or the eyes of the

lifting legs may be shackled directly on the hoisting block or balance beam. The eyes may be placed on the lifting hook without shackles if the hook is of the safety type.

Each container or receptacle used for raising or lowering filter media or other loose material of any kind shall be so enclosed, constructed or designed as to prevent the accidental fall of such material.

Crane loads shall be raised vertically so as to avoid swinging during hoisting.

No crane shall travel with a suspended load except upon a safe runway. During travel without loads, crane's falls shall be secured or placed so as to prevent accident or damage by swinging.

8.3 Environmental Protection

The Contractor shall minimize, as far as is practically possible, the effects of all his and his Subcontractors' activities upon the environment and shall implement and monitor measures to prevent:

- (a) Contamination of surfaces, ground, groundwater, surface water and rivers,
- (b) Emissions to air, including smells, gases, smoke, and dust.
- (c) Unsanitary or unsafe storage or discharge to drain, sewer and surface waters,
- (d) Unsanitary or unsafe storage or discharge of solid wastes,
- (e) Noise,
- (f) Visual intrusion, and
- (g) Excessive energy and water consumption.

These requirements shall be met through the constant and careful attention of the Contractor's management of all Site and off-site activities, and by instruction to all staff and labour in these matters.

The Contractor shall appoint an Environmental Control Manager for the Works, who shall be responsible for preparing an Environmental Management Plan and ensuring its implementation by the Contractor after obtaining approval of the Employer's representative.

Implementation shall include for monitoring and reporting on the results of the above measures. Monitoring reports shall be in writing and submitted on a monthly basis as part of the monthly report referred to above. The report shall include a listing and summary of daily monitoring results on all aspects listed above.

All potentially affected areas of the Site, other areas used for or affected by the works and all adjacent or affected waterways shall be monitored and where instructed by the Employer's representative tested.

The Environmental Management Plan (EMP) shall identify the potential environmental impacts from the various construction and operations and maintenance activities to be undertaken in the Contract and set out in detail the approach he will adopt in mitigating these environmental impacts to ensure that the residual impacts are minor and confined to a short period.

The EMP shall consider but not be limited to the following:

- The methods of materials delivery, storage, usage and disposal; equipment usage; and site activities to ensure they have minimal impact on the environment,
- Only environmentally safe products and practices shall be adopted in performing his works, and

- The Contractor shall comply with all of the statutes regarding environmental effects.

The EMP shall provide separate descriptions of its proposals for minimizing any adverse environmental impacts/effects during the construction phase and the subsequent operations and maintenance phase.

The EMP shall be provided in draft form within 28 days from the Notice to Commence, and shall be updated from time to time by the Contractor as agreed or required by the Employer's representative to ensure the objectives of environmental protection are fully met.

SUB-SECTION 6A.9

OPERATION AND MAINTENANCE MANAGEMENT REQUIREMENTS

SUB-SECTION 6A.9: OPERATION AND MAINTENANCE MANAGEMENT REQUIREMENTS

9.1 General

The assessment regarding requirement & planning for long term O&M sustainability of the Aug. to Solapur City Water Supply Scheme for the has been presented in this sub- section.

9.2 O&M Strategy

Solapur Smart City Development Corporation shall constitute a Special Purpose Entity (SPE) with the successful DBO bidder to take up the responsibility of the O&M of the created infrastructure through integrated single contract along with capital works for effective execution and operation of the water Supply scheme.

A bulk water supply contract shall be executed for operating and maintaining the project assets for an initial period of 5 years. Under this arrangement, the operator shall be paid as per contract rate for O&M activity. The performance benchmarks and supervision mechanism shall also be coupled in the management contract. This shall be aimed at enhancing the efficiency of project assets and reduction of water losses.

The Contractor shall submit operation and maintenance management plan before commencement of commissioning for review and approval of the Employer. The plan shall include the followings.

- i) Daily, weekly and monthly reporting formats and schedules
- ii) Contractor's key staff
- iii) Supervisory staff
- iv) Skilled manpower with qualification and experience for
 - Pumping equipment
 - HT substation
 - Instrumentation, control

- Pipeline maintenance and repairs
- v) Operation and desludging philosophy
- vi) Equipment-wise periodical maintenance schedule
- vii) List of spares, oil and lubricants
- viii) List of tools, special tools and plant for maintenance and repairs
- ix) Methodology for repairs to pipeline during burst / failure
- x) Emergency and crisis management
- xi) Safety practices
- xii) Health and staff welfare
- xiii) Any other activity as per instructions of Employer

9.3 Customer Interface Management

Customer services encompass a broad range of activities

- i) The interface with Solapur Municipal Corporation to ensure required performances are met (e.g. water pressure and flow) and proper responses are given to customer enquiries.
- ii) Advance warning of planned supply shut off for repairs and renewals
- iii) Advice customer during emergencies
- iv) Recording and Responding to Solapur Municipal Corporation
- vi) Consulting with customers and the Employer for future plans regarding service standards and charges

9.3.1 Employers Service

In order to maintain the efficiency and improve Employer satisfaction, a study shall be undertaken of the interfaces between the Operator and Employer. This shall be undertaken during the early months of operation and

thereafter similar test shall be made in order to monitor the improvements in customer service and effectiveness of the steps taken.

9.3.2 Employers Complaints

Complaints received from the Employer regarding mal attention shall be investigated with special reference to the procedures invoked, so as to establish and correct any weakness.

9.4 Key issues and obstacles in regard to O&M

The following issues have been considered for efficient management of operation and maintenance of water supply scheme as, general and personal administration, Inventory and financial control and public relations. All these issues are important in view of safe water quality, good services to consumers, and self-supporting operations with strong financial management.

General and personal Administration

The general administration shall be achieved through supervisory control and operational control. The supervisory control is expected to control all the functions of management while the operational level is to subordinate to supervisory level. The duties and responsibilities of supervisory units cover development and implementation of Annual operation and Maintenance program (AOM), keeping accounts, material records, performance appraisal system, purchasing tools and supplies and providing in-service training. A well framed operation and maintenance manual is also a key issue. In all supervisors should ensure that entire work of O&M could be grouped into logical tasks or functions. For optimum output of the operating staff modern business principles shall be introduced. Personal administration is achieved by clear job descriptions, setting goals with routine evaluation and in-service training.

Inventory control

Many of the water works failure require spare parts or supplies available instantly to put the system back in working condition. Materials of stock would pertain to items which have frequent usage and items of emergency repairs. Inventory control cards are vital documents to serve the purpose of accountability and stock demand by reflecting usage pattern for enabling stock control and recording purchasing information

In-service training

The objective of well-founded short term in-service training for employees of the Aug. to Solapur City Water Supply Project shall be as under:

- To improve group level of operational efficiency
- To acquaint the group with the new developments
- To develop amongst the members of the group a better understanding of human relations and concept of their individual responsibility to the community
- To bring about and increase community awareness of water works operation

9.5 Contractor's Responsibility

9.5.1 General Responsibilities

- i) The Contractor shall be responsible for the operation and maintenance of the project systems and system components from the date of physical commissioning of the project after successful trial runs duly certified by the Employer.

ii) The Employer places the great importance on the successful project delivery thereby implying continuous and uninterrupted supply of 108.75 ML/day raw water to the Solapur City and 1.25 ML/day for Project affected villages every day without fail. To achieve this objective, the Contractor shall design and implement its Operation and Maintenance Program and Guidelines which shall be inviolable.

iii) The maintenance of the Jackwell works, jack well and pumping station refers to the civil, mechanical, electrical and instrumentation components of the raw water collection and pumping system so that it can operate at the designed output through the project life. It is anticipated that routine repairs shall be necessary to achieve this objective. The operation of the system components shall involve routine handling and inspections of the components.

iv) Operation refers to the plants, equipment, valves, power systems, machinery etc. which shall be handled and operated by a trained operator. For the purpose of operation and maintenance of the system the Contractor shall ensure the following.

- Eight sets of detailed As-Built drawings and maps of the system and its components and the O & M Manual shall be kept available with the operators at all times. These shall be renewed and updated if any changes to structures and equipment are necessitated during the O & M period
- The schedule of daily operations shall be prepared and distributed to the operators
- A regular schedule for the inspection of the Jackwell system components shall be drawn and executed by the Contractor
- Record of all inspections shall be maintained in soft files and backups shall be available for inspections. All records shall

be authenticated by authorized and designated official of the Contractor

- Raw water quality shall be tested and recorded every day and certified
- Daily manning and deployment of operating staff and their names shall be intimated to the Employer
- Inventory of stores shall be maintained and updated every day by the head of operations

9.5.2 System Components

a) Jackwell Works

i) Sanitary surveys shall be conducted every week in the backwaters of the Ujani dam to ensure that there is no indiscriminate discharge of pollution load in the catchment area of the weir.

ii) Before every monsoon the Jackwell structures shall be inspected and repairs / rectifications shall be carried out if and when required.

iii) Regulated desilting of the Jackwell structures like Jackwell wells, jack well and inspection chambers shall also be carried out every six months. Strainers and racks shall be cleaned and painted every year

iv) All pumps and related equipment and machinery, valves and connectors shall be checked and preventive maintenance shall be carried out as per the maintenance manual of the manufacturers and requirement in particular specifications.

b) Transmissions System

i) The entire raw water transmission line (pressure mains), pumping mains to the BPT and raw water gravity main to the WTPs including all en-route structures and air valves as well as other appurtenances shall be maintained as per the maintenance plan of the Contractor and approved by the Employer.

ii) All expansion joints shall be checked once every month.

iii) Sufficient stock of spare pipes of all relevant sizes shall be maintained for replacement of damaged pipes. Regular leak detection surveys shall be conducted along the entire length of the lines.

iv) All air and scour valves shall be inspected as per Contractor's inspection schedule approved by the Employer.

9.5.3 Security

Unauthorized entry and trespassing by persons and animals at any of the system component locations shall be strictly prohibited. Adequate safety and security staff shall be provided to prevent such incidents by the Contractor as approved by the Employer.

SUB-SECTION 6A.10

ENVIRONMENTAL MANAGEMENT PLAN

SUB-SECTION 6A.10: ENVIRONMENTAL MANAGEMENT PLAN

10.1 Introduction

An Environmental Management Plan (EMP) takes into account all the environmental issues and the corresponding mitigation measures to minimize the impacts.

The EMP presented below includes:

- Specific actions to be taken regarding site-specific issues;
- Responsible agencies for its implementation & supervision;
- Time frame for implementing Mitigation actions;
- Reference to contract documents and specifications;
- Project level environmental monitoring;
- Environmental status reporting frequency; and
- Institutional arrangement, Strengthening of their capability, and role

It also includes a monitoring plan to enable evaluation of the success or failure of environmental management measures and reorientation of the plan if required. Several of the protective and enhancement measures can be implemented by adopting suitable planning and design criteria during construction of the project. Further, it is necessary that the resources required for the mitigation / protection, enhancement measures and monitoring are provided for in the cost estimates of the project, to ensure proper implementation.

10.2 Environmental Management and Implementation

The EMP has been delineated for all the three stages viz., Pre-construction, Construction and Operation stages of Surya project. During construction phase, contractors as well as site-in-charge will be responsible for implementing all the mitigation measures. Table-1, Table-2 and Table-3 show the EMP for Pre construction, construction & operational phase respectively.

Table 10.1: EMP for Pre-Construction Stage

S. No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to Documents
1	Resettlement and rehabilitation	The entitlement framework to the PAPs shall be in accordance to the RAP of the project. It shall be ensured that all R&R activities be reasonably completed as per RAP, before the construction activity starts in the relevant sub- section.	Before Start of construction	-
2	Ecological impacts due to tree cutting	Trees falling within the alignment which are to be removed before commencement of construction shall be identified and approved by PIA. Prior permission from Forest dept. Tree authorities shall be obtained. Compensatory plantation shall be carried out.	Before Start of construction of relevant sub- section	-
3	Local traffic arrangement	Temporary traffic arrangement during construction within RoW shall be planned. This plan shall be periodically reviewed with respect to site conditions. During site clearance activity, the demolition	During site clearance and construction	M/ORT&H: 112

S. No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to
		debris shall be preferably removed during non-peak hours and with deployment of more vehicles for the purpose.		
4	Providing labour camps and facilities	The Contractor shall abide by the Contract conditions and directions of PMC/PIA with respect to siting of labour camps, providing sanitation facilities and labour welfare issues etc.	During construction	M/ORT&H: 105.2
5	Siting of construction site/casting yard	The Contractor shall abide by the Contract conditions and directions of PMC/PIA with respect to siting of construction camps. The construction camps should have located at least 500 m away from sensitive receptors/residential area.	During construction	M/ORT&H: 105.2
6	Traffic Control and Safety	The contractor shall take all necessary measures for the safety of traffic during	During pre-construction	M/ORT&H: 112.4 and 112

S. No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to Documents
		construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the PMC for the information and protection of traffic.		
7	Safety of pedestrians	Special consideration shall be given in the local traffic management to the safety of pedestrians.	Before Construction and during construction	M/ORT&H: 112.2
8	Impact on land use outside RoW	Construction activities shall be preferably restricted within project road RoW.	During site clearance and construction	M/ORT&H: 201.2
9	Utility relocation including shifting of gas pipeline	All utilities, such as water supply lines, electrical installations, telephone lines etc. to be shifted after prior approval of agencies. Utility relocation shall be carried out in shortest possible time to reduce inconvenience to public.	Before Start of construction of relevant sub- section	M/ORT&H: 110

Table 2: EMP for Construction Stage

S. No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to Documents
1.	Traffic Control and Safety	The contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the PMC for the information and protection of traffic.	During construction	M/ORT&H: 112.4 and 112
2.	Air Pollution	All vehicles delivering material to the site shall be covered by tarpaulin to avoid material spillage.	Entire construction phase	M/ORT&H: 111.9, 111.11 and 11.12
3.	Using existing hot mix/ Concrete/ asphalt plants	If the contractor uses the existing Concrete, Asphalt and Hot Mix Plants, he shall ensure that existing plants, which are sourced, are licensed and authorised for operation by concerned authorities and shall intimate the PMC/PIA prior to procuring materials from them. PMC shall	During entire construction phase	M/ORT&H: 111.5

S No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to Documents
		<p>procure relevant documents from the plant owners to ensure that they are adhering to relevant emission norms as laid out by MoEF/ CPCB.</p> <p>If the contractor wishes to establish a new plant, he should obtain consent-to-establish and consent-to-operate under Air and Water Act from MPCB.</p>		
4.	Plying vehicles on unpaved roads	The unpaved roads, if used by the contractor, shall be sprinkled with water at least once in a day to control the fugitive dust emissions. Dust emission will be a critical issue near villages.	Construction phase	M/ORT&H: 111.1
5.	Location of batching plant	Batching plant, if contractor wish to establish, shall be located away from the residential/sensitive area and shall be licensed and authorised for operation by concerned authorities.	During construction phase	-

S. No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to Documents
6.	Watering to control dust at site	Construction site to be watered periodically to minimize fugitive dust generation during construction near urbanised area	During entire construction phase	M/ORT&H: 111.8
7.	Roads used for transport	Contractor shall ensure that the transport vehicles used to ferry materials and dispose debris does not create hazardous conditions for general traffic using the roadway especially the National Highway.	During entire construction phase	M/ORT&H: 111.9
8.	Barricading site	The construction site especially near habitation should be barricaded at all time in a day with adequate marking, flags, reflectors etc., for the safety of general traffic movement and pedestrians.	During construction phase	M/ORT&H: 112
9.	Earthwork	All earthwork and construction material should	During entire	M/ORT&H: 201.4

S. No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to Documents
		generation of dust and spillage on roads. The stacks of earthwork shall be preferably located away from habitation		
10.	Inspection of site	Daily inspection at construction site should be carried out to ensure removal of construction debris. Debris removal frequency shall be quicker to the extent possible. Piling up of debris generated near steep slope section would create hazardous condition for traffic movement and pedestrians.	During construction phase	Contract Documents
11.	Earthwork debris disposal	The excavated material to the extent possible would be reused for proposed construction and the remaining material would be disposed at authorised dumping grounds. In no case, loose earth should be allowed to pile up along the alignment.	During construction phase	M/ORT&H: 201.4 and 301.3.11

S. No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to Documents
12.	Idling of vehicles	Idling of delivery trucks or other equipment should not be permitted during periods of unloading or when they are not in active use.	During construction phase	M/ORT&H: 201.2
13.	Construction equipment emissions	Exhaust and noise emissions of construction equipment shall adhere to emission norms as laid out by MoEF/ CPCB.	During construction	Legal requirement
14.	Noise from construction equipment	All construction equipment shall be fitted with exhaust silencers. Damaged silencers to be promptly replaced by contractor.	During construction	M/ORT&H: 111.0
15.	Noise impact due to operation of DG sets	DG sets, if used, shall adhere to noise standards of MoEF. Operation of DG sets shall be preferably avoided near habitation and sensitive receptors.	During construction	M/ORT&H: 111
16.	Noise level near	Construction activity induced noise levels shall	During construction of	M/ORT&H: 111

S. No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to Documents
	sensitive receptors	mitigation measures such as restricted and/or intermittent activity or as directed by PMC.		
17.	Exposure to loud noise	Workers exposed to loud noise shall wear earplugs/earmuffs.	During construction	M/ORT&H: 111.6 and 105.2
18.	Storage of construction material	Construction material containing fine particles shall be stored in an enclosure such that sediment-laden water does not drain into nearby storm water drains and underground sewage pipes.	During construction	M/ORT&H: 306
19.	Blockage and change in drainage pattern	<p>Along steep slope section located along alignment, earth, stone, pipes or any other construction material shall be properly stored, if storage cannot be avoided, so as not to block the flow of water.</p> <p>If the channel/ drains gets blocked due to negligence, contractor should ensure that they are cleaned especially during monsoon season.</p>	During construction	M/ORT&H: 306

S. No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to
		Once the work is completed in all respects, the contractor shall, as a mark of good gesture, clean up the drains along the project road to the extent possible.		
20.	Soil erosion	On road embankment near steep hill section, slope shall be stabilized. The work shall consist of construction of retaining wall.	During construction	M/ORT&H: 306
21.	Areas susceptible to erosion	Along the steep hill section along the alignment, earthwork should be preferably carried out before rainy season or temporary/permanent erosion protection work as may be feasible shall be provided.	During construction	M/ORT&H: 306.2/ Project construction requirement
22.	Debris disposal	Debris generated due to dismantling of existing road/ pavement/structures shall be suitably reused in proposed construction. Un-utilisable debris shall be suitably disposed at sites authorised by competent authority	During construction	M/ORT&H: 112.10 and 301.3.11

S. No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to Documents
		with the approval of PMC.		
23.	Soil contamination by construction wastes, fuel etc.	Oil and fuel spills from construction equipment shall be minimised by good O&M practice. Soils contaminated by such spills shall be disposed as per MoEF requirements.	During construction	Project requirement
24.	Sourcing quarry materials	Sand, aggregates and other quarry material	During construction	M/ORT&H: 111.30
25.	Compensatory plantation	Compensatory plantation shall be done in line with Tree authority / Forest Dept. regulations and guidelines. Also it is recommended to grow trees in lieu of loss of trees.	During construction	Preservation of Trees Act of Maharashtra, 1975
26.	Providing labour camps and facilities	The contractor shall abide by the contract conditions and directions of PMC with respect to labour camps, providing sanitation facilities and labour welfare issues.	During construction	M/ORT&H: 105.2

S. No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to Documents
27.	Occupational Health and Safety	The contractor is required to comply with all the precautions as required for the safety of workmen as per the International Labour Organisation (ILO) Convention No. 62, as far as those are applicable to the contract.	During Construction	M/ORT&H: 105.2
28.	Provision of Safety accessories/ appliances to each worker	The contractor shall supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, masks etc. to the worker and staff. All laws related to safe scaffolding, ladders, working platform, gangway, stairwells, excavations, safety entry and exit etc. shall be complied with.	During Construction	M/ORT&H: 105.2
29.	Safety precautions	Adequate precautions shall be taken to prevent danger from electrical equipment. All machines/equipment used shall conform to the relevant Indian Standards (IS) codes and shall be regularly inspected by the PMC.	During Construction	-

Augmentation to Solapur City Water Supply Project (Ujani Dam as a source – 110 MLD) on Design, Build, Maintain, Operate and Transfer (DBMOT) Basis

S.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to
30.	Availability of first aid kit at construction site	A readily available first aid unit including an adequate supply of sterilized dressing material and appliances shall be provided.	During Construction	M/ORT&H: 105.2
31.	Workers health and hygiene	All anti-malarial measures as prescribed by the PMC shall be complied with, including filling up of burrow pits.	During Construction	M/ORT&H: 105.2
32.	Non-compliance of EMP	If during progress of work, breach in compliance / observance of mitigation measures observed, competent authority/committee will have right to levy any penalty as per the nature of default summarily without assigning any reasons thereof.	During Construction	-

Table 3: EMP for Operation Phase

S. No.	Environmental Issue	Mitigation Measures	Time Frame	Cross Reference to Documents
1	Air quality impact	Ambient air concentrations of various pollutants shall be monitored as per the pollution monitoring plan.	Starting immediately after completion of construction	Project requirement
2	Noise pollution	Monitoring of noise levels at locations as per monitoring plan.	Starting immediately after completion of construction	Project requirement
3	Survival rate of plantation	Adequate care of the compensatory plantation should be taken up so as to comply the survival rates recommended in the relevant policies of the Tree authority	Up to 3 years after project becomes operational	Project requirement
4	Road embankment & cut section stability	Road embankment & cut section stability should be checked for erosion and rutting. The high embankment section along the alignment shall be periodically checked for soil erosion and stability. Any sign of instability should warrant adequate response immediately and well before succeeding monsoon season	Throughout operation stage	Project requirement

10.3 Environmental Monitoring Plan

Recommended Project level Environment monitoring plan is presented in **Table 10.2**

Table 10.2: Environmental Monitoring Plan

Component	Project Stage	Parameters	Standard	Location	Frequency	Duration
Air Quality	Before Construction	SPM, PM10, SO2, NOx	NAAQS of CPCB	Surya Nagar	Once every season – Winter,	24 hr/day for 2 consecutive working days per week
Air Quality	Construction	SPM, PM10, SO2, NOx	NAAQS of CPCB	Surya Nagar	Once every season – Summer, Winter, post monsoon	24 hr/day for 2 consecutive working days per week
Air Quality	Operation	SPM, PM10, SO2, NOx	NAAQS of CPCB	Surya Nagar	Once every season – Summer, Winter, post monsoon	8 hr/day for 2 consecutive working days per week
Noise Level	Construction	Leq Day, Leq night, L10, L50, L90 dB(A)	CPCB noise standards	Sensitive and residential locations located near construction	At start of construction activity, followed by every season (Summer, winter and post monsoon)	Continuous 24 hr reading with a frequency of 10 minutes for 2 non-consecutive days per week for 2 weeks

Component	Project Stage	Parameters	Standard	Location	Frequency	Duration
				equipment	during construction period	
Noise Level	Operation	Leq Day, Leq night, L10, L50, L90 dB(A)	CPCB noise standards		Once every season (excluding monsoon) for 1 year after operation starts	Continuous 24 hr reading with a frequency of 10 minutes for 2 non-consecutive days per week for 2 weeks
Soil Quality	Construction	Heavy metals and Oil and grease	Contaminant threshold level given by USEPA	Debris disposal site	At start and end of construction activity	One time sample
Ecology	Pre-construction	Monitoring of tree felling/transplantation	As laid out in project detail design. Trees to be adequately marked for	At locations of Tree felling	During tree felling	--

Component	Project Stage	Parameters	Standard	Location	Frequency	Duration
			felling			
Ecology	Operation	Survival rate of plantation and other compensatory plantation	Survival rate to be at least 70%.Below which replantation should be done.	At locations of compensatory plantation	Annual	For 3 years after operation starts

SUB-SECTION 6A.11
ACCEPTABLE MAKES

SUB-SECTION 6A.11: ACCEPTABLE MAKES

Acceptable makes for Plant, pipe and material are as per Maharashtra Jeevan Pradhikaran's approved list . Equivalent makes unless specified will not be accepted except where prior approval by the Employer is granted.

1.0 Civil

S. No.	Equipment	Acceptable Makes
1.	Cement	ACC, Vikram, Ambuja, JK, Shri, Uttam
2.	Structural Steel	SAIL, TISCO, ISSCO
3.	RCC Pipes	ISI Marked
4.	SW Pipes	ISI Marked
5.	RCC Manhole Cover & Frame	ISI Marked
6.	Epoxy Paint	Hindustan Ciba Giegy, Fosroc, Seiko Roffec, Burger
7.	Bituminous Paint	Burger, Asian Paints, Shalimar, Tar Products
8.	Synthetic Paints	Burger, Asian Paints, Nerolac, Delux, Salimar
9.	Water proofing Compounds	Sika, Fosroc
10.	Concrete Admixtures	Sika, Fosroc
11.	Bitumen	IOCL, HPCL, BPCL

MAHARASHTRA JEEVAN PRADHIKARAN
Up-dated List of Approved Makes (Elect./Mech.) As on Aug. 2018

S No.	Name of Co. / Brand	Manufactured at (Telephone Nos.)	Valid Upto
1	Pumps		
A)	Submersible Pump		
	For 100 mm (4") pumps a) with Polypropylene Impellers	--	--
	For 150 mm(6") and b) above with Bronze impellers only.		
	Category "A"	No limit	
	i) MBH Pumps	GIDC, Naroda Ahmedabad, Ph 079-22823066 Email-markting@mbhpumps.com	31.05.20
	ii) Jasco Pump Pvt. Ltd	47 Phase I,GIDC, Naroda Ahmedabad, Ph 079-22821240 Email-jascopump47@gmail.com	31.05.20
	iii) CRI	M/s, CRI pumps P.Ltd,RANSARIndustries-I ,Saravanampatti,Coimbatore Ph No.0422-3027000 Email-corp@cripumps.com	30.09.2019
	iv) Unnati Pumps Pvt. Ltd.	Ph. 079-22200128/3434. Email-sales@unnatipumps.com	28.02.20
	v)Uneel	Unnati Ind.corporation ,Ahmad.Ph No 079-22811320 / 21 ,Email-pump.uneel@gmail.com	31.1.21
	Category "B"	HP - 30, Q - 1000 LPM, Head - 100 mtr	
	i) Lubi Upto 25 HP	M/s,Lubi Industries LLP,Naroda Road ,Ahmedabad - Ph No 079-30610100 Email - info@lubipumps.com	31.10.19
	ii) Fidel Pumps	G-567,GIDC, Metoda Rajkot, Mob. 09909973073 Email-fidel.mkt@gmail.com	30.04.20
	iii) Deccan Industries	Ph. 0422-2531242 . Email-deccan@deccanindustries.com / Pune@deccanindustries.com	28.02.20
	iv) Flotech All Energy Efficient Pump Upto 12.5 HP	M/s Flotech Engg.Pvt Ltd. Opp.Kaneri Oil Mill ,Shapar Road,Shapar Dist. Rajkot ,Ph No - 02827-252509/253309	30.04.21
	vi) Sterling	M/s Siddhi Engineers, G-2223, Kranti Gate main Road ,GIDC Lodhika at Metoda Dist. Rajkot Ph No - 02827 - 287167 / 287168 Email-info@sterlingpumps.in	31.03.21

	Category “C”	HP- 15, Q -500 LPM, Head - 80 mtr	
	i) Jalganga	M/s,Jalganga Electricals,4, Samrat Ind. Area ,Gondal Road , Rajkot .Ph . No. 0281-6545656/2366336 Email- jalgangapumps@gmail.com	30.09.19
	ii) Colin / Texmek	Hariom Industries,Ahmedabad Ph - 07922900469/65220469 E mail- hariomind.pump@gmail.com	30.06.19
	iii) Gold Colin / Texmek / Meghana	Harihar Industries,Ahmedabad Ph - 07965412532 email: hariharind@gmail.com	31.07.19
	iv) Ellen Industries Pvt. Ltd.	Ph. 0422-2571573 Email- ho@ellengroup.in	31.01.20
	v) Laxmi Pumps Pvt. Ltd.	Ph. 0231-2672495 / 2672298. Email- ladapump@laxmipumps.com	31.01.20
	vi) Uttam	M/s Uttam Industries,Plot No 5302 , Phase - 4 , GIDC Vatva, Ahmedabad Ph No .079-40084494/ 95 / 96, Email- uttampump@gmail.com ,uttampump@ymail.com	31.03.21
	Category “D”	HP- 7.5 , Q-250 LPM, Head - 65 mtr	
	i) Saga Windel Pumps Pvt. Ltd	Mob.- 09825015990. Emal - sagawindel@gmail.com	31.03.20
	ii) Mascot Pump Ltd.	Ph. 079-22821252 / 22203161 Email- info@mascotpumps.com	31.01.20
	iii) Ajanta Industries	Ph-02827-287460 / 61. Email- info@ajantaindustries.co.in	30.04.20
	c) Polder Pumps	--	--
	i) MBH Pumps (Upto 200 HP)	GIDC, Naroda Ahmedabad, Ph 079- 22823066 Email- marketing@mbhpumps.com	31.05.20
	ii) Jasco Pump Pvt. Ltd (Upto 150 HP)	47 Phase I,GIDC, Naroda Ahmedabad, Ph 079-22821240 Email- jascopump47@gmail.com	31.05.20
	iii) Uneel Brand	Unnati Ind.corporation ,Ahmad.Ph No 079-22811320 / 21 ,Email- pump.uneel@gmail.com	31.1.21
	d) Submersible Open Well		
	i) Lubi upto 25 HP	Lubi Industries LLP,Naroda Road ,Ahmedabad - Ph No 079- 30610100 Email - info@lubipumps.com	31.10.19
	ii) Fidel Pumps (Upto 30 HP)	G-567,GIDC, Metoda Rajkot, Mob. 09909973073 Email- fidel.mkt@gmail.com	30.4.20
	iii) Saga Windel Pumps Pvt. Ltd. (Upto 5 HP)	Mob.- 09825015990. Emal - sagawindel@gmail.com	31.03.20

	iv) Mascot Pump Ltd.(Upto 7.5 HP)	Ph. 079-22821252 / 22203161 Email- info@mascotpumps.com	31.01.20
	v) Ajanta Industries(Upto 7.5 HP)	Ph-02827-287460 / 61. Email- info@ajantaindustries.co.in	30.04.20
	vi) Uneel Brand	Unnati Ind.corporation ,Ahmad.Ph No 079-22811320 / 21 ,Email- pump.uneel@gmail.com	31.1.21
e) Submerged Centrifugal Pump			
	i) Jasco Pump Pvt. Ltd (Upto 100 HP)	47 Phase I,GIDC, Naroda Ahmedabad, Ph 079-22821240 Email- jascopump47@gmail.com	31.05.20
	ii) Aqua (Upto 600 HP)	M/s Aqua Machineries Pvt Ltd.Plot No.3821, Phase -IV, GIDC ,Vatva,Ahmedabad-382445 (Gujrat) , Ph No. 079-25840954 / 240 / 915, Email - marketing@aquapumps.com	30.06.21
f) Submerged Vertical Pump			
	Aqua (Upto 200 HP)	M/s Aqua Machineries Pvt Ltd.Plot No.3821, Phase -IV, GIDC ,Vatva,Ahmedabad-382445 (Gujrat) , Ph No. 079-25840954 / 240 / 915, Email - marketing@aquapumps.com	30.06.21
B) Centrifugal Pump			
a) No Limit	Centrifugal HSC		
	Flowmore	M/s Flowmore Ltd ,714/715, Marathon Max ,Mulund-Goregaon Link Road , Mulund ,Mumbai 80 Ph No- 022 - 67997964 Email - bommkt@flowmoregroup.com, ajish.kumar@flowmoregroup.com	31.03.21
b) Up to 300 H.P			
	i) All Above		
c) Centrifugal Monoblock Pump			
	ii) MBH Pumps (Upto 30 HP)	GIDC, Naroda Ahmedabad, Ph 079-22823066 Email- marketing@mbhpumps.com	31.05.20
e) Booster Pump			
C) Vertical Turbine Pump No Limit			
	Flowmore	M/s Flowmore Ltd ,714/715, Marathon Max ,Mulund-Goregaon Link Road , Mulund ,Mumbai 80 Ph No- 022 - 67997964 Email - bommkt@flowmoregroup.com, ajish.kumar@flowmoregroup.com	31.03.21
D) SEWAGE PUMP			
	i) Sewage Submersible		

	Flowmore	M/s Flowmore Ltd ,714/715, Marathon Max ,Mulund-Goregaon Link Road , Mulund ,Mumbai 80 Ph No- 022 - 67997964 Email - bommkt@flowmoregroup.com, ajish.kumar@flowmoregroup.com	31.03.21
ii)	Up to 250 HP		
	i) All above		
	ii) Jasco Pump Pvt. Ltd (Upto 150 HP)	47 Phase I,GIDC, Naroda Ahmedabad, Ph 079-22821240 Email-jascopump47@gmail.com	31.05.20
	iii) MBH Pumps (Upto 150 HP)	GIDC, Naroda Ahmedabad, Ph 079-22823066 Email-markting@mbhpumps.com	31.05.20
iii)	Up to 100 HP		
	i) All above		
iv)	Upto 50 HP		
	i) All above		
v)	Upto 20 HP		
b)	Dry Well Installation		
i)	No limit	As per approved by SE (M)	
ii)	Upto 150 HP	As per approved by SE (M)	
c)	Vertical Non clog	As per approved by SE (M)	
E)	Vacuum Pump		
	i)KPT Blower (Upto 30 HP)	Ph. 02322-661500. Mob.07709356666. Email-kptblower@kpt.co.in	31.03.20
VII	Dewatering Pump		
VIII	SPV Solar Pumping System		
2	Valves		
a)	Sluice valve		
i)	600 mm and above with Gland & Gland Less		
	i) Jupiter Engg Co.(Upto 1000 mm) for PN-1 & 1.6	Ph. 033-26531285 /8759 Email-jupitervalves@gmail.com	30.04.20
	ii) Infra / Trustman (Upto 600 mm)	Shree Krisna Ind.Howrah Ph No .033-26510077 , Mo No -09163905657 Email -skivalves@gmail.com	31.1.21
ii)	400 mm dia to 600 mm dia		
	i) All above		

	ii) McWane Services Pvt Ltd. Including Gate Valves-Upto 600 mm	143/2A, Anna Nagar Road,Neelambur, Coimbatore-641062. Ph -0422-3222884/85 Email - sales@mcwaneservices.com	31.05.20
iii)	200 mm dia to 400 mm dia.		
	i) All above		
iv)	Upto 600 mm Dia CI / CS		
	i) Gavane Patil	M/s, Gavane &Patil P. Ltd.Pandharpur Road , Miraj Ph No-0233-2231253 Email-gavane_patil@yahoo.co.in	30.09.19
v)	Upto 400 mm Dia CI / DI / CS		
	i) KVMC Brand	M/s Kamla Valve Manufacturing Concern 83/85,Netaji Subhash Road, 4th floor, Room No. 401 , Kolkotta 700001 Ph 033-26517561/ 22108965	30.06.19
vi)	50 to 200 mm dia		
	i) All above		
b)	Ball valve	--	--
c)	Reflux Valve		
	i) 600 mm dia and above.		
	i) Jupiter Engg Co.(Upto 1000 mm) for PN-1 &1.6	Ph. 033-26531285 /8759 Email-jupitervalves@gmail.com	30.04.20
	ii) Infra / Trustman (Upto600mm)	Shree Krisna Ind.Howrah Ph No .033-26510077 , Mo No -09163905657 Email -skivalves@gmail.com	31.1.21
ii)	400 mm dia to 600 mm dia		
	i) All above		
	ii) McWane Services Pvt Ltd.	143/2A, Anna Nagar Road,Neelambur, Coimbatore-641062. Ph -0422-3222884/85 Email - sales@mcwaneservices.com	31.05.20
iii)	Upto 400 mm Dia CI / DI / CS		
	i) KVMC Brand	Howrah Ph 033-26517016	30.06.19
iv)	200 mm dia to 400 mm dia		
	i) All above		
v)	50 to 200 mm dia		
	i) All above		
d)	Air Valves		
a)	Kinetic Air Valves		
	Up to 200 mm Dia		
	i) Jupiter Engg Co.(Upto 200 mm)	Ph. 033-26531285 /8759 Email-jupitervalves@gmail.com	30.04.20
	ii) Infra / Trustman (Upto 200 mm)	Shree Krisna Ind.Howrah Ph No .033-26510077 , Mo No -09163905657 Email -skivalves@gmail.com	31.1.21

b)	Double Ball Air Valve CI / DI / CS		
	i) McWane Services Pvt Ltd.	143/2A, Anna Nagar Road, Neelambur, Coimbatore-641062. Ph -0422-3222884/85 Email - sales@mcwaneservices.com	31.05.20
	ii) KVMC Brand	Howrah Ph 033-26517016	30.06.19
c)	Air Relief Valve		
	i) Dorot up to 200 mm	M/s Synergy Engineering & Environmental Solutions Pvt. Ltd Thane Ph No. 022 - 25335975 Email- enquiry@synergyeesolutions.com	30.11.19
e)	Foot Valve up to 80 mm dia	--	--
f)	Butter Fly Valve		
	i) Infra / Trustman (Upto 1000 mm)	Shree Krisna Ind. Howrah Ph No .033-26510077 , Mo No -09163905657 Email -skivalves@gmail.com	31.01.21
	ii) Dyanamic Valves Pvt. Ltd.(Upto 1800 mm & PN1.6)	Ph. 022-27692277 Email- info@dyanamicvalves.com	30.04.20
g)	Butter Fly Valves CI / DI / CS		
	i) Upto 600 mm Dia		
	i) McWane Services Pvt Ltd.	143/2A, Anna Nagar Road, Neelambur, Coimbatore-641062. Ph -0422-3222884/85 Email - sales@mcwaneservices.com	31.05.20
	ii) KVMC Brand	Howrah Ph 033-26517016	30.06.19
h)	Air Cushion Valve / Zero Velocity Valve		
i)	Pressure Reducing Valve		
	i) Dorot upto 400 mm	M/s Synergy Engineering & Environmental Solutions Pvt. Ltd Thane Ph No. 022 - 25335975 Email- enquiry@synergyeesolutions.com	30.11.19
j)	Flow Control Valve		
	i) Dorot upto 600 mm	M/s Synergy Engineering & Environmental Solutions Pvt. Ltd Thane Ph No. 022 - 25335975 Email- enquiry@synergyeesolutions.com	30.11.19
k)	Actuators		
	i) Marsh Automation Pvt. Ltd.	98A/25A, Hadapsar, Pune- 13. Ph No 020-26875424. Email- response@marshautomation.com	31.05.20
	ii) Cair Euromatic Automation Pvt Ltd. Upto 500 mm Dia	Plot No 177 -179 , Shiv Shakti Estate ,Narol Road, Ahmedabad , Ph No- 079-25730189 Mob. No. 07567862575 Email-	31.03.21
3	Pipes		

a)	G.I. Pipes and Special	Approved at Local Level	--
b)	C.I. Pipes and Special	Approved at Local Level or As per Civil CSR	--
c) Dismantling Joint			
	i) Anant upto 1000 mm	M/s, Anant Engineers & fabricators,D-37, MIDC, Ahmednagar .Ph No-0241-2777440/6602681 Email-pnn@anantengg.com, enquiry@anantengg.com	30.09.19
4	Tools	Approved at Local Level	--
5	Pressure/Vacuum Gauges	Approved at Local Level	--
6 Lifting Equipments			
a) Chain Pulley Block with travelling trolley			
	i) JAPS Projects (Upto 10 T	565, Phase II,GIDC, Ahmadabad-382445. Ph- 079-40083048. Email-japspro@yahoo.co.in	31.05.20
b) HOT, Cranes			
	i) JAPS Projects	565, Phase II,GIDC, Ahmadabad-382445. Ph- 079-40083048. Email-japspro@yahoo.co.in	31.05.20
c) EOT, Cranes			
	i) JAPS Projects	565, Phase II,GIDC, Ahmadabad-382445. Ph- 079-40083048. Email-japspro@yahoo.co.in	31.05.20
7	Motors		
A	L.T. Motors		
i) Horizontal Motors			
	i) Saga Windel Pumps Pvt. Ltd. (Upto 15 HP)	Mob.- 09825015990. Emal - sagawindel@gmail.com	31.03.20
ii) Vertical Solid Shaft Motors			
	i) Marathon Electric Motors (I) Ltd.	Pahalpur Works, 58, Taratala Road, Kolkatta-700024 Ph.033-44030400. Email - Salil.Nerurkar@marathonelectric.com	31.05.20
iii) Vertical Hollow Shaft Motors			
	i) Marathon Electric Motors (I) Ltd.	Pahalpur Works, 58, Taratala Road, Kolkatta-700024 Ph.033-44030400. Email - Salil.Nerurkar@marathonelectric.com	31.05.20
iv) VFD			
	Fuji Electric India Pvt Ltd.	409-410 Meadows , Sahar Plaza,J.B.Nagar,Andheri (E) , Ph No - 022-42524850, Email-info@fujielectric.com, paresh-patilfujielectric.com	31.03.19
v) Gear Motors			

B	H.T. Motors		
	i) Jeumont Electric (3.3 kV and 6.6 kV & upto 750 kW)	Mumbai Email- india@jeumontelectric.com Ph - 022 40151264	31.05.19
	ii) TMEIC Industrial System (I) Pvt. Ltd. (Upto 1000 HP)	Ph. 022-61555444. Email - mvdrivesmotors@tmeic.in	31.04.20
C	A C Generator/D.C Motor		
8	Starters		
A	D.O.L.		
B	Star Delta		
C	Auto Transformer Starter with Air Break Contactor		
	Locally Fabricated as per M.J.P.'s Specifications		
D	Power Contactor for ATS		
	Upto 800 Amps		
	Upto 600 Amps		
	All above		
	Upto 400 Amps		
	i) All above		
E	Soft Start Starters		
	FCMA + Soft Starters (Lecon Energetics)	Lecon Energetics Pvt .Ltd. Survey No .77/113,Site No 2 , 15 th Cross, Kareem saheb Layout, Manjunatha Ind. Complex, Vishwaneedan Post, Bangalore - 91. Email : lecongmg@gmail.com,sales@leconsystem.com .Mo. No. 09845067240 / 09449041220	31.08.20
9	Switches & Fuses		
i)	Rotary Switch Fuse		
ii)	Change Over Switch On Load / Off Load		
iii)	HRC Fuses		
10	LT Circuit Breaker		
i)	Oil Circuit Breakers		
		--	--
ii)	Moulded Case Circuit Breakers		
iii)	MCB		
11	Air Circuit Breaker		
a)	No Limit.		
		--	--
b)	Upto 1600 Amp		

	c) Upto 630 Amp	--	--
12	Vacuum Circuit Breaker		
	a) 22 kV / 33 kV	--	--
	b) 11 kV		
	In Door VCB & Kiosk	--	--
13	Vacuum Contactors	--	--
14	ELCB	--	--
15	Protection Relay	--	--
	i) Motor protection relay for HT Motors	--	--
	Motor protection relay for LT Motors	--	--
		--	--
	ii) Over current and earth fault relay high Speed tripping relay.	--	--
		--	--
	iii) Static relay	--	--
	Timers	--	--
16	Transformers		
	i) Upto 10 MVA		
	ii) Up to 5 MVA		
	iii) Upto 3000 kVA		
	iv) Up to 2500 kVA (Transdelta) for 11,22,33 kV	Transdelta Transformers Pvt Ltd. B - 8 & 9 , MIDC Area, Chikalhana,Aurangabad -431006 Email: transdelta@rediffmail.com Ph No. 02402482427 / 643	31.08.20
	v) Up to 1000 kVA		
	ii) Telawane Power Equipments (Upto 1000kVA) Energy efficient	Ph.022-27642273/74/75. Email-tender@telawane.com	31.01.20
	v) Up to 750 kVA	All above	
	vi) Upto 630 kVA		
	i) Rajesh Jalgaon (Upto 500kVA) for 11,22,33 kV	Ph. 0257-2212416 /227046. Email-rajeshelctro@gmail.com	31.01.20
	vii) Up to 315 kVA		
	viii) Instrument Transformer		
17	Ammeters/Voltmeters	--	--
18	Capacitors		
	L.T. Capacitor 25 kVAR and above		

	i) EPCOS India Pvt. Ltd (Upto 50) M.V. Upto 500kVAR	Ph. 022-25750819.	30.04.20
	ii) L.T.Capacitor upto 25 kVAR	All above and as MSEB approved	
	iii) Capacitors H.T.		
19	Sub-Station Equipment		
	i) Outdoor CT/PT		
	Transdelta	Transdelta Transformers Pvt Ltd. B - 8 & 9 , MIDC Area, Chikalthana,Aurangabad -431006 Email: transdelta@rediffmail.com Ph No. 02402482427 / 643	31.08.20
	ii) A.B.Switch (GOD)/Isolators	--	--
	iii) D.O.Fuse Unit/Horn Gap Fuse Unit	--	--
	iv) Lightning arrestor	--	--
20	Cables		
	i) PVC Submersible (Copper Conductor) Cable	--	--
	ii) 1.1 kV PVC armoured ,unarmoured & XLPE Alum / Copper Cable	--	--
	Asian Galaxy Pvt. Ltd. i) Single/Multi Core upto 400 sqmm. ii)Single/ Multi core upto 50 sqmm. iii) Aerial Bunch cable upto 1.1 kV	Ph. 011-43025843. Email- sales@v- marc.in	28.02.20
	Vishal i) Armoured /Unarmoured Power cable upto 1.1 kV ii) Copper Control Cable iii) Flexible Wires and Cables	M/s Vishal cable P. Ltd.56,Ashoka shopping Centre ,Mumbai Ph. No-022- 22695486 /22641337 Email- vishalcables@gmail.com	30.09.19
	iii) 3.3 kV/6.6 kV/11 kV/ 22 kV/ 33 kV XLPE cable	As per MJPs norms	
	iv) Control Cable		
21	Automatic Control Unit for Submersible Pump		
	A) Automation products	--	--
	B) Remote Data Aquisition & Control System	--	--
22	Voltage Stabilizers		
	i) Upto 800 kVA	--	--
	ii) Upto 300 kVA	--	--
	iii) Upto 50 kVA	--	--

	iv) Upto 12.5 kVA	--	--
23	Blowers		
	Up to 200 HP Compressor and Blower		
	KPT Blower (Upto 150 HP)	Ph. 02322-661500. Mob.07709356666. Email-kptblower@kpt.co.in	31.03.20
	Up to 30 HP		
24	Worm, Helical Gear Boxes & Geared Motors	--	--
	i) Sluice Gate, Open Channel Gate, Fine/Coarse bar screen, Knife Gate Valve	--	--
	ii) S.S. Screen	--	--
	iii) Gear Box		
	iv) Filter Pump		
	v) Dosing Pumps		
	vi) WTP Accessories		
	Upto 100 Mld		
	HNB Brand		
	1) Penstock/Sluice gate		
	2) Clarifiers / Clarifloculator/ Thickener 3) Belt / screw conveyer 4) Mechanical Multi rake / Single rake, Coarse / Fine Screen and Manual Bar Screen 5) Gravity and Vortex type detritus Mechanism 6) Submersible / Floating / Surface Aerators	M/s HNB Equipments Pvt .Ltd . Henabh centre , 1326 , Shukravar Peth, Opp. Bajirao Road , Pune - 2 Ph No - 020 - 24473299 , E mail - hnbc@hnbc.in, hnbequipment@rediffmail.com	31.12.20
	7) Moving Weir / Fixed weir / Floating decanter 8) Digester / draft tube / poly jelly mixers, agitators 9) Grit and moisture trap, vortex type pump. 10) Bio gas safety equipment (flare , PVRV, flame arrestor)	M/s HNB Equipments Pvt .Ltd . Henabh centre , 1326 , Shukravar Peth, Opp. Bajirao Road , Pune - 2 Ph No - 020 - 24473299 , E mail - hnbc@hnbc.in, hnbequipment@rediffmail.com	31.12.20
25	Sunrise to Sunset time limit switches for Street Light		--
26	A) L. T. Panel -		

	i) Technocraft Switch Gears Pvt. Ltd.	Ph. 022-25705977 / 25706865 Email - nc.shenoy@technocrafts.net nishmitha@technocrafts.net	31.01.20
	B) PCC ,MCC , APFC, PLC Lighting, Distribution & Instrument Control Panel	--	--
	C) Medium Voltage control Panel & Control Relay panel 3.3 KV to 33 KV		
	i) Technocraft Switch Gears Pvt. Ltd.	Ph. 022-25705977 / 25706865 Email - nc.shenoy@technocrafts.net nishmitha@technocrafts.net	31.01.20
	P.F. Correction Panel	--	--
	LT/HT	--	--
		As per MJP Specifications	
27	Water Meters		
	A) Mechanical Type meters		
	a) ISI Marked Domestic Water Meters as per IS:779:1994		
	i) Fedrel Brand 15 mm to 40 mm Single Jet / Multijet Class B	V.A.Valves ,Udyog Nagar ,Gadaipur, Jalandhar .144004 Ph No 0112601540/41 Email:vavalves@vk-utam.com, info@fedrelflowmeters.com	31.08.20
	ii) Janta Brand 15 mm Single Jet Class B 15 mm to 25 mm Multijet Class B	Associated Precision Metal Works 100 / 2 , Patpargang ,mayur Vihar ,Ph 1 , Delhi 110091 Ph No 011 22751049 ,Mo No. 09999942610 Email: apmw100@yahoo.com	30.09.20
	b) OIML/MID certified Multi Jet Domestic Water Meter as per ISO -		
	c) AMR Water Meter		
	B) Bulk Meters		
	a) Bulk water Meter as per IS 2373		
	b) Bulk water meters as per ISO 4064, OIML /		
	C) Ultrasonic Water Meters		
	a) AMR Domestic Meters		
	15 mm to 40 mm	i) M/s Kamstrup Metering Solutions Pvt Ltd,214 Orion Business Park, Kapurbawadi,Ghodbunder Road,Thane (W) 400610 PhNo-022-25896215, Mob No.- 9967607445/9702015903 Email-sub@kamstrup.com,upb@kamstrup.com	30.04.21

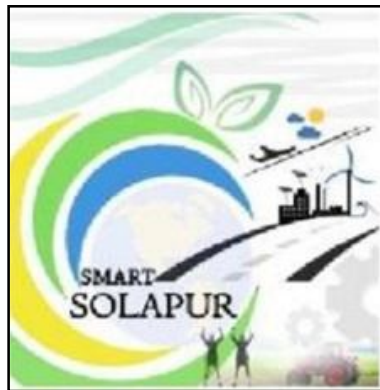
	b) AMR Bulk Meters	i) Adapt Fluidyne Pvt. Ltd.Pune. Ph. 020-25464551/25431474. Email- info@adaptfluidyne.com	31.01.20
D) Ultrasonic Flow Meters		i) RL Technologies Pvt. Ltd. No 2, Rangarajapuram, 1st Street,Kodamdakkam, Chennai-600024. Ph. 044-24806500. Email - chennai@rltech.in	31.01.20
		ii) Adapt Fluidyne Pvt. Ltd.Pune. Ph. 020-25464551/25431474. Email- info@adaptfluidyne.com	31.01.20
i) Insertion type		i) Endress+Hauser	30.06.19
		ii) Adapt Fluidyne Pvt. Ltd.Pune. Ph. 020-25464551/25431474. Email- info@adaptfluidyne.com	31.01.20
ii) Portable type No Limit		i) Endress+Hauser (Aurangabad)	30.06.19
		ii) Adapt Fluidyne Pvt. Ltd.Pune. Ph. 020-25464551/25431474. Email- info@adaptfluidyne.com	31.01.20
E) Full Bore Electromagnetic Flow Category "A" (Having its own testing facility with NABL Labortary)			
		i) Endress+Hauser (Aurangabad) Ph No 022-30236100 Email-yogesh.nikam@in.endress.com	30.06.19
Upto 1000 mm		ii) Krohne Marshall Pvt Ltd.Pune Ph No 020-27442020 Email- akhole@crohnemarshall.com , hawati@crohnemarshall.com	30.11.20
		iii) Electronet (Pune) M/s Electronet Equipment P Ltd ,Plot No 84,85&86,Tiny Indusrtial Estate,Kondhwa Budruk,Pune Ph No 020-26932093/1476 Email- ho@eeplindia.com	28.02.21
	Upto 800 mm	i) Manas Micsystems Pvt Ltd Pune Ph No 020-27127044 Email- mktg@manasmicro.com , manasmicro@yahoo.com	31.12.20
Upto 400 mm (Including Battery Operated)		Adapt Fluidyne Pvt. Ltd.Pune. Ph. 020-25464551/25431474. Email- info@adaptfluidyne.com	31.01.20
ii) Category "B" upto 200 mm			
		RL Technologies Pvt. Ltd. No 2, Rangarajapuram, 1st Street,Kodamdakkam, Chennai-600024. Ph. 044-24806500. Email - chennai@rltech.in	31.01.20

iii)	UP to 150 mm dia		
F)	Water Meter Calibration System (Test Bench)		
28	WTP Process Equipment		
a)	Web based PLC with HMI for automation of WTP/pumping station.		
	PLC Controllers Scada, HMI , I/O Modules, Indu.Grade Ethernet switches / Wireless system,lightening protection Devices- Valvetrab,Linetrab,Surgetrab (20kA),terminal block (Polymide / Non Ferrous Metal),Cables & Connectors, Indu. Grade Din Rail SMPS, DC- UPS ,Relays, Isolators , Fiber Optics Serial Convertor, Solid States Contactors (Motor Management.)		
29	Web based Intelligent PLC and Instrumentation		
	Fuji Electric India Pvt Ltd.	409-410 Meadows , Sahar Plaza,J.B.Nagar,Andheri (E) , Ph No - 022-42524850, Mo. No. 8879090765 / 8879042235 / 9987221588 Email- info@fujielectric.com, paresh-patilfujielectric.com	31.03.19
30	Level Transmitter		
31	Level Switch		
32	Lab Equipments, chemical analysis instruments, PH meter & turbidity meter		--
33	Chlorination plants		
a)	Vacuum operated Chlorination S.M. Polymers (Automatic / Manual) Upto 15 kg/hr	S.M.Polymers 4B / 8 Om Sudama CHS, Kalva West , Thane Ph No 02227692776 , Email : smpolymer@gmail.com	31.08.20
b)	Electro Chlorinator	--	--
34	Pressure, Level, Temprature Transmitter, Liquid Analysis Sensor & Transmitter	i) Endress+Hauser (Aurangabad) Ph No 022-30236100 / 02402563695	30.06.19
	Pressure, Level Transmitter, Ultrasonic / Radar level Transmitter. PH, DO Turbidity and Chlorine Analyser.	ii) RL Technologies Pvt. Ltd. No 2, Rangarajapuram, 1st Street,Kodamdakkam, Chennai-600024. Ph. 044-24806500. Email - chennai@rltech.in	31.01.20

35	Fibre glass Product- Cable Tray,trefoil lamps,Luminiare Ladder,Poles	--	--
36	Local Control station, Distribution board, Control panel, Junction box, Switch Socket Outlet.		--
37	Energy Monitoring System & Automation		
<p>Note : If any make of the product is not mentioned in the above approved list, then the same shall be got approved from Superintending Engineer (M).</p>			



Solapur City Development Corporation Limited



Tender No.

**Augmentation to Solapur City Water Supply Project (Ujani Dam as
a source – 110 MLD) on Design, Build, Maintain, Operate and
Transfer (DBMOT) Basis**

Part - II: EMPLOYERS REQUIRMENTS

Section 6B : STANDARD SPECIFICATIONS

TECHNICAL SPECIFICATIONS

DETAILED SPECIFICATION

All material such as sand, metal, rubble, steel, bricks, etc. shall be get checked from GOVERNMENT AUTHORISED LABORATORY. Then it should be allowed to use. Charges for this shall have to be borne by the contractor.

General Note- Payment will be done as per As per Annexure 2 of Bid Document.

1. EXCAVATION IN ALL SOFT AND HARD STRATA MATERIAL

1.0 GENERAL

The specifications contained in the standard specification volume IInd published by Public Works and Housing Department, Govt. of Maharashtra, Chapter Bd. A shall apply. And the Specifications approved by Govt. for Water Supply Projects Under AMRUT Programme. In addition to above following specification shall apply. In case of any discrepancy between the two the below given specifications shall govern.

1.1 SITE CLEARANCE

The area to be excavated shall be cleared off. All trees and bushes and rubbish and other objectionable materials removed shall be burnt or disposed off as directed by the (SCDCL)Employer's Representative. The cost of such clearing shall be deemed to have been included in the rates accepted for different items under excavation.

1.2 DEWATERING

No distinction shall be made as to whether the materials being excavated is dry, moist or wet. The item also includes bailing out of water by manually or pumps to keep the trenches reasonable dry for all further works of lowering, laying, jointing and testing of the pipe line till the completion of the work.

1.3 SHORING AND STRUTTING

The item includes all shoring and strutting that may be required. On no account the width of trenches more than these mentioned here in after shall be measured. If excavation width more than the specified is required for the purpose of keeping machinery, steeping due to loose material or for any other reasons the same shall be at the Contractors cost.

1.4 LIGHTING, BARRICADING AND GUARDING

The items of excavation are including necessary lighting at night at suitable intervals, but not more than 15 meter along the excavated trenches and at all crossing and barricading the same by fencing so as to avoid the accident. Chowkidars shall be employed at place where the trenches cross over any traffic road to caution the vehicles and pedestrians etc. The arrangements shall be maintained till completion of work and at the cost of the Contractor.

1.5 **ALIGNMENT AND LEVELS**

Before the trenches excavation is commenced, sight rails shall be erected at every 30 meters and at all points of change of direction, gradient and at ends. The excavation work shall be preceded by a detailed survey along the alignment of the main to obtain ground levels at every 30 meters or less distance. Temporary bench mark shall be constructed at every 30 meters distance along the alignment and shall be maintained till the completion of work. All labour and materials required for the survey work of fixing bench mark etc. shall be provided by the Contractor at his own cost. For any mistakes in survey the Contractor is fully responsible. should not lay the pipes, unless the alignment is thoroughly checked by the Solapur City Development Corporations Limited (SCDCL'S) Representative who is empowered to sign the work order book in token of checking the exact grade and level of the trenches excavation.

Excavation at random places shall not be measured by the (SCDCL) Representative. Any non-technical practices during the excavation of the contracted work shall be viewed very seriously by the (SCDCL) and a note to that effect will be recorded against the Contractor in his name.

1.6 **DEPTH AND GRADES OF TRENCHES**

The trenches shall be excavated to the required grades and depth in all types of strata and on the lines as shown on approved drawings or as directed by the (SCDCL) Representative. The depth of excavation and the levels of the pipe inverts shall be checked by means of boning rods of suitable lengths. Additional depths if required to be excavated for pipes, for sockets, collars, specials, joints and for any other working facility and shall not be measured and paid. The minimum cover above the pipe shall be 1.00 m.

The Contractor shall notify the (SCDCL) Engineer when the trenches are ready for bedding so that the (SCDCL) Engineer can inspect and record the depth. Only on explicit approval by (SCDCL) Engineer, the bedding shall be provided by the Contractor. If any public utility i.e. electrical cable, telephone cable, water connections, sewer connections, gutter damage etc. then same will be rectified by contractor at his own cost.

1.7 WIDTH OF TRENCHES

The maximum width of the trenches admissible for payment shall be as under

Sr. No.	Internal dia. of pipe	Width of excavation of trenches	Nature of strata
1.	80 mm and below	0.70 M	In soft and hard material
2.	100 mm	0.75 M	In soft and hard material
3.	150 mm	0.75 M	In soft and hard material
4.	200 mm	0.85 M	In soft and hard material
5.	250 mm	0.85 M	In soft and hard material
6.	300 mm	0.90 M	In soft and hard material
7.	350 mm	0.95 M	In soft and hard material
8.	400 mm	1.10 M	In soft and hard material
9.	450 mm	1.15 M	In soft and hard material
10.	500 mm	1.20 M	In soft and hard material
11.	550 mm	1.25 M	In soft and hard material
12.	600 mm	1.25 M	In soft and hard material
13.	700 mm	1.30 M	In soft and hard material
14.	750 mm	1.40 M	In soft and hard material
15.	More than 750 mm	OD + 0.60 M	In soft and hard material

1.8 PRESSING AND CONSOLIDATING OF THE TRENCHES

The bed of the trenches shall be well rammed before laying of the murum or sand for bedding hollows, if any, shall be filled with murum duly rammed and watered to required level and grade at cost of the Contractor.

1.9 CLASSIFICATION OF MATERIALS IN TRENCHES

The Contractor shall carry out his own assessment regarding the strata at different depth along the alignment, before submission of the tender.

1.10 EXCAVATION BY CHISELLING MECHANICAL MEANS (In Hard Strata)

Excavation in hard strata shall be done by chiseling, wedging or line drilling as specified any mechanical all means or ordered by the SCDCL'S Engineer. The excavation refers to excavation generally for foundation, wet or dry, in hard rock by chiseling, wedging or line drilling and shall comply with the specifications.

1.11 MODE OF MEASUREMENT

As per Annexure 2 of Bid Document.

2. PLAIN/REINFORCED CEMENT CONCRETE

a) PLAIN CEMENT CONCRETE

b) REINFORCED CEMENT CONCRETE

2.1 (a) Proportions of concrete for types of work

- i) M-150 – For leveling course and foundation of chairs and thrust blocks etc.
- ii) M-150 PCC with temperature nominal 0.15% reinforcement for footing thrust blocks, anchor blocks, chairs and encasing of pipes etc.
- iii) M-200 PCC for water retaining structure
- iv) M-300 for Construction of Jack well, Pump House & Water Retaining Structure. Such as ESR, WTP, MBR, BPT.
- v) M-250 Pump house and bridges (excluding sub-merged portion)
- b) General specifications of this work shall be as per standard specification of Public Works Department, latest edition, for PCC Bd.- E1 to E-7 and for RCC Bd.F2 to F16.
- c) Whenever concrete is to be laid in trenches, the trench shall be cleaned, and watered before placing. The sub-soil water which is met shall be removed and the trench shall be kept dry during and after 2 hours of placing concrete.
- d) Pedestal pier shall be perpendiculars to center line of pipe.
- e) Proper seat shall be left on top of pedestal pier to construct saddle. Seat shall be strictly done within 24 hours, failing which will not accept it for payment
- f) RCC saddle shall be constructed as per approved detailed drawing. The top of saddle where pipe rests shall be provided with wearing plate fixed in CM 1.3 smoothly and CM grouting may be done after pipe is placed and no extra payment will be made for this.

2.2 MODE OF MEASUREMENT.

The concrete shall be measured for its length, breadth and depth limiting dimensions to those specified in approved drawing or as per direction of (SCDCL'S) Representative.

The damages to concrete during laying of pipe line shall be rectified free of cost. The rate for the concrete includes all labour, material centering shuttering securing etc. all leads and lifts.

Mixing of concrete shall be done with concrete mixer.

For providing Electric wiring duct tubes of the required diameter and length shall be provided through walls beams and floors, slabs as and when directed without any extra cost.

- a) The contractor shall make his own arrangement for receiving all

material tools etc. required for the work.

- b) No extra charges for the carriages of material, water will be allowed.
- c) The cost for all items are inclusive of all charges (such as carting, lifting, etc.) The contractor should not be Sublette without written permission of the (SCDCL) Representative
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- a) The contractor will make his own arrangement for receiving all material tools etc. required for the work.
- b) No extra charges for the carriages of water will be allowed.
- c) The rates for all items are inclusive of all charges such as carting, lifting, etc. No extra payment for any lead and lifts will be paid for any item.
- d) The contractor should not be Sublette without written permission of the (SCDCL) Representative

- a. The conditions in the tender notice will be binding on the contractor and the Tender Notice will form a part of agreement.

Cement cubes of size 15 cm x 15 cm x 15 cm are taken during the concreting of important structure like RCC well, water treatment plant, elevated service reservoirs, bridge etc. to check the strength of the concrete and its acceptability. It is observed that while taking cubes the requirement specified in the relevant Indian Standard specification are not observed properly and cubes are not cast in the required numbers., the acceptability of the concrete cannot be decided correctly. Similarly, proper care is also not taken for curing of the cubes the requirements specified in the ISS in respect of casting of concrete cubes and curing thereof, with acceptability criteria of concrete are reproduced below, which shall be following scrupulously.

2.3 FREQUENCY OF SAMPLING (IS:456:2000 (Clause 15.2)

- a) Number of samples to be taken during concreting based on the quantum of concrete cast shall be as below.

Quantity of concrete in Cum	No. of samples
01 to 05	1
06 to 15	2
16 to 30	3
31 to 50	4
50 and above	4+1 for every 50 Cum part thereof

At least one sample shall be taken from each shift of concrete and three test specimens (cubes of size (15 x 15 x 15 cm) shall be cast from each such sample for testing of the compressive strength additional three cubes will also have to be taken for 7 days test.

The test strength of the sample shall be the average the strength of the three specimen.

2.4 ACCEPTANCE CRITERIA (IS:456:2000 Clause 16)

The concrete cost shall be supposed to be acceptable in the compressive strength (i.e. average strength of the three specimen) of the samples fulfill the following requirements.

a) Every sample has a test strength not less than characteristic value.

OR

b) The strength of one or more samples, though less the characteristic value is in each case, not less than the greater of following.

i) The characteristic strength minus 1.35 times the standard deviation.

and

ii) 0.80 times the characteristics strength.

c) And the average strength of all the samples is not less than the characteristic strength plus

$$1.65 * \frac{1.65}{\text{No. of samples}} = \text{times the standard deviation}$$

d) However, it should be noted that individual variation should not be more than the percent of average.

STANDARD DEVIATION VALUES

Grade of Concrete	Assumed Standard deviation in Kg/Cm ²
M-100	35.00
M-200	46.00
M-250	53.00
M-300	80.00

2.5 CURING OF CONCRETE CUBES (IS:516:1959, CLAUSE 3.3)

The test specimen (cubes) shall be stored on the site at place free from vibration, under damp matting, sacks or other similar material for 24 hours +

½ hour from the time of adding the water to the other ingredients. The temperature of the place of storage shall be within the range of 22° to 32°C. After the period of 24 hours, stored in clean water at temperature of 24° to 30°C until those are transported to the testing laboratory. Samples shall be sent to the testing laboratory well packed in damp sand, damp sacks or other suitable material as to arrive there in a damp condition, not less than 24 hours before the time of test.

On arrival at the testing laboratory, the specimen shall be stored in water at a temperature of 27° + 2° C until the time of test. Record of the daily minimum and maximum temperature shall be kept, both during the period specimen remain on the site and in the laboratory.

2.6 **TEST PROCEDURE (IS:516:1959 CLAUSE 5.5)**

Specimen stored in water shall be tested immediately on removal from water and while those are still in the wet condition. Surface water and grit shall be wiped off the specimens and any projecting fins removed. Specimen, when received dry, shall be kept in water for 24 hours before taken for testing. The dimensions of the specimens to the nearest 0.2 mm and also weight shall be noted before testing.

2.7 **OTHER THINGS**

Here, it should be specifically noted that age of concrete cube will be age as on the date of testing i.e. time difference between addition of water to dry ingredient and actual testing.

2.8 **MIX DESIGN**

The following instructions shall be followed as regards preliminary design of mix and methods of batching of plain cement and reinforced cement concrete. These instructions should be treated as supplementary to the relevant provision in the specifications for the respective items contained in the book of standard specification and will be carried the provisions contained therein, wherever they are contrary to the following instructions.

The preliminary design and batching for various grades of concrete shall be governed by the following guidelines.

No.	Concrete Grade	Guidelines
1	Up to M-150	This should only be ordinary concrete. No change may be prescribed in the present practice as regards preliminary design of mix and permitting volume batching.
2.	M-200 to M-250	Preliminary mix design must be carried out for these mixes. However, weigh batching shall be insisted for cement, fine aggregate and coarse aggregate.
3.	Above M-250	Preliminary mix design must be prepared for such mixes weigh batching should be for cement fine aggregate and coarse aggregate.

For the grades of concrete M-200 and above the preliminary mix design shall be carried out from the approved laboratory. The rate quoted by the contractor in the agreement for these items shall be final and binding on him, irrespective of content of cement required as per preliminary mix design and there shall be no adjustment in the agreement rate for these items on this account.

The charges for preliminary design of concrete mix shall be entirely borne by the contractor.

For grades of concrete M-200 and above where cement is to be used by weightment, the cost of extra cement required to make up the underweight bags shall be borne by the contractor.

For the items of concrete of grades lower than M-200 and other items in the agreement where cement is not to be used by weightment the cement bags as received from the manufacturer and shall be assumed to contain cement of 50 kg net weight.

This shall be as per specification of P.W.D. (Hand Book) and as directed by Employer's Representative. Only trap stone shall be used other than the specification for this item in Standard Specification Book.

3. SPECIFICATIONS FOR MILD STEEL AND TOR STEEL REINFORCEMENT FOR RCC WORKS

3.1 The item provides for supply of mild steel, tor steel bars, cutting, bending with G.I. wire and placing in position, welding for reinforcement in the RCC.

- 3.2 Mild steel and tor steel bars shall confirm to Relevant BIS, Specification A-10 of Standard Specification of Public Works Department, Latest Edition.
- 3.3 The binding wire shall confirm to Relevant BIS, Specification A-15 of Standard Specification of Public Works Department, Latest Edition.
- 3.4 The steel bars shall be supplied directly to the site of work.
- 3.5 Bending reinforcement confirm accurately to the dimensions and shapes in the details drawings (approved) or as directed by the (SCDCL) Representative.
- 3.6 Bars shall be bend cold only. In no way bending by heat will be allowed.
- 3.7 Bars with kinks, bends or cracks shall not be used.
- 3.8 Details of length, size, laps and bending diagram shall be got approved by the (SCDCL) Representative.
- 3.9 As far as possible full length of bars shall be placed as per drawing details. When full lengths are not available, bars be supplies only after written permission of the (SCDCL) Representative. Supplies shall be staggered and in tension zone shall be avoided strictly. Bars shall be lapped as specified in IS:456-2000 with due regards to the grade of concrete. Welding may be used for large diameter of bar only after permission of (SCDCL) Representative.
- 3.10 Welding, if permitted shall conform to specification B.10.7 of Standard Specification of Public Works Department.
- 3.11 All reinforcement shall be accurately placed in position with spacing and cover shown in detailed drawing and firmly held during the placing and setting of concrete. Bars shall be ties at all intersections. Binding wire of 1.63 mm or 1.22 mm diameter (about 16 or 18 gauge) shall be used. Spacing of the bars shall be maintained by means of stays, blocks ties, spacers, hangers or other approved supports at sufficient close intervals so that bars will not be displaced. During placing vibrating or compacting concrete, placing bars for reinforcement on a layer of fresh concrete as the work progress will not be permitted. The use of pieces of broken stones or bricks or wooden blocks for maintaining spacing or cover shall not be permitted. Layers of bars shall be separated by precast cement blocks, spacer bars or other devices.
- 3.12 Full details of numbers, sizes, lengths, weights, laps, welds, spacing of bars placed in position in different parts of the work shall be recorded by the contractor and certified and signed by the(SCDCL) Representative to show that all reinforcement has been placed correctly as per sanctioned drawing or

as directed by the Employer's Representative in writing, before placing concrete. No concrete shall be placed in position until the certified the correctness of reinforcement, recording the steel measurements and has given permission in writing to place concrete. After approval of reinforcement as above, it will be the contractor's responsibility to seal that the spacing of reinforcement and arrangements are not tampered with in any way before or during concreting.

3.13 Any steel is required to be procured by Contractor. He shall produce the test certificate. In addition, actual test shall be carried out according to IS:432-1982, in an Government laboratory and the cost of test shall be borne by the contractor, including all transport, etc.

3.14 **This item includes,....**

- a) Cost of labour, materials, use of tools, plant and tackle and other incidental items to complete the work satisfactorily.
- b) Supplying, conveying, cleaning, cutting, bending, binding with (1.63 mm or 1.22 mm diameter – 16 to 18 gauge) wire on spot, welding and placing reinforcement in position and maintaining it clean and in position till the concrete is laid.
- c) Cost of sampling and testing, as required.

3.15 In no case, any foreign material e.g. oil, grease, etc. which prevent bonding between steel and concrete shall remain on steel on steel bars during placing of concrete.

3.16 **MODE OF MEASUREMENT**

As per Annexure 2 of Bid Document.

4. BURNT BRICK MASONRY SECOND CLASS

4.1 GENERAL

This specification lays down the requirements for B.B. Masonry 1st class in cement mortar of specified proportion required for various structures, including necessary scaffolding, watering etc. The specifications shall conform to IS:2212-1991 its latest revision.

4.2 MATERIALS

BRICKS : Bricks shall be first class and shall conform IS:1077-1992.

4.3 MORTAR

The quantity of mortar to be used per Cum of B.B. masonry shall be about 30 to 32% or 300 to 320 liters for conventional bricks and 32 to 33% or 320 to

330 liters for ISI bricks. The proportion of mortar shall be as specified in the item of the tender.

Mode of Measurement :

As per Annexure 2 of Bid Document.

4.4 CONSTRUCTION

JOINTS : Joints shall not exceed 12 mm (about ½") in thickness and shall be uniform throughout.

All other specifications of KB-1 for B.B. masonry first class shall apply to this class of masonry also.

4.5 HALF BRICK MASONRY

The half brick masonry shall be in cement mortar specified in the item but not weaker than 1:4.

The half brick masonry shall be reinforced by 2 No. of 6 mm dia. M.S. longitudinal bars or 2 No. of hoop iron strips of 25 x 1.6 mm size, at even third course properly bent and bounded in vertical joints of the brick work or to main walls as directed by the Employer's Representative, if continuous strip is not available, strips shall be rivet jointed with a minimum overlap of 8 cm. All the bricks shall be laid stretch wise breaking joint with the upper and lower courses. Fixtures, plugs, hold, fasts, frame down, windows shall be based into brick work while laying only and of the correct levels and positions. Holes of required size and stage shall be left in the brick work during laying for fixing pipes or service lines, passage of water etc. After the pipeline work is completed, extra hollow left around the hole shall be plugged with 1:3 cement mortar or 1:3:6 cement concrete. Hold fasts for frames of doors and windows shall be accommodated in the joints of the brick which laying. The joints in the courses where reinforcements is places shall admit of a mortar cover at least 5 mm for the brick work with 15 bricks and not more than 12 mm for conventional brick work. A set of mason's tools shall be maintained on work for each group of 3 masons or less for frequent use and checking. The ends of walls shall be bonded into the side walls where necessary.

The joints shall be raked out to depth not less than the thickness of the joints.

This item shall include :

- a) Providing and fixing mild steel reinforcement bars or hoop iron strips as mentioned above.
- b) Leaving holes for fixtures or pipes and making them good after completion of the work.

- c) Building in frames, hold fasts etc. and forming chassis and grooves.

5. CEMENT PLASTER : Internal Neeru finish

5.1 GENERAL

This specification lays down the requirement of cement plaster to be applied to concrete or brick masonry surface. In cement mortar of specific proportion and thickness.

5.2 PREPARATION

For masonry all joints in the frame work that is to be plastered shall be raked out to a depth not less than the width of the joints or as directed by the Employer's Representative. The raking shall be done taking care not to allow any chipping of masonry. In new work the raking out shall be done while the mortar in the joints is still green. Smooth surface of concrete or plaster etc. must be suitably roughened to provide necessary bond for the plaster all dirt, soot oil paint or any other materials that might interfere with satisfactory bond shall removed and surface wetted before plastering is started.

5.2.1 General : The item shall comply with specification B.11.b subject to the additional clauses Bd.L 1.2, Bd.L 1.3, Bd.L 1.4 and the following

5.2.2 Finishing : When no finish is specified the plastered surface shall be rubbed well to an even plane with a wooden float for external surfaces and finished smooth with a steel trowel for internal surfaces.

- When cement finish is specified, coat of pure Portland cement slurry 1.5 mm (1/6") thick shall be applied to the plastered surface while the second coat is still fresh. If neeru finish is specified, then the surface shall be finished as per specification for Item Bd.L-10.

The thickness of the cement plaster shall be 12 mm excluding cement or neeru finish.

5.3 MATERIALS

Cement mortar shall be prepared from cement and as specified for RCC work and mixed in the proportion specified. Sand shall be screened and washed if called upon to do so. Water proofing compound of directed make in directed quantities shall be added where it is water proof plaster, scaffolding shall be prepared from sound materials and shall be provided, where ever situation demands for facility of proper working.

5.4 GAUGES

Patch of plaster 15 x 15 cm shall be put on about 3 m apart as gauges to

ensure even plastering in one place.

5.5 **FINISHING**

In any continuous face of wall, finishing treatment of any type shall be carried out continuously and day to day breaks made to coincide with architectural breaks in order to avoid unsightly junctions. All mouldings shall be worked true to template and drawn neat, clean and level. All exposed angles, junctions and openings shall be carefully finished.

6 **WATERING**

All pointing work shall be kept damp continuously for a period of 14 days. To prevent excessive evaporation of the sunny and wind ward side of the building in hot, dry weather matting or gunny bags may be hung over on the outside of the plaster in the beginning and kept moist. If the contractor fails to water the work to the satisfaction of the Employer's Representative, the requisite labour, materials and equipment to water the work properly shall be engaged departmentally at the cost of the contractor.

5.7 Cost all scaffolding is included.

6. **SAND FACED CEMENT PLASTER**

6.1 **GENERAL**

The item shall comply with the specification B.11 in all pertinent particulars. In addition Bd.L.1.2, Bd.L 1.3, Bd.L 1.4 and the following specifications shall also be complied with.

Base Coat : The base coat plaster shall be of cement mortar 1:4. Water proofing compound of approved make like Pudlo, Sika, Accor proof shall be added according to the maker's instruction in Bd.L 2 which a thickness of 15 mm for brick work and concrete surfaces and 20 mm for rubble stone masonry. Keys shall be formed on the surface by thoroughly combing it with wavy horizontal lines about 12 mm apart and about 3 mm deep when the mortar is still plastic.

Sand Faced Treatment : The cement mortar fo sand faced plaster shall have washed Kharsalia or Kasaba or similar type of approved sand with slightly larger proportion of coarse material The proportion of cement to sand shall be 1:4. The water is added gradually to make the mixture homogeneous. The thickness of finishing coat shall not exceed 8 mm. After applications the surface should be finished with a wooden float lined with cork and tapped gently to retain a coarse surface texture. When the finishing coat has hardened the surface shall be kept moist continuously for 14 days.

Item to include relevant portion of Bd.L 1.6. it shall also be include the base coat and san face treatment of above.

The specification lays down the requirements of applying sand faced plaster in specified thickness with cement mortar to concrete or masonry surface in specified coats. This shall conform to specification for ordinary cement plaster where ever it is not irrelevant and in addition following shall also be applicable.

Tools and accessories used in plastering work be thoroughly cleaned before plastering is done.

The programming of other building operations before during and after plastering shall be according to the instructions contained in Clause 4 of IS:1661-1960 or its latest revision. The item shall be executed as per Red book specification BdL-7 to 7.50 page No. 351)

Care shall be taken that other parts of work of adjacent work are not damaged while plastering.

The base coat plaster shall be of cement mortar of specified proportion 1:4 and thickness as mentioned in the item or otherwise, it shall be of cement mortar 1:3 and thickness 15 mm to 20 mm. The base coat shall be laid in a similar manner as stipulated in. However, instead of finishing the top surface smooth keys shall be formed on the surface thoroughly combined in with wavy horizontal lines about 12 mm apart and about 3 mm deep when the mortar is still plastic. The base coat shall be cured for suitable period as per relevant code.

7. DOORS, WINDOWS AND ROLLING SHUTTERS

The specification for this work are as per Standard Specification BD-T-2 and T-7 and as directed by(SCDCL) Representative. (The item shall be executed as per Red book specification)

8. PAINTING WHITE WASH

This item is to be executed as per Standard Specification and as directed by (SCDCL) Representative. (The item shall be executed as per Red book Specification)

9. WATER PROOF CEMENT PAINTING

9.1 GENERAL

This specification lays down the requirement of applying cement based paint in specified coats to concrete or masonry surface.

9.2 MATERIALS

Cement paint with a base of white Portland Cement of approved manufacture. Colour and shade shall be used. Approved quality cement based paint shall be brought to site in original air tight containers with seal intact.

Scaffolding wherever necessary shall be provided to the entire satisfaction of the Employer's Representative.

9.3 PREPARATION

The surface to be painted shall be cleaned of all loose dust, and dirt paints and all cracks, holes and surface defects shall be repaired with cement plaster cured and allowed to set hard. Before the painting is commenced the surface is wetted well and water is allowed to run off. Any grease, oil paint, shall be removed by approved methods.

9.4 APPLICATION OF PAINT

Mixing of paint and procedure of painting shall be as specified by the manufacturer when no specification are following specification shall generally apply.

The dry cement shall be thoroughly mixed with clean fresh water to produce paint of required consistency (normally that of ordinary paints). The paint shall be kept stirred and used within one hour of mixing hardened or damaged paint shall not be used. The paint shall be applied by brushes in the manner specified by the manufacturer.

The number of coats shall be specified in the wording of the item. When more than one coat is to be given the subsequent coats shall be applied after the preceding coat has thoroughly hardened, inspected and approved.

9.5 CURING

Each application of paint should be wetted at the end of the day with a fine water spray, depending on climatic conditions. Wetting shall be done only after an interval of at least 6 to 8 hours after the applications. In dry weather the painted surfaces shall be kept damp for at least two days and protected from direct sun.

10. STEEL ROLLING SHUTTERS

10.1 The specifications lays down requirements of providing and fixing steel rolling shutters with accessories locking arrangement top hood cover and painting in three coats of synthetic enamel paint of approved quality and shade

The specification for this work as per standard specification of Red Book - and as directed by Employer's Representative.

10.2 MATERIALS

The rolling shutters shall conform to IS:6248:1979. Rolling shutter shall be supplied of specified type with accessories. The size of the rolling shutters shall be as specified in the drawings. The shutters shall be constructed with interlocking lath sections foamed from cold rolled steel strips not less than 0.9 mm thick and 80 mm wide for shutters up to 3.5 m width and not less than 1.25 mm thick and 80 mm wide for shutters 3.5 m width and above unless otherwise specified. Guide channels shall be of mild steel deep channel section and or rolled pressed or built up (fabricated) joint less construction. The thickness of sheet used shall not be less than 3.15 mm.

Head cover shall be made of M.S. sheet not less than 0.9 mm thick for shutters up to 3.5 m width. For shutters having width 3.5 mm and above the thickness of M.S. sheet for the hood cover shall not be less than 1.25 mm.

The spring shall be of best quality and shall be manufactured from tested high tensile spring steel wire or strip of adequate strength to balance the shutters in all positions. The spring pipe shaft etc. shall be supported on stron M.S. or Malleable C.I. brackets the brackets shall be fixed on or under the lintel as specified with raw plugs and screws bolts etc.

The rolling shutters shall be self-rolling type up to 8 Sq.mt clear area without ball bearing and up to 12 Sqm.. Clear area with ball bearing. If the rolling shutters are of larger size, then gear operated type shutters shall be used.

The locking arrangement shall be provided at the bottom of shutters at bottom ends. The shutters shall be opened from outside.

The shutters shall be complete with door suspension shafts, locking arrangements, pulling hooks, handles and other accessories.

10.3 WORKMANSHIP

Rolling shutters and top hood with all accessories shall be supplied of specified type and shall be got approved before fixing by the Employer's Representative. The fixing shall be done in true line and level. The damaged work shall be made good to the level of original works. The fixing work shall be done to the entire satisfaction of the SCDCL's Representative. After the erection and fixing the rolling shutters with hood shall be painted with synthetic enamel paint in three coats. The paint shall be of approved quality and shade.

11. PROVIDING, FIXING RSJ AND OTHER STRUCTURAL STEEL WORK FOR JACK WELL / WTP

The specification of the work as per standard specification Bd.C2 and the item cover fixing MS/RS girders, M.S. angle, channels, flats, base plate gusset

plates, cleat, bracket etc. and other accessories as per requirement and as directed and fabricating the assembly by cutting, drilling holes etc and erecting and fixing item as site with necessary riveted or welded joints fixtures with nuts and bolts etc. wherever necessary together with their proper fixing and embedding in masonry or slabs of concrete as directed. Structural steel works materials shall be procured by the Contractor from open market at his cost. The item includes 3 coats of oil paint of shade as directed to all structural work.

All above operations including cost of materials and labour thereof are included in the tender item. The measurement shall be on the weigh basis. RSJ channels, angles, flats, gusset plates, brackets base plate, cleats, packing pieces actual used as directed shall be admissible for payment but not the rivets, nuts and bolts etc.. the riveted or welded joints or fixing with nuts are included in the tendered rates. The specifications for this item given in Standard Specification (Red Book) published by B&C Department will be followed.

12. STRUCTURAL STEEL WORK (for pipe line, outlet arrangement and weir work only)

12.1 Requirements specified in this section will form a part of detailed specifications for items of works falling under this category. Indian Standard shall apply as if included herein. Design of structure shall be compliance with Indian Standard (IS) viz. Rivet IS:1148-1964 for bolts IS:1148-1964 and IS:800-1962 for structural fabrication IS:800-1962, etc.

PRINCIPAL ITEMS

- 1) Structural steel members
- 2) Steel joints
- 3) Plates and connection
- 4) Steel chair assembly
- 5) Pipe supports and hangers for piping in all locations
- 6) Pipe railing
- 7) Ladders and stairs
- 8) Misc. metal work for water supply and sewerage disposal installations.

12.2 QUALITY ASSURANCE

Unless otherwise specified all work specified herein and shown on the drawings shall conform to the applicable requirements of the following specifications and codes.

- A) Fabrication and erection of structural steel shall be in accordance with IS:800-1962. (latest edition)

B) WELDING INSPECTION

The contractor shall perform all structural field welding under continuous inspection of a representative of the (SCDCL) Notice will be given at least 24 hours in advance of needed inspection.

**12.3 SUB METALS
SHOP DRAWINGS**

The contractor shall submit shop drawings for approval before fabrications of any of the work. Complete fabrication details with material and specification lists showing all welds, fabrication and finish details, and shop painting will be shown with the drawing. In approving shop drawings, the owner does not assume responsibility for accuracy of the work relative to other components as constructed.

**12.4 SHOP FABRICATION
GENERAL**

- A) The maximum possible fabrication on structural steel work shall be manufactured off-site in a fabrication shop.
- B) Shop connections shall be welded or bolted, unless otherwise indicated.
- C) In so far as possible all work shall be fitted and assembled in shop ready for erection.

12.5 MEMBERS

- A) All members shall be free from twists, kinks, buckness or open joints.
- B) All members, holes and their spacing shall be so accurately made that when assembled the parts shall cone together and bolt without distortion.
- C) Parts assembled with bolts shall be in close contact, except where separators are required where unlike metals are in contact, to insulate as necessary to prevent corrosion.
- D) Bolt holes will be provided to secure special items, if any, to structural members.
- E) Bearing surface shall be planned to true beds. Abutting surface shall be closely fitted. Steel requiring accurate alignment shall be provided with slotted holes and/or washers for aligning the steel.
- F) All materials shall delivered in the order, in which they will be required so as to avoid all delay in completion of the project.

12.6 WELDING

- A) Welding in shop and field shall be done by qualified operators who have experience of similar work. The standard for welders will be as

required by IS:817-1966.

- B) All steel before being fabricated shall be thoroughly wire brushed, cleaned of all scale and rust and thoroughly straightened by approved methods, that will not injure the materials being worked on. Welding shall be continuous along the entire line of contact except where tack or intermittent welding is permitted. Where exposed welds shall be cleaned of flux and slag and ground smooth.

12.7 ERECTION

- A) Erection shall include the installation and erection of all steel as called for in this section. The contractor shall verify correctness before starting erection.
- B) As erection progresses, the work shall be securely bolted up to take care of all dead-load, wind and erection stresses.
- C) No final bolting or welding shall be done until each portion of the structure has been properly aligned and plumbed.
- D) Bolts shall be drawn up tight and threads set so that nuts cannot become loose.

E) DAMAGED MEMBERS

During erection, members which are bent, twisted or damaged shall be straightened or replaced as directed. If heating is required in straightening, a heat method shall be used, which will ensure uniform temperature throughout the entire members. Members which in the opinion of the (SCDCL) are damaged to an extent impairing appearance, strength or service ability, shall be removed and replaced with new members.

F) ANCHOR BOLTS AND ANCHORS

Anchor bolts and anchors shall be properly located and built into connection work. Bolts and nuts shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately. Embedded anchor bolts that are submerged in process, water or pump room floors, or are in enclosed tanks or spaces exposed to process gas or moisture shall be of stainless steel with nuts of same material. To such stainless steel bolts, a non-oxidizing lubricant grease will be applied before bolting.

G) BEARING PLATES

Bearing plates shall be provided under beams and columns resting on walls or footings. Bearing plates may be attached or loose and aligned on steel wedges or shims. After the supported members have been plumbed and properly positioned and the anchor nuts tightened, the

entire bearing are under the plate shall be dry packed solidly with bedding mortar. Wedges and shims shall be cut off flush with edge of bearing plate and shall be left in place.

H) **SUBSTITUTIONS**

Unless otherwise directed, the exact sections, shapes, thickness, sizes, weights and the details of construction shown for the structural steel work, shall be furnished. However the contractor, because of his stock or shop practices, may suggest change of the net area of section is not thereby reduced, if the section properties are at least equivalent and if the overall dimensions are not exceeded. All substitutions or otherwise deviations from drawings and/or specifications shall be specifically noted or 'clouded' on the shop drawing submittals.

I) **FLAME CUTTING**

Flame cutting by the use of a gas cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing. The use of a flame cutting torch will be permitted only on minor members, when the members is not under stress, and only after the approval of the SCDCL has been obtained.

J) **STORAGE OF MATERIALS**

Structural materials, either plain or fabricated shall be stored above ground upon platforms, skids, or other supports. Materials shall be kept free from dirt, grease and other foreign matter and shall be protected for corrosion.

K) **TEST REPORTS**

Certified physical and chemical mill test reports for material used for major structural members shall be furnished. All tests shall be performed in accordance with applicable Indian Specification Standards.

12.8 MATERIALS AND WORKMANSHIP

A) **STRUCTURAL STEEL AND MISCELLANEOUS METAL WORKS**

i) **GENERAL**

This work shall include the furnishing and installation of all structural steel and miscellaneous metal work and related work including grating and grating supports, pipe hangers and supports, tanks, manhole steps, equipment guards, anchors and other appurtenances and any other shown on the drawings or herein specified. All materials shall be new, sound and of the best quality available.

ii) **MATERIAL**

Steel rolled sections, plates and bars shall conform to the latest editions of IS:226, 808, 1730, 1731, 1732 and 3954. Pipe used for columns or other structural purposes shall conform to IS:1161-1968. Iron for castings shall conform to IS:210.

B) **STEEL JOINTS**

These shall be fabricated true to size and details shown on drawings in strict conformance with requirements of reference standards.

C) **COMMON BOLTS**

Bolts and nuts shall conform to IS:1363-1967.

D) **WELDING ELECTRODES**

The electrodes shall conform to the requirements of IS:814, latest edition.

E) **SHOP PAINTING**

Structural steel not designated to be galvanized shall be shop coated, using priming coat of red lead as specified in painting section, of these specifications. The portion of steel to be embedded in concrete shall not be painted.

F) **GALVANIZING**

All metal work shown or specified to be galvanized, shall be zinc coated, as per IS:2629-1966. The zinc coating should be free from defects and shall have uniform thickness of coating.

Galvanizing coating marred or damaged during erection or fabrication shall be repaired by any approved process as directed by the Engineer.

G) **SHOP PAINTING**

Before leaving the shop all steel not shown or specified to be galvanized shall be given one coat of primer red lead. Final painting shall be in specified coats of approved and approved brand oil paint. The portion of steel to be embedded in concrete shall not be painted.

H) **TEST REPORTS**

Certified physical and chemical mill test reports for material used for major structural members shall be furnished by the contractor.

I) **SHOP DRAWINGS**

Five sets of shop drawings shall be submitted to the Engineer, for approval before fabrications of any of the work. In approving shop drawings, the (SCDCL) Engineer does not assume responsibility for accuracy of the work relative to other plant components, as constructed.

J) **ANCHOR BOLTS**

Anchor bolts shall be galvanized and shall be fabricated as shown or as specified by the equipment manufacturer.

Suitable expansion bolts may be used in lieu of anchor bolts, at certain locations. It shall be the responsibility of the contractor to request the substitution and obtain the (SCDCL) Engineer's approval, regarding type and location of expansion bolts proposed to be used prior to pouring concrete.

K) **STEEL GRATING**

Seat angles and anchors shall be of steel, grating and support shall be galvanized. Gratings to be supplied and installed as detailed in the drawings.

L) **MECHANICAL EQUIPMENT GUARDS**

All rotating belts, pulleys and shafting shall be covered and guarded in conformity with applicable safety requirements or as directed by the (SCDCL)Engineer.

13. **CHEQUERED PLATE**

Plate shall be of regular quality carbon steel of the thickness shown on the drawings. The raised lugs shall be diamond shaped and have an angled and opposed pattern.

14. **PROVIDING & FIXING SLUICE VALVES & BUTTERFLY VALVES, AIR VALVES SPECIFICATION FOR MANUFACTURE, SUPPLY AND DELIVERY OF SLUICE VALVES, BUTTERFLY VALVES
SLUICE VALVES**

These specifications cover general provisions and requirements and are supplementary to the General conditions of contract.

GENERAL

The Sluice Valves proposed to be procured through this tender are to be used for drinking water supply schemes under execution.

WORK UNDER THIS CONTRACT

The work entitled manufacture, supply and delivery of Sluice valves for transmission mains shall comprise the manufacture, supply and delivery of the goods as mentioned in the Bill of Quantities.

a)	Sluice Valves	PN 1.0 of IS: 2906:1984. of various sizes, ranging from 350 mm to 1200 mm.
b)	Sluice Valves	PN 1.0 of IS:780:1980, of various sizes, ranging from 200 mm to 300 mm.

The manufacturer of sluice valves should be from approved list

NOTE :

The above goods to be used for conveyance of potable water at temperatures varying from 10 degree centigrade to 40 degree centigrade.

The tender price shall include all labour and machinery and all materials necessary for the proper, manufacture of the goods, for tests at the contractor's works for the insurance and for delivery to works for the proper maintenance and for discharging every obligations and requirement of the contract, in accordance with the intent of the contract documents, as stated in the General Conditions of Contract.

STANDARDS

Where reference is made to a particular standard, it shall be the latest revision of the Indian Standard Institution. Unless otherwise specified, the sluice valves shall be in accordance with the provisions of IS:780:1980 and IS:2906:1984 or sizes of the sluice valves covered under relevant standards.

MARKING OF SLUICE VALVES

Each sluice valve shall be marked as per IS:780:1980, Para-II for sizes (50 mm to 300 mm) and IS:2906:1984, page: 11.1 (for sizes 350 mm to 1200 mm).

PACKING AND HANDLING

The contractor shall dispatch from the manufacturer's works goods adequately protected to prevent damage and deterioration during transportation and storage, etc. The packing is to be quite robust to withstanding rough handling during the transit by road/ rail/ sea and storage.

Each package / create will contain sluice valve of one size only in relevant class.

The packing procedure followed shall be in accordance with Para 12 of IS:780:1980 and Para 12.1 of IS:2906:1984

The contractor shall use proper handling equipment or follow suitable handling method as approved by the Engineer to unload the materials at the delivery site to prevent damage to the goods and equipments.

Third party inspection from agency approved by (SCDCL) should be carried out at contractor's cost only.

The contractor should produce manufacturer's test certificate conforming that the valves have been tested in accordance with I.S. specifications, stating the actual pressure and the medium used in the test. The design workmanship, material, strength and dimensions of all parts shall be as per I.S.S. The product shall be of proven quality rendering reliable service during maintenance and requirement.

THIRD PARTY INSPECTION

Third party inspection shall be carried from MJP approved list. The valve shall be tested in factory by third party in presence of (SCDCL) representative and bear all expense including testing fee etc. at least for

- a. Review of material of construction
- b Overall dimension of all component
- c. Hydraulic testing.

PROVIDING AIR VALVES OF ALL CLASSES AND DIAMETERS.

This item includes Air valves (with IS make) and as per MJP latest approved list. The cost of valves should be including all taxes (Central & Local) railway freight, transportation up to site of work or departmental store.

15. HYDRAULIC TESTING OF PIPELINE :

After the work of laying pipeline is completed and before it is commissioned, the pipeline shall be tested in the field both for its strength and leakage in the following manner.

NOTE

Whether stated specifically elsewhere or not, the testing in section of 1 km shall have to be completed within 3 months of laying and jointing.

The pipeline laid length will be divided into sections specified by (SCDCL) Representative. The contractor shall recheck pipe and valves for cleanliness and shall recheck operations of the valves. The open ends of

the pipeline or sections thereof shall normally be stopped off by blank flanges or cap ends additionally secured where necessary by temporary struts and wedges. All anchor and thrust blocks must have been completed and all pipe straps and other devices intended to prevent movement of pipe must have been securely fastened. The contractor shall clean out the whole pipeline and flush it with water, so as to remove dust, dirt and any foreign matter laying in the pipeline. No separate payment for the work of cleaning will be made and the rates under various items of work include thereof.

Each valves section of the pipeline shall be subjected to hydraulic test in section. For this test, the pipe shall be slowly filled with clean water by opening cross connection with the existing mains or otherwise by pumping water into the line (water and pumping arrangement is to be arranged by contractor) as directed and all air shall be expelled from the pipeline through hydrants, air valves and blow off fixed on the pipeline. Once the pipe is full, the cross connection or pumping shall be closed. The pressure in the pipeline should then be raised in stages and built up and maintained by means of suitable approved pumps, to the specified test pressure based on the elevation of the lowest point on the line or per section under test.

The pipe line should be tested hydraulically up to required pressure as per IS specification or as per detailed specification for the Sub-Work. Before starting the pressure test, the expansion joint shall be tightened the test pressure shall be maintained for at least 24 hours. The drop in pressure shall not exceed 0.7 kg/cm² within a period of 2 hours after the full test pressure is built-up. Under this pressure no leak or sweating shall be visible at the joints. During the test, the pipe shall be struck sharp blows with 1.5 kg hammer. Water shall not spout, ooze or sweat through any part. In case of any leak observed anywhere in the field joints whether welded or bolted, the same shall be repaired entirely at the contractor's cost which shall include repairs to welding and Three layer polyethylene coating etc. The repaired joint shall be subjected to retest. No section shall be accepted unless it is perfectly water tight.

The entire cost of testing, retesting including cost of water taken together shall be paid under relevant item. The contractor shall make all the arrangements for all labour, pumps, pressure gauge equipment etc. The gauges should be got tested if insisted by the (SCDCL) Representative. The contractor shall arrange for labour required for operating air valves, scour valves etc. The hydraulic testing of the water main will be carried out for entire length as directed by Employer's Representative. If any leakages are observed even during defects liability period due to defective workmanship, the same shall be rectified immediately. Repairs on live water mains are to be carried

out immediately to avoid wastage of water and other problems such as disruption of water supply and traffic etc. In view of this, it will be very difficult to give prior intimation to concerned contractor. As such the cost of repairs, being the expenditure will be recovered from the contractor's retention money withheld in deposit without giving any prior intimation. The contractor will not challenge or claim any extra for such action on the part of the Department.

Generally the contractor shall be required to test the pipe line sections of 2 km using necessary equipment. However, if the Employer's Representative directs, to test full pipeline lengths in further suitable sections in the interest of the work, the tenderers will have to carry out the test in such sections as directed by (SCDCL) Representative.

16. REFILLING OF TRENCHES OF PIPELINE

After lowering, laying, jointing and welding of pipe line, site gunniting and concreting work, refilling of trenches with available excavated stuff shall be done.

The available excavated stuff shall be laid in layers of 15 cm to 20 cm. Each layer shall be watered and compacted before the upper layer is laid till the required level is reached. First 2 layers of 15 to 20 cms shall be free from stones or chips or any harmful material, to protect the pipe from damage.

Only soil or soft murum shall be used for filling.

Originally filling shall be done 30 to 40 cm. above natural ground or road level.

Sinking below the road or ground level, if noticed till the completion of work, the contractor shall have to make it level at his cost.

This item includes,..

- a) Clearing useful excavated material of rubbish breaking clods, stone, etc.
- b) Conveying the useful excavated material up to 500 M and filling in layers, watering and compacting.
- c) All labour, equipment and other arrangements necessary for the satisfactory completion and completion of the item.

. The measurement shall be net for the compacted filling and no deduction for shrinkage or voids shall be made. However, deduction for pipe volume will be made. Depth of filling for measurement will be limited from natural ground level only. No payment will be made for filling for 30 to 40 cm above natural

ground level, if so insisted by the (SCDCL) Representative.

Surplus excavated material is the property of Solapur Municipal Corporation. So contractor is not empowered to sell this excavated material to any other agency.

This disposal will not be considered for initial 500 M lead from edge of pipe line trenches and so will not be paid for.

The material shall be conveyed by means of suitable devices/manner.

The material conveyed to the place of disposal shall either be stocked or spread as directed by Employer's Representative or his representative.

The route opening and maintenance, payment of any royalties, compensation to land owners and for damaged of any etc. during the process of conveyance etc. shall be the entire responsibility of the contractor.

17. **DEWATERING**

The rate of the items requiring dewatering viz. excluding foundation concrete RCC or masonry shall be deemed to be inclusive of provision of dewatering and no separate claim shall be entertained. The amount is restricted. In any case no extra will be paid for dewatering. The specifications hereunder shall cover diversion of steams, providing coffer dams, bunds, etc. as necessary for carrying out work and bailing out and pumping work as per requirement of work.

The foundation trenches shall kept dry by resort to pumping alone or pumping in combination with diversion, channels, cofferdams, bunds, diversion weirs, drainage channels, or other method suitable for the local conditions at the choice of the contractor. The responsibility of adequacy of dewatering arrangements and quality and safety of work rests solely with the contractor.

Though the method to be adopted is the choice of the contractor, the scheduled programme shall have to be strictly adhered to.

The contractor shall plan, construct and maintain necessary diversion and protective works, so as to keep the work safe at all stages. The coffer dams where required shall be carried out to required depths and heights and safety designed and constructed with suitable dimensions and protections and shall be made enough water tight for facility of construction inside it. The coffer dam shall leave sufficient clearance for construction and inspection facility and permit installation of pumping machinery as required.

The item includes the entire dewatering operation from start of work till its completion in all respect.

The measurement under RCC works for net dimension cast as directed without allowance for rendering finishing etc.

18. PROVIDING AND FILLING BAGS FOR COFFER DAM

The item provides for constructing temporary coffer dam for river dam providing barricade, signs, signals, watchman and red light, maintaining the diversion, etc. a condition satisfactory for the use of construction work till the completion and dismantling on complete completion of the work. During the execution of this item photographs shall be taken at various stages such as construction, after completion, during removal and after complete removal of coffer dam. The photographs may be produce during the submission of bill otherwise payment will not be made.

This item shall be carried out as directed by(SCDCL) Representative.

ALIGNMENT

The contractor shall align the cofferdam suitably and obtain approval of the(SCDCL) Engineer before entering into bid.

LANDS

The contractor shall be allowed if possible and convenient to the SCDCL to make use of the (SCDCL) land free or royalties, rents, etc. complete.

CONSTRUCTION

The cofferdam shall be constructed to the satisfaction of the (SCDCL) Engineer on the approved alignment, design with the safety and convenience for the construction at all times and shall,....

- a. not have a gradient
- b. have a specified width and specified height.
- c. have a two lane of filled empty cement bags of murum and in between black cotton soil for stopping seepage of flow for construction purpose.

The (SCDCL) Engineer may permit in writing deviation in the above, if circumstances justify.

The coffer dam shall be formed in layers as directed. Two lane of filled empty cement bags by murum or sand shall be used as directed and then in between the lane of bags of hearting material should be laid and should be consolidated to required strength and condition or as directed by the (SCDCL)Engineer.

MAINTENANCE

The contractor shall maintain the coffer dam in a reasonable good condition till the work is over. He shall also be responsible to reconstruct it or parts of it if damaged due to floods, or any other cause without extra claims for the same.

If the contractor fails to repair the coffer dam in a satisfactory manner, even after being required by the (SCDCL)Engineer to do so within a specified period in writing, the (SCDCL)Engineer will be free thereafter to repair and keep the coffer dam in satisfactory condition at the cost of the contractor.

Special points

The Contractor shall be responsible thus for,

- i) suitable alignment of the coffer dam.
- ii) construction of the coffer dam as directed by the Engineer.
- iii) providing adequate and necessary barricades, sign boards, signals and watchmen.
- iv) maintenance of the coffer dam in good condition.
 - v) accident over or due to the coffer dam cause by etc. bad condition and compensation, if any on that connection.
 - vi) reconstruction of the coffer dam when damaged.

Item to Include

- i) All the labour, material use of equipments, tools and plants necessary for lighting constructing, maintaining the coffer dam satisfactory.
- ii) All sorts of compensation and responsibilities arising out of the coffer dam.
- iii) After completion of work the constructed coffer dam will be dismantled and all material should be lifted from river bridge.

19 G.I. HAND RAILING

The item shall be executed as specified in the tender item and as shown on drawing. The vertical supports shall be properly fixed at base either in masonry or concrete by nuts and bolts duly embedded in the form, right anchorage holes in the vertical support to pass G.I. piping in it or welding to fix the G.I. pipes to supports together with M.S. cleats, etc. are included in this item. The G.I. piping shall be provided along with required specials, fixtures, fastening, etc. and G.I. piping shall be bent in circular or spiral railing pipes and shall be joined by G.I. collar or welded as per necessity. The diameter of G.I. piping, number of rows size and type to vertical posts together with its center to center distance height, etc. shall be as specified in the tender item an in absence thereof as per the s type design in force. The item shall also include two coats of approved shade oil paint. Cost of all the materials which shall be procured by the Contractor, labour involved for executing this item is included in tender item. The measurements shall be As per Bid Document.

The agency should provide G.I. pipe railing having one meter height consisting 50 x 50 x 6 mm thick MS angles and vertical at 1.50 m c/c and additional post at every corner bends or curved point with three rows of 25 mm G.I. pipe of medium class variety of horizontal at 3 coats of oil paints over

one coat of anti-corrosive paint approved colour including cost of labour, transport, materials etc. complete

20. TRIAL RUN OF THE SCHEME

The period of trial run is 3 month and shall start from the satisfactory commissioning of the scheme.

Daily record of raw water pumped, shall be maintained.

Log book of pumping shall be maintained.

Daily record of bulk meter reading shall be maintained.

During operation and maintenance period all the minor repairs of equipment and machinery and leakages in the network shall be rectified by agency at their own cost.

The equipment and machinery shall be operated as per design capacity and parameter .or else necessary deduction will be done in the bills

During this period MSEDL Co. charges and raw water charges shall be borne by the owner.

Staff to be deployed. Required skilled staff shall be deployed

1.	Supervisor	
2.	Pump operator	
3.	Helper to pump operator	
4.	Lab Assistant	
5.	Filter operator	
6.	Labour	
7.	Valve man	
8.	Labour for distribution	

Mode of Measurement

As per Annexure 2 of Bid Document.

21. M.S. ROSE PIECES

The rose pieces shall be fabricated out of 10 mm thick M.S. plates. The strength diameter shall be 1% times the diameter specified in the Schedule-B. The holes to be drilled in strainer portion shall be of 12 mm diameter at 50 cm center to center and shall be staggered. The inside and outside surfaces of the rose piece shall be applied with three coats of anticorrosive oil paint. The item includes cost of all material and labor required for the work, and this item will be executed as directed by the (SCDCL) Representative.

22. PROVIDING AND FIXING MANHOLES FRAME AND COVER COWL TYPE VENTILATORS

The cost of providing the above item is included in tender item. These are to be properly fixed at place and manner as directed, painting with two coats of anti-corrosive black paint is also included in this item. If locking arrangement are required they shall be done by Contractor as directed without any extra cost.

23. LIGHTING CONDUCTOR

The contractor shall ensure that any structure. Must or other installation provided by him is adequately designed to minimize damage to the works from lighting strike.

Any lighting conductors shall be design in accordance with the edition of the appropriate Indian Standard Code of Practice IS:2903:1969.

24. PENSTOCKS

Penstocks shall be of cast iron with scrapped non-ferrous sealing faces. Each penstocks shall be provided with a suitable hand wheel of adequate diameter for the easy operation and gearing shall be supplied where necessary.

Hand wheels shall have engraved on it the direction of closing which shall be 'Clockwise'

Spindles shall have machine cut trapezoidal or square from threads. They shall be of stainless steel or manganese steel with the exception of non-threaded sections of extended spindle installations which may be of mild steel.

Head stocks and foot brackets shall be provided for non-rising spindle penstocks where necessary. Guide bracket shall be provided where necessary. Headstocks with non-rising spindle installation shall have a penstock position indicator.

Penstocks shall be watertight under the conditions of head and direction of maximum design flow.

The frames and door of cast iron penstocks shall be made from close grained gray iron. The penstocks shall be designed so as to ensure tight closure while maintaining freedom of door movement during operation and minimizing sliding wear of the sealing faces.

25. DETAILED SPECIFICATIONS FOR MS PIPELINE

THE PIPES TO BE SUPPLIED WITH INTERNAL CLEAR DIAMETER WITH INSIDE AND OUTSIDE Three Layer Polyethylene COATING.

1. Pipes to be supplied under this contract shall conform to IS:3589-2001, (latest version) and IS:5504 (Latest version) Indian Standard for Electric Resistance welded or seamless or spirally welded steel pipes for water, gas and sewage (subject to specific requirements given below).
2. In case supplier proposes to supply pipes to the standards superior to the above standards no weightage will be given while evaluating the bid.

Method of Manufacture	Electric resistance welded (ERW)
Applicable Standards (with latest edition)	
Welded or seamless steel tubes for water, gas and sewage	ISO-1977
Steel pipes and tubes for pressure purposes, carbon steel, ordinary duties	BS:3601 (Latest version)
Specification for gas line pipe	API 5L-1980

Method of Manufacture	Electric resistance welded (ERW)
Specification for electrically welded steel pipes for water, gas and sewage.	IS:3589-2001 IS:5504 (Latest version)
Methods of sampling of steel pipes, tubes and fittings	IS:5711- (latest version)
Methods of tensile testing of steel tubes	IS:1984 (latest version)
Code of practice for laying and jointing MS pipes	IS:5822- (latest version)

25.1 INSPECTION

Inspection of MS pipe is divided in 2 parts.

Inspection during manufacturing.

- a) Identification of plate/strip material for manufacturing.
- b) Qualification of welding process to be used for manufacturing of pipes.
- c) Qualification of welders.
- d) Dimensional check before start of welding to avoid rejection at a later stage.

Inspection of ready built pipes.

25.2 SPECIFICATION FOR LAYING OF MS PIPELINE

Warped or deformed timber shall not be used for shoring. Shoring shall

project at least 150 cm above ground and shall extended the trench as approved by the Engineer. Planks shall be placed close enough to avoid any running in of sand or earth through the joints.

For walling pieces round timber shall not be allowed.

Spacing of struts shall be as per the requirements of the design of shoring. The shoring material shall be of the minimum sizes as specified below unless steel sheet piling is used.

- | | | |
|----|----------------|-------------|
| a) | Planks | 5 cm thick. |
| b) | Walling Pieces | 20 x 10 cm |
| c) | Struts | 20 x 15 cm |

Shoring shall be removed only after the approval of the (SCDCL) Representative. In case shoring may be required to be left in trenches after confirmation that its removal is likely to cause damage to the structure or utilities etc. the same shall be left therein permanently with all accessories without any compensation or extra cost. Mode of measurements for providing shoring in square meter of area shored and leaving it in the trench in cubic meter of timber left is included in the item of excavation. Projection above ground level after attaining final depth, however, shall not be retained in any circumstances.

25.3 UNDERGROUND PIPE LAYING GENERAL

Pipe laying shall be done as per approved alignment and shown on the drawings approved by (SCDCL)Engineer, to the correct line and level. (SCDCL). The SCDCL'S representative, at his discretion, may change the alignment and/or levels depending on the site conditions without any extra claim .The minimum cover under roadway etc. where traffic is expected over the pipeline shall be 1.20 m, as specified in IS: 5822 (latest version). The minimum cover for pipeline along the major district road and State Highway shall generally be 1.0 m, where traffic is not expected over the pipeline. Pipes and specials to be laid underground shall be provided **INSIDE AND OUTSIDE 3 LPE COATING** .Care shall be taken to see that while handling these pipes, the pipe and coated portion is not damaged. The cost includes all expenses on account of labour, machinery, material etc. required for complete process of lying. No extra rate for any reason for this job will be admissible even if the process of lowering and laying of these pipes requires additional labour, machinery, materials etc. from safety point of view.

25.3.1 LAYING PROCEDURE

The contractor shall lower the pipes of standard lengths. Short length pipes shall be lowered only if found necessary and only after obtaining the

permission of (SCDCL) Engineer. The pipes shall be lowered in the trench on prepared bedding or concrete bedding as per the decision of (SCDCL) Representative. Pipes shall not be laid on the open rock bottom as it may damage the pipe shell on account of point loads.

The alignment and levels shall be checked by Theodolite/EDM. Cutting of pipes shall not be allowed for matching the sides of trenches excavated. While assembling the pipes the ends shall be brought close enough to leave a uniform gap not exceeding 3 mm. Marginal cutting and grinding shall be done if found necessary, for which no extra payment shall be made. There shall be no lateral displacement between pipe faces to be jointed.

When the pipe is properly assembled and checked by Employer's Representative for correct line and level, it shall be firmly supported on wooden beams and wedges and then tack welded.

In the trenches where shoring is provided, care shall be taken to see that during lowering of pipes, only required struts are removed at a time with additional precautions to keep the shoring in position if necessary.

25.3.2 SPECIAL PRECAUTIONS FOR MAINTAINING CIRCULAR SHAPE OF PIPE

Special attention of the tenderer is drawn to the fact that the proposed pipeline is to be provided with three layer polyethylene coating .It is therefore very necessary that the circular shape of the pipes be maintained till these pipes are coated . The contractor shall provide adjustable steel struts of the approved design for this purpose. Minimum three sets of struts shall be provided per pipe length of 6 meter. They shall be retained till complete refilling is done and properly consolidated or till concrete encasing is set. Any diametric variation beyond + 2% shall have to be rectified by the contractor at his cost, which may include, removing the section of the pipeline and relaying it along with all other ancillary operations. Providing required number of adjustable struts and all other operations involved as above shall be deemed to have been included in the item of laying and no separate payment on this account will be admissible.

25.3.3 MODE OF MEASUREMENT

As per Annexure 2 of Bid Document.

25.4.0 SPECIFICATIONS FOR LAYING SPECIALS

25.4.1 GENERAL

All specials like distance pieces, straps, tapers, saddles, branches, tees etc. shall be generally fabricated in the factory. Only small kinks or bends or saddles may be fabricated on site, care being taken to see that the length of the fabricated fitting is at least equal to the diameter of the pipe to which

it is being fixed. Such fabrication of specials on site shall be done only on approval of the Engineer and as his direction. As specified earlier, only kinks or bends shall be fabricated on site by cutting the pipe faces and then welding shall be carried out as specified hereinafter and shall be paid separately.

All specials shall necessarily be in steel and shall be laid in the same manner specified in pipes section.

25.4.2 STRAPS

Whenever the pipe laying work proceeds from two ends and if gap between two faces is less than 30 cm., this gap shall be bridged by providing a strap. Strap shall also be provided during fixing of expansion joints as has been specified earlier. Such strap shall be fabricated on site by cutting a piece from the pipe. This piece shall be split longitudinal and stepped over the gap. A minimum gap of 8 cm shall be kept on both the pipes to be connected and strap shall be welded with required number of fillet welds from inside and outside. The gap between the ends of straps shall be welded longitudinally butt welded.

25.4.3 DISTANCE PIECES

Distance piece shall be provided with the gap between the pipe faces to be jointed is more than 30 cm measured in the evening. Distance pieces shall be cut from the pipe pieces on site or can be cut in factory. These will be measured and paid for laying as specials

25.4.4 TAPERS AND BENDS ETC.

These shall be fabricated in the factory and shall be welded on site as per requirements. Laying of tapers shall be paid for laying as specials for the diameter in the larger size. Bends shall be measured along the mean length and paid for in the respective items of Tender.

25.5 WELDING JOINTS

25.5.1 GENERAL

Before aligning, assembling and welding the pipe faces shall be cleared by scraping with wire brushes or by any other method approved by the Engineer. Welding of pipes in field shall conform to ISS:816-1969 (code of practice for use of metal arc welding for general construction in Mild Steel). In case of variance, specifications hereunder shall have precedence.

Welder shall be qualified, experienced and approved by the Employer's Representative to do the welding at the locations welding shall not be allowed to be done by helpers. Contractor shall remove such of the welders

form the job, whose work is not found to be satisfactory. The(SCDCL) Engineer may ask them to do test welding before approving their employment on the job.

The contractor shall keep record of the welding for each circumferential joint. It shall contain the name of the Welder, Operator and Date of Completion of such run of internal and external welding.

25.5.2

GOUSING AND CHIPPING

MS Pipes of diameter larger than 1016 mm shall be welded with two number of runs from inside and a sealing run from outside. External sealing run shall be done only after internal welding is completed. Before starting the external welding the weld material in the joint shall be cleaned by clipping out loose scales. Gouging shall be done before rectification of any defective welding wherever necessary and as directed by the (SCDCL) Engineer. Gouging or chipping shall not be paid for separately and the rate for welding shall be deemed to include the cost of gouging.

25.5.3 ELECTRODES

Welding electrodes to be used for welding in this contract shall conform the Indian Standard Specifications ISS:814-1971 (Specification for covered electrodes for metal arc welding of Mild Steel)

The contractor shall use standard electrodes depending on the thickness of the plates to be welded and the type of joint. The contractor shall also use standard current and A.C. voltage required for the machine as per manufacturer's directions.

25.5.4 TYPES OF WELDED JOINTS

The circumferential joints of the pipes shall be butt welded with required number of runs externally and internally.

All fillet welds shall have a throat thickness not less than 0.7 times the thickness of the pipe to be welded.

25.6.0 WELDING PROCEDURE

All parts of pipes, specials, etc. shall have all loose scale, slag, rust, paint and any other foreign material shall be removed with wire brush and left clean and dry. All scale and slag shall be removed from each run of weld when that run is completed.

Openings in the form of manholes in the laid pipeline at suitable distance of access for the work of cleaning, repairs etc. Such manholes, as far as possible shall be provided on sides of the pipe line and cutting manholes at the crown shall be strictly avoided.

Patch Plates for plugging the above manholes shall be cut from a separate pipe of the same diameter. Edges of the patch plate shall be properly shaped and shall be inserted in the opening leaving a gap of 3 to 4 mm and tacked. Welding of patch plate shall be done in segments in a proper sequence conforming to Indian Standard Specifications IS : 823

25.6.1. TESTING OF WELDED JOINTS :

Welded joints shall be tested in accordance with procedure laid down in Indian Standard Specifications (IS : 3600, Part I –1985 of procedure for Testing Fusion welded joints and weld metals in steel)

At least one test specimen shall be taken out for testing for every fifty field joints done. Test pieces shall be taken out from the places pointed out by the SCDCL. These shall be machined and tested early as possible. The shape of the test pieces removed for testing shall be such that it shall be such that it shall give the specimen of the required dimensions with the weld in the middle of the specimen and at the same time leave the holes in the pipe with rounded corner. This hole shall be patched with a plate of suitable size cut from a separate pipe of same diameter. It must ensure good butt weld.

25.6.1.1 TENSILE TEST

The test specimen taken perpendicularly across the weld shall be shaped in accordance with Indian Standard Specifications IS:223. The tension test specimen shall be machined. The protruding welded portion from inside as well as outside shall be machined. The protruding welded portion from inside as well as outside shall be removed by machining before the specimen is tested.

If the specimen shows defective machining or develops flaws not associated with welding, It shall be discarded and another specimen substituted. The welded joint shall show a strength not less than the minimum tensile strength for the plate in accordance with ISS:226

25.6.1.2 BEND TEST

Bend Test specimen shall also be prepared in the same fashion as the tensile test specimen. The specimen shall stand being bent cold 180o around a pin that has a diameter equal to 4.5 times the plate thickness, without developing cracks. For this test face representing inside of the pipe

shall be placed next to the pin.

25.6.1.3 TRE-PANNED PLUG :

Tre-Panned plugs shall be taken out from any welded portion as pointed out by the Engineer. These plugs shall not show any defect in welding such as inclusion of slag, blow holes cavities, etc. the plug shall be 12 mm in dia and shall be taken out by means of suitable electrically operated holes. Such holes in the pipe shall either be filled back by inserting a steel stud and welding around or threading the hole and providing suitable G.I. plug. This test shall be done only if considered necessary by the SCDCL

25.6.1.4 PROCEDURE OF FAILURE OF TEST SPECIMEN

If the test fails in either tensile or bend test or in both, two additional test specimen shall be taken out from the section and shall be tested for tensile and bend tests. If any one of them fails, extensive goosing and rewelding shall be done for the welded joints in that section to the full satisfaction of the (SCDCL) Engineer. However, if both the samples give satisfactory results, the joint from which the original sample was taken and had failed shall be repaired to the satisfaction of the Engineer by goosing and welding etc. at contractor's cost. Welder who has done the welding of the joint that has failed shall be solely held responsible for bad workmanship and failure. Since all other factors like electrodes, current, arc voltage etc. are already controlled, on negligence on the part of the welder only is responsible for such failure. For first such failure the welder shall be warned and if the welded joint done by him fails for the second time, he shall be removed from the job.

25.7 GAS CUTTING

25.7.1 GENERAL

Gas cutting of MS Pipes may require to be adopted on site for fabrication of bends on site or for preparing distance pieces, straps etc. and for cutting holes in pieces for manholes, branches scour valves, Air Valves and other appurtenances and temporary manholes for cleaning welding etc..

After gas cutting the edges shall be made smooth and even so as to remove all the equalities ends of the pipe shall have 'V' edge from inside.

25.7.0 PROVIDING, FABRICATING AND TRANSPORTATION OF M.S SPECIALS

25.7.1 SCOPE

The scope or special specification shall cover the following works under the contract. Fabrication MS plates for specials for road crossing works, expansion joints and testing, etc. at the contractor's factory and testing the pipes.

These specials (detailed hereafter) specifications, supplement, standard specifications for civil construction works prepared by the SCDCL

25.7.2 DRAWINGS

Working drawings shall have to be prepared by the contractor as per detailed survey, design and taking into consideration the sizes and lengths of the MS plates, flats, etc. The contractor shall have no claim by whatever reason of sizes of material issued being different from those shown in the drawings, in case supplied by the SCDCL to the contractor.

25.7.3 SUPPLY OF MATERIALS TO THE CONTRACTOR:

The conveyance of fabricated materials from workshop to site of work shall be deemed to have been covered in the relevant items of fabrication of pipes, specials etc. The contractor should note that the steel plates and other structural steel required for fabrication of specials is to be procured by him from open market at his cost. The contractor has to procure such plates in several stages as the circumstances demand, or, as directed by (SCDCL) Representative.

The SCDCL shall not however supply any steel or structural steel to the contractor for his use for preparing jigs, testing arrangements, platforms etc. in the factory or in the field. The contractor shall have to make his own arrangements for procuring them at his own cost immediately on receipt of work order and the SCDCL shall not entertain any request for extension of completion period of compensation on increase in cost etc.

25.7.4 HYDRAULIC TESTING OF FABRICATED PIPES

The pipe length fabricated shall be as specified earlier above. The contractor shall provide all the required machines and apparatus for testing all the pipes at the factory. The arrangements made by the contractor for hydraulic testing of pipes shall be subject to the approval by the Engineer. The contractor shall paint inside the serial number of pipe, the diameter and the plate thickness and letters as well as the date of the test etc. as directed by the Engineer. The pipes shall be inspected thoroughly before testing for any apparent defect in welding and the contractor shall repair such defects by gousing and rewelding. Such pipes will be laid only on approval of the (SCDCL) Representative. Necessary provisions for storage tank for water for testing water pumping arrangements, if necessary and making available the required water shall be made by the contractor. Hydraulic test shall be carried out under cover at the fabrication in the presence of and to the satisfaction of the (SCDCL) Employer's Representative or his authorized representative.

Accurate pressure gauge of approved make shall be mounted on one end

of the pipe to indicate the pressure inside the pipe being tested.

The pressure shall be applied gradually by approved means and shall be maintained at least for 10 minutes or till inspection by EIL and (SCDCL) Employer's Representative during which time, the pipes be hammered throughout its length with sharp blows with 1 kg. Hand hammer. The pipe shall stand the test without showing any sign of weakness, leakage, oozing or sweating. If any leakage is observed, on approval of (SCDCL) Representative, it shall be repaired by gousing and rewelding or as directed by him.

25.7.5 HYDRAULIC TESTING OF PIPE LINE

The working pressure shall be not less than 16.5 kg/cm². The drop in pressure shall not exceed 0.7 kg/cm² within a period of 2 hours after the full test pressure is built-up. Under this pressure no leak or sweating shall be visible at the welded joints. During the test, the pipe shall be struck sharp blows with 1.5 kg hammer. Water shall not spout, ooze or sweat through any part. In case of any leak observed anywhere in the field joints whether welded or bolted, the same shall be repaired entirely at the contractor's cost which shall include repairs to welding and coating etc. The repaired joint shall be subjected to retest. No section shall be accepted unless it is perfectly water tight.

The contractor shall make all the arrangements for water and all labour, pumps, pressure gauge equipment etc. The gauges should be got tested if insisted by the (SCDCL) Representative. The contractor shall arrange for labour required for operating air valves, scour valves etc.

The hydraulic testing of the leading main will be carried out for entire length or part of it as directed by (SCDCL) Employer's Representative. If any leakages are observed even during defects liability period due to defective workmanship, the same shall be rectified immediately.

The charges of repairs if done departmentally will be recovered from the amount of retention money. Repairs on live water mains are to be carried out immediately to avoid wastage of water and other problems such as disruption of water supply and traffic etc. In view of this, it will be very difficult to give prior intimation to concerned contractor. As such the cost of repairs, being the expenditure will be recovered from the contractor's retention money withheld in deposit without giving any prior intimation. The contractor will not challenge or claim any extra for such action on the part of the Department. Generally the contractor shall be required to test the pipe line sections of 1 km using necessary equipment. However, if the Employer's Representative directs, to test full pipeline lengths in further suitable sections in the interest of the work, the tenderers will have to carry

out the test in such sections as directed by SCDCL Representative.

26. PROVIDING AND SUPPLYING DI/CI/MS SPECIALS

The items include providing ,supplying DI/CI/MS Double flanged specials suitable for diameter as required and of required thickness and including all materials labour charges with epoxy paint from inside and outside including all taxes (Central & local) if necessary, inspection charges, transportation to stores/ sites & stacking etc. complete. As per requirement a machine ends DI specials suitable for PCCP/BWSC/D.I .pipes will also be supplied under this item.

Scope: The item cover supply of DI/CI/MS double socket and flanged specials of various diameters including conveyance of specials form manufacture's works to site stores, stacking them properly and protecting till commissioning of work. **General:** The specials shall confirm to relevant I.S.S.

Materials: The specials shall be manufactured form cast iron conforming to IS 210 Gr. 20.

Coating: The specials shall be coated by bitumen by not dipping process.

Tests: The specials shall be tested at factory for 25 kg/sq/cm/ Pressure.

Flanges: The flanges shall be drilled to IS-1538.

Tolerance: The tolerance in weight and dimensions shall be as per ISS. Only the specials fitting within tolerance limit shall be accepted.

26.1 DISMANTLING JOINTS

Providing and fixing Dismantling joints

Providing dismantling joints of appropriate diameter of M.S.as per detailed drawing suitable for PCCP pipes including epoxy coating of approved make from inside, outside, transportation, loading, unloading octroi, inspection charges as per directions from Employer's Representative etc.

26.3 PERMANENT TEST POINTS

Providing permanent test points on the pipe line as per drawing and as directed by SCDCL including providing and fixing sluice valves, road box for sluice valve of Size 80mm to 250mm in one brick masonry chamber 300mm x 300mm clear C.M 1:5 with 12 mm thick 1:3 cement plaster both inside and outside on M -100 C.C 150mm thick etc. complete as specified & directed.

26.4 MODE OF MEASUREMENT

As per Annexure 2 of Bid Document.

26.5 GAS CUTTING HOLES

Gas cutting holes up to 50 mm dia.(for plugs) (either square Cut of 'V' cut) to pipe, plates etc. of required thickness including cost of Gas, tools, machinery, conveyance of labour and machinery etc. complete and as directed by Employer's Representative..

26.6 MODE OF MEASUREMENT

As per Annexure 2 of Bid Document.

26.7 ALL CAST IRON SPECIALS

Material

All Cast iron specials such as C.I. detachable joints shall confirm to I.S. 1538-1993 (Part 1 to 24). The Supply at departmental stores shall be of various diameters as specified. The specials shall be free from any defects. It should be possible to cut/drill the special to suit site condition to fit in the position. The hardness of the external surface shall not exceed 210 HBS. Rings shall confirm to IS 5382- 1985. Ring shall be homogeneous and free from porosity, grit and surface defects ,such as pitting, irregularities. Dimension of rings shall be as per IS 10292-1988.

26.7.1 MANUFACTURE :

The dimensions of flanged sockets and flanged spigots shall be as per Tables 7 & 8 of IS 1538-1993, respectively. Supply and Stacking at Departmental Store or Work Site : As specified under the agreement.

Markings :

Each fitting shall have cast stamped or indelibly painted on it the following markings :

1. Manufacturer's Name or trademark or identification mark.
2. The nominal diameter,
3. Mass of fitting,
4. Last 2 digits of year of manufacture,
5. Any other mark required by the purchaser.

Item to Include:

The item includes the supply of Cast Iron detachable joints, including all taxes, transporting, loading, unloading and stacking at departmental store or work site as directed. The necessary test certificate also shall be provided along with the supply.

26.7.2 MODE OF MEASUREMENT :

As per Annexure 2 of Bid Document.

26.7.3 CAST IRON JIFFY COLLAR COUPLING WITH RINGS

The item provides to supply at departmental store the Cast Iron jiffy collar coupling with rings etc. complete as per the specified diameter of pipe / pipes. (Dia. between 150 mm & 250 mm). The joints shall conform the provisions of IS: 1538-1993 and IS 5382-1985.

26.7.4 MATERIAL

All Cast iron specials such as C.I. mechanical compression collar coupling shall conform to I.S. 1538- 1993 (Part 1 to 24). The Supply at departmental stores shall be of various diameters as specified in supply order. The specials shall be free from any defects. It should be possible to cut it drill the special to suit the site condition and fit in position etc. The hardness of the external surface shall not exceed 210 HBS. Sealing Rings shall confirm to IS 5382-1985. Ring shall be homogeneous and free from porosity, grit and surface defects, such as pitting, irregularities. Dimension of rings shall be as per IS 10292- 1988.

Manufacture:

Generally as per item WS/B/2.3. The dimensions of jiffy collar coupling shall be as per Table 9 IS 1538-1993.

Supply and Stacking at Departmental Store :
Specified under agreement.

Markings:

Each fitting shall have cast stamped or indelibly painted on it the following markings:

Manufacturer's Name or trademark or identification mark.

The nominal diameter,

Mass of fitting,

Last 2 digits of year of manufacture,

Any other mark required by the purchaser

Item to Include :

The item includes the supply of Cast Iron jiffy collar coupling, including all taxes, , transporting, loading, unloading and stacking at departmental store or work site as directed. The necessary test certificate also shall be provided along with the supply.

26.7.5 MODE OF MEASUREMENT :

As per Annexure 2 of Bid Document.

26.7.6 Flat rubber gaskets.

The item provides to supply at departmental store the flat rubber gaskets for flanged joints. Following two types of rubber gaskets, depending upon the hardness of rubber may be supplied as specified in the supply order:

1. Type A: 50 to 65 Hardness in IRHD and
2. Type B: 65 to 80 Hardness in IRHD.

In each of two types, 2 Grades, Grade 1 & 2 are again prescribed.

Material:

The rubber gaskets shall be manufactured from either a) Sheet Rubber or b) Sheet Rubber reinforced with fabric (Rubber insertion jointing). For manufacturing rubber gaskets, natural rubber or synthetic rubber or a blend thereof, shall be used, with suitable composition and vulcanization to attain the required degree of hardness.

The fabric for rubber insertion jointing shall have a minimum breaking strength of 120 N/mm², under test conditions according to IS: 1969- 1968.

Manufacture:

The rubber gaskets shall be free from porosity, grit and surface defects such as pitting and irregularities. The rubber shall be homogeneous. The manufacturing of sheet rubber and rubber insertion jointing shall be in accordance with the IS: 638-1979. The thickness and number of fabric plies shall be as per the IS. Unless mentioned in the supply order the size of each rubber sheet shall have suitable bolt holes conforming to IS 1538-1993, for the pipe diameter specified in the order.

Supply and Stacking at Departmental Store:

As specified under agreement.

Markings:

Each piece of rubber sheet jointing or rubber insertion jointing shall be marked with the following:

1. The name of manufacturer or the Trade Mark,
2. Type, Grade and Thickness,
3. Month and Year of manufacture,
4. Any other Marking as specified in the purchase order Item to Include:

The item includes the supply of flat rubber gasket at departmental store, suitable for flanged joints (3/6 mm thick) with bolt holes and nominal bore, pitch circle diameter as per IS: 1538- 1993 and gasket as per IS: 638-1979, including all taxes, transporting, loading, unloading and stacking at departmental store as directed. The necessary test certificate also shall be provided along with the supply.

27 DUCTILE IRON PIPES

27.1 Applicable Codes:

The manufacturing testing, supplying, at work sites of Ductile Iron pipes shall comply with all currently applicable statutes, regulations, standards and codes.

In particular, the following standards, specified herein shall be referred. In all cases, the latest revision of the codes shall be referred to. If requirements of specifications conflict with the requirements of the codes and standards, this specification shall govern.

Sr. No.	Code	Particular
1	IS: 8329	Specification for Centrifugally Cast (spun) Ductile Iron pressure pipes for water, gas and sewage specification.
2	IS: 1387	General requirements for supply of metallurgical materials.
3	IS: 1500	Methods for Brinell hardness test for metallic materials.
4	IS:9523	Ductile Iron fittings for pressure pipes for water, gas and sewage.
5	IS: 12820	Dimensional requirements. of rubber gaskets for mechanical Joints and push on joints for use with cast Iron pipes and fittings for carrying water, gas and sewage.
6	ISO: 4179	Ductile iron pipes for pressure and no pressure-Centrifugal cement mortar lining - General requirements
7	ISO: 2531	Ductile iron pipes, fitting and accessories for pressure pipe lines.
8	IS: 12288	Code of practice for use & laying of Ductile iron pipes.

27.2 Manufacturing:

27.2.1 General

DI pipes shall be systematically checked for any manufacturing defects by experienced supervisors and a very high standard quality shall be maintained.

Owner / Engineer shall at all reasonable times have free access to the place where the pipes are manufactured for the purpose of examining and testing the pipes and for witnessing the test and manufacturing.

All tests specified either in this specification or in the relevant Indian Standards shall be performed by the supplier/contractor at his own cost and in presence of Owner/Engineer if desired. For this, sufficient notice before testing of the pipes shall be given to Owner/Engineer.

If the test is found unsatisfactory, (SCDCL) Engineer may reject any or all pipes of that lot. The decision of SCDCL'S Engineer in this matter shall be final and binding on the contractor.

27.2.2 Materials

The general requirements relating to the supply of material shall be as per IS:1387.

27.2.3 Dimensions:

The internal diameter, thickness and length of barrel, dimensions of pipes shall be as per the relevant tables of IS.8329/IS: 9523 for different class of pipes.

The tolerances for pipes regarding dimensions and deviations from straight line shall be as per relevant IS codes.

The standard weight of uncoated pipes and the permissible tolerances shall be per relevant IS codes.

27.2.4 Workmanship and Finish

The pipes shall be stripped, with all precautions necessary to avoid warping or shrinking defects. The pipes shall be free from defects, other than any unavoidable surface imperfections which result from the method of manufacture and which do not affect the use of the pipes in the opinion of (SCDCL) Engineer.

The pipes shall be such that they could be cut, drilled or machined. The hardness of the external unmachined surface shall not exceed 230 HBS.

In the case of spigot and socket pipes and fittings for lead joints, the socket shall be without the centering ring.

In the case of flanged pipes the flanges shall be at the right angles to the axis of the pipe and machined on face. The bolt holes shall be drilled and located symmetrically off the center line. The bolt hole circle shall be eccentric with the bore and bolt holes equally spaced. The flanges shall be integrally cast with the pipes and fittings and the two flanges of the pipes shall be correctly aligned.

27.3 Testing

27.3.1 Mechanical Tests:

Mechanical tests shall be carried out during manufacture of pipes as specified in relevant IS codes. The results so obtained shall be considered to represent all the pipes and fittings of different sizes manufactured during that period and the same shall be submitted to (SCDCL)Engineer. The method for tensile

tests and the minimum tensile strength requirement for pipes shall be as per relevant IS codes.

27.3.2 Brittle Hardness Test

For checking the Brittle hardness, the test shall be carried out on the test ring or bars cut from the pipes used for the ring test and tensile test in accordance with IS 1500.

27.3.3 Re-test

If any test piece representing a lot fails in the first instance, two additional tests shall be made on test pieces selected from two other pipes from the same lot. If both the test results satisfy the specified requirements, the lot shall be accepted. Should either of these additional test pieces fail to pass the test, the lot shall be liable for rejection.

27.3.4 Hydrostatic Test

For hydrostatic test at works, the pipes shall be kept under test pressure as specified in relevant IS codes for 15 seconds, shall be struck moderately with a 700 g hammer for confirmation of satisfactory sound. They shall withstand the pressure test without showing any leakage sweating, or other defect of any kind. The hydrostatic test shall be conducted before coating the pipes.

27.4 Coating

All D.I. pipes shall be delivered with internal lining and external coating.

Coating shall not be applied to any pipe unless its surface is clean dry and free from rust.

All DI pipes shall be mortar lined on internal surface as specified in ISO: 4179 and externally coated with bituminous paint as specified in IS: 8329.

27.5 Marking

Each pipe shall have cast stamped or legibly and indelibly painted on it with the following appropriate marks:

- a. The nominal diameter
- b. Class reference
- c. Mass of pipe
- d. Date of manufacture and

e. Manufacturer's name, initials or identification mark

Marking shall be done as per IS: 8329.

27.6 Transporting of Pipes

All pipes manufactured in the factory and temporarily stacked in the Contractor's yard shall be transported to the site of laying after cleaning them internally etc. The item of transport covers the cost of loading in the factory, transporting to the site of laying or to stacking yard selected by the (SCDCL) Engineer in its vicinity and unloading and stacking them carefully in such a manner that the material so kept is not easily disturbed or rolled away from the place of stacking. The loading in the factory shall be carried out by means of either a crane, gantry or shear legs, so as not to cause any damage to the finished material. Similarly, while unloading and stacking, great care shall be taken to ensure that the material is not damaged or dented. The contrivances to be used for unloading will be different in different situations and in each case the one approved by the (SCDCL) Engineer shall be adopted. The material stacked at site shall be jointly inspected by the (SCDCL) Engineer and the Contractor and defect or damage noticed shall be repaired to the satisfaction of the (SCDCL) Engineer before payment is admitted.

The stacking ground, both in the Contractor's yard and at the site of laying shall be selected in such a way as not to get waterlogged during monsoon. If this cannot be done, the pipes shall be supported on sleepers to avoid contact with wet earth. As explained in earlier paragraphs, materials such as pipes, tapers, etc. may be transported to the site of laying as soon as the material is finished in all respects with the permission of the (SCDCL) Engineer.

27.7 Procedure for Receiving DI Pipes:

27.7.1 Handling of Pipes,

It is essential to avoid damage to the pipes, or their coatings at all stages during handling. The pipes shall be handled in such a manner as not to distort their circularity or cause any damage to their surface treatment. Pipes shall not be thrown down from the trucks nor shall they be dragged or rolled along hard surfaces. Slings of canvas or equally non-abrasive materials of suitable width of special attachment shaped to fit the pipe ends shall be used to lift and lower coated pipes to prevent damage to the coating. Great care shall be taken in handling the pipe right from the first operation of manufacture until they are delivered to the store. No defective or damaged pipe shall be allowed in the work without rectification/replacement to the satisfaction of the

(SCDCL)Engineer. Any damage to the coating shall be repaired by the Contractor at his own cost to the satisfaction of the(SCDCL) Engineer.

27.8 Laying of Ductile Iron Pipes and Fittings / Specials

27.8.1 Scope

The specification covers laying of DI pipes and DI fittings/specials for above-ground/underground works.

27.8.2 Applicable codes

The laying of pipes and fittings/specials shall comply with all currently applicable status, regulation, standards and codes. In particular, the following standards, unless otherwise specified herein, shall be referred to. In all cases, the latest revision of the standards/codes shall be referred to. If requirements of this specification conflict with the requirements of the standards/codes, this specification shall govern.

27.8.3 Codes of practice

Sr. No.	Code	Particular
1	IS:8329	Centrifugally cast (spun) Ductile Iron pressure pipe for water, gas and Sewage.
2	IS:3764	Excavation Work - Code of Safety.
3	IS:12288	Code of Practice for use and laying of Ductile iron pipes.

27.8.4 Carting & handling

Pipes and fittings/specials shall be transported from the factory to the work sites at places along the alignment of pipeline as directed by (SCDCL) Engineer and as specified by MANUFACTURER. Contractor shall be responsible for the safety of pipes and fittings/specials in transit, loading/unloading. Every care shall be exercised in handling pipes and fittings/specials to avoid damage. While unloading, the pipes and fittings/specials shall not be thrown down from the truck on to hard surfaces. They should be unloaded on timber skids with steadying ropes for by any other approved means. Padding shall be provided between coated pipes, fittings/specials and timber skids to avoid damage to the coating. Suitable gaps between pipes should be left at intervals in order to permit access from one side to the other. In case of spigot socket pipes, care should be taken regarding orientation of pipes while unloading. As far as possible, pipes shall be unloaded on one side of the trench only. All pipes shall be checked for any

visible damage (such as broken edges, cracking or spalling of pipe) while unloading and shall be sorted out for recantation. Any pipe which shows sufficient damage to preclude it from being used shall be discarded. Dragging of pipes and fitting/specials along concrete and similar pavement with hard surfaces shall be prohibited.

27.8.5 Storage

Each stack of pipes shall contain only pipes of same class and size, with consignment or batch number marked on it with particulars of suppliers wherever possible. Storage shall be done on firm level and clean ground and wedges shall be provided at the bottom layer to keep the stack stable. The stack shall be in pyramid shape or the pipes laid lengthwise and crosswise in alternate layers. The pyramid stack shall be made for smaller diameter pipes for conserving space in storing them. The height of the stock shall not exceed 1.5m. Fittings/specials, shall be stacked under cover and separated from pipes.

Rubber rings shall be stored in a clean, cool store away from windows, boiler, electrical equipment and petrol, oils or other chemicals. Particularly in the field where the rubber rings are being used it is desirable that they are not left out on the ground in the sun or overnight under heavy frost or snow conditions.

28. LOWERING, LAYING AND JOINTING DI PIPES OF GIVEN DIAMETER AND CLASS

Contractor shall take delivery of pipes from the stores and shall convey them up to work site for use after checking and testing for soundness of the pipes and shall be held responsible for replacement of such materials of cracked or damaged materials are in advertantly fixed and jointed.

During laying the pipe line some time it may be necessary to cut the pipe suit the site condition or to put in some special or valve or to have exact length of the section etc. The contractor at his cost shall do this cutting only. No claims for extra amount due to any particular type or individual length of cut pipes and specials being supplied or joints having been increased due to small lengths shall be entertained.

All the pipes and specials and valves to be taken into use shall be cleaned and brushed clear of rust and paint at both the spigot and socket ends.

Before the pipes and specials are lowered and laid in trenches, the contractor shall see that the bedding is plane or the surface is brought to uniform grade and leveled with the help of cross sight rails and boning staff and approved in

advance by the last 3 days by the(SCDCL)

The contractor shall provide, fix and maintain cross sight rails and boning staff whenever required until the time of completion without any extra claim for cost etc. and which shall be considered inclusive of the rates for excavation and lowering and laying. The contractor shall provide temporary benchmarks if called upon at a minimum distance every 150 M without any claim for extra cost. These benchmarks shall be either of stone masonry or mass concrete not less than 0.03 Cum.

The contractor shall provide ladder for inspection of works at least 2 Nos. at the time of inspection for all the trenches of depth greater than 1.2 M.

The pipes, specials and valves shall be lowered by means of ropes, reckless or pulley as ordered evenly and uniformly and shall be brought level with well consolidated hard murum or wooden sleeper as ordered.

All the S & S pipes and specials shall be laid with sockets facing direction of flow, as per manual.

Materials to be used for jointing such as spun yarn, etc. shall be first get approved in advance from the (SCDCL) .

No jointing operations shall be started unless the (SCDCL) approves the grade and levels.

The pipes shall be laid in a complete straight line with center line ranged accurately by mean of string stretched between marked centers in cross sight rails and no deviation will be permissible without the permission of the (SCDCL) For deviations proposed by the SCDCL from marks on sight rails, the contractor shall postpone the work of jointing without claiming extra cost. The spigot end of the pipe or specials shall be inserted in socket and of the other pipe or special and shall touch squarely without any gap.

Under no circumstances, the D.I. pipes and other water mains will be laid in black cotton soil or rock surface without murum cushioning.

The above murum cushioning of a depth of 150 mm thick or as specified shall always be provided in all formation within the rate of laying pipe line unless an item for murum bedding is provided for separately in the tender.

The murum bedding shall be of the full width of the trench. Murum bedding will be necessary in rock formation boulder formation and soft soils and black

cotton soil but not in murum formation itself.

No brickbats or hard stone metal bigger than 20 mm gauge shall be allowed beneath the pipe line directly in touch with the pipe as in the murum bedding.

All stakes such as electric wires, water and sewer mains, manhole, natural drainage, culverts, storm water drains, gutters, poles, etc. coming in the way shall carefully be looked after and any damage be prevented to the same. Any work of removing repairing and reducing such structures or obstacles in the process of laying, jointing and testing pipe line etc. should be carried out by the contractor wherever directed, without any claims for extra to the satisfaction of the (SCDCL)'s Representative. Contractor shall foresee all such situation and make necessary arrangement to overcome those in advance.

The contractor shall not be allowed, any wastage and breakage in pipes brought by him for pipes issued departmentally, the total length of pipes laid and that returned to stores in cracked or unused conditions shall coincide with total length is used. The cost of pipes etc. cracked due to fault of contractor beyond the above permissible limit shall be recovered from him. All waste and broken pipe pieces shall be returned by the contractor to the store of issue at no extra cost. The contractor shall keep an up to date account of pipes, specials and valves etc. procured, quantity used giving chainages as and balance at hand and returned (supported by acknowledgements signed by (SCDCL) ,failing which the SCDCL Representative shall reserve the right to keep final bill pending till this account is finalized and contractor shall not claim any compensation in that case for delay in settlement of final bill.

Pipes shall be laid in reasonably dry trenches. Under no circumstances pipes shall be laid in slushy, marshy or water logged and filled up or yielding strata before getting it inspected from (SCDCL) Employer's Representative and providing proper foundations.

Contractor shall make his own arrangements for obtaining permission for stacking or pipes etc. on the road from land Owners whether it is belonging to any other Government Department or Municipal or Local Bodies or Private Land Owners.

For crossing obstacles natural or built up such as culverts, drains,roads,railways,canals, gutters, cables, pipeline, poles etc. contractor shall approach respective authorities obtain permission for crossing them immediately at the time limit of acceptance of the tender and shall take into consideration all such difficulties for the time limit allowed for execution and completion of the work. Any such work left remaining to be carried out due to want of the permission from concerned authority work shall be treated as incomplete .contractor shall not claim for extra cost or compensation due to non-receipt of permission or any other natural or unforced happenings. Until

the date of completion the contractor shall not claim compensation if work is delayed on account of permission for road crossing etc. not being received in time.

Before the work of laying pipe line is started the contractor shall see that all pipes are stacked length wise above the trench between road fencing in sufficient number and without causing any obstructions to the traffic.

Necessary road diversion as directed shall be provided without any extra claims by the contractor for excavation the roads till completion of work, so that the traffic shall not be hampered. Necessary guide stones duly painted with white wash shall be provided on both sides of temporary diversions. Necessary sign boards, indicating diversions and road closed etc. shall be provided at prominent places along with red flags and red letters at night time and maintained till the crossing work is over and road opened for traffic. The diversion shall be removed after road surfaces are brought to original condition. Necessary storing planks for crossing the trenches shall be provided on the open trenches in the towns and wherever required without claiming extra cost.

The contractor shall take utmost care in laying the pipe line along with roads and in towns in order to avoid accidents to human life and animal.

28.1 JOINTING OF PIPES

All the jointing work shall be carried out by the contractor after giving written due intimation in advance at least for 4 days before jointing operation starts and laid pipes are approved for grade and cleaned of all inside waste material such as mud etc. and in presence of responsible (SCDCL) representative .Unless otherwise mentioned in the wording of the item in Schedule 'B' of the tender all labour and materials required for jointing (depending upon the type of joint mentioned in item) such as lead, spun yarn, grease, oil, SBR quality rubber rings and gaskets, cement, sand, water, fire wood, nut-bolts, washers, rubber packing, RCC collars, etc. shall be Produced and used by the contractor at his cost. All the materials to be used for jointing should be first got approved from the (SCDCL).

No extra claims or compensation will be admitted for items of laying pipes etc. If the pipes are required to be laid up to a depth not greater than 3 times the maximum depth shown in the longitudinal sectional drawings or estimate so also no compensation shall be paid if class of pipes to be laid is changed during execution.

If the lines are laid in separate detached sections and not continuous length due to any of the reasons such as non-availability of specials or due to obstacles etc. contractor shall see that no end of any pipe length is kept open even temporarily and that all open ends are immediately covered up either by suitable blank flange or cap, plug or by means of a double layer gunny cloth tied properly by means of mild steel wires and without any claim for extra cost or compensation.

The contractor shall take utmost precautions to see that no extraneous matters such as lead, stones, brick bats or animals such as rats, reptiles are allowed any access into the pipe line and in case of their existence being detected in the pipe line, the contractor shall remove them by means of rodding etc. to the complete satisfaction of the SCDCL, without any claim for extra cost.

The cutting operation shall be carried out preferably by means of standard pipe cutter or hacksaw unless cutting by chisel and hammer is allowed by the (SCDCL) Employer's Representative. The end of pipe to be used for gasket joint shall be chamfered by means of file and made perfectly true or like original chamfered and if portion of pipe or specials is damaged rendered useless due to careless cutting of the contractor the cost of the damaged portion as decided by the (SCDCL) Engineer will be recovered from the contractor.

Insertion of gaskets shall be done by proper application of a thin film of lubricant (Vegetable oil only) to the butt seating inside the socket. The gasket shall be wiped clean, fixed and then the socket with the bulb towards the back of the socket. The groove in the socket must be located on the retaining board in the socket and retaining hole of the gasket firmly bedded in the seating. Contractor shall ensure to the satisfaction of the SCDCL that the gasket fits evenly around the full circumference removing any bulges which would prevent the proper entry of the spigot and for large diameter this operation should be assisted by forming a second loop in the gasket opposite to the first and then pressing the loops flat one after the other.

The thin film of lubricant (Vegetable oil only) shall be applied to the inside surface of gasket which will be in contact with the entering spigot. A thin film of lubricant shall be also applied to the outside surface of the entering spigot for a distance of 25 mm from spigot end. The pipeline to be jointed should be supported centrally by the tackle used for laying and balance just clear of the trench bottom. The spigot of the pipe must be aligned and entered carefully into the adjacent socket until it makes contact with the gasket. Final assembly of the joint is completed from this position.

The spigot end of the entering pipe shall be compressed until it reaches the bottom of the socket. If the assembly is not completed with reasonable force, the spigot end shall be removed and the position of the gasket examined and then the assembly is refitted properly to the satisfaction of the (SCDCL). The work shall generally be carried out as per instructions given in manufacturer's pamphlets. All the tools and tackles required for jointing, such as rack and layer 3 mm dia. 5 m long wire rope with thimble, hook and rope adjuster should be procured by the contractor at his own cost.

The item includes all other necessary materials including rings, etc. and labour.

28.2 HYDRAULIC TESTING

The pipeline and valves should be tested hydraulically up to the required pressure as per IS satisfactorily and all the leakages if any should be repaired at the time of hydraulic testing. The 10% amount of the lowering, laying and jointing of pipeline shall be released after satisfactory hydraulic testing. Contractor should make his own arrangements at his own cost for water for hydraulic testing of pipeline. He should not rely upon completion of any other sub-works for such testing.

Note:- Contractor shall maintain pipe line Gravity Main for a period of 5 Yea

29. VALVES/PEN STOCKS/SLUICE GATES

All the valves shall be C.I.D.F. type Valves shall be of approved make by or such other reputed and approved make. Valves shall have the certificate of I.S.I. and shall be as per the relevant IS codes. All valves having diameter 300 mm and above shall have spur gear arrangement for manual operations. Dia below 300 mm shall be with hand wheel for operation.

All sluice gates shall be of approved make and with brass lining. It shall be provided with spur gear arrangement and hand wheel for easy manual operation.

All pen stocks shall be brass lined and provided with suitable arrangement for easy and smooth manual operation.

GAS CUTTING

GENERAL

Gas cutting of M.S. Pipes may require to be adopted on site for fabrication of bends on site or for preparing distance pieces, straps etc. and for cutting holes in pieces for manholes, branches scour valves, Air Valves and other appurtenances and temporary manholes for cleaning welding etc..

After gas cutting the edges shall be made smooth and even so as to remove all the equalities ends of the pipe shall have 'V' edge from inside.

MAKING CROSS CONNECTIONS :

Making cross connections, to existing distribution system of any type including excavation, breaking and removing existing pipes, lowering, laying of special and pipes and their position, refilling closing the water supply in that area dewatering and restoring the water supply etc. complete as directed by (SCDCL) Representative.

30. ROAD BOX

The item includes providing and fixing 225x300 mm (20 Kg.) CI road box including necessary excavation, supporting B.B. Masonry etc. complete.

31. C.I. MECHANICAL JOINTS

Supply of C.I. Mechanical Compression collar coupling (popularly known as Jiffy Collar Coupling) suitable for C.I. spun pipes (as per IS:1536:2001) and D.I. pipes (as per IS:8329:2000) complete with sealing rubber gasket of SBR. C.I. Follower glands and MS Nit bolts. The whole assembly should be mechanically and hydraulically tested to the provisions as paid down in IS:1538:1993 and as directed by (SCDCL) Representative.

32. COLOUR WASH

General

It item refers to providing and applying of approved colour wash to surfaces which are not given any finishing.

COLOUR WASH

This is prepared by adding necessary colouring matter of approved make to the white wash which has been stained. The colour shall be as approved by the Engineer. For all colour wash, a sample must first be applied, allowed to dry and approved by the Employer's Representative before the work proceeds. It should be noted to large surface such as a the walls of a room . Care must be taken to mix sufficient colour wash to complete the whole surface to be treated, otherwise it is taken to mix impracticable to obtain exactly the same shade of colour in two successive mixtures. Sufficient gum or rice size should be added to prevent the colour wash coming off when rubbed with fingers.

Preparation of surfaces : The surfaces shall be prepared by brooming down, brushing or other means as may be ordered by the (SCDCL) Employer's Representative. The surface shall be thoroughly cleaned down and freed from all foreign matter before the base coat is applied.

Sub-base: Sub-base of two coats of white wash shall be applied as specified in Item No. Bd.P-1.

Application of colour wash: The colour wash shall be applied over the base coat. It shall be applied in the same way as white wash. The number of coats shall be as mentioned in the item, each coat being applied after the earlier coat has dried.

33. POLISHED SHAHABAD/TANDUR/KOTAH STONE FLOORING

The specification for this item shall be same as for item No. B.M.1

1. All the stone slabs shall be square in shape. The dimensions shall be 0.60 x 0.60 m or other dimensions as specified in the special provisions or as directed by Employer's Representative. Tolerance in thickness \pm 3 mm
2. The exposed surface of the specified stone flags shall be machine polished to a smooth, even and true plane and the edges machine cut square and to the required shape when necessary. Samples shall be got approved by the (SCDCL) Representative who will keep them in his office for reference.
3. The thickness of joints shall not exceed 1.5 mm
4. Joints shall be grouted with neat cement slurry
5. When the bedding and joints of the flooring have completely set, the surface shall be machine polished to give a smooth, even and true plane to the floor and thoroughly cleaned.

34. GLAZED TILES FOR SKIRTING AND DADO

Plastering : Cement plaster of about 12 mm for brick walls and 20 mm for stone masonry walls shall be applied to the part of the wall where dado or skirting is to be fixed as per specification No. B.11. The proportion of mortar shall be as mentioned in the item.

Fixing tiles : Dado or skirting work shall be done only after fixing tiles on the floor. The white glazed tiles shall be soaked in water for at least 2 hours before being used for skirting or dado work. Tiles shall be fixed when the cushioning mortar is still plastic and before it gets very stiff. The back of tiles

shall be covered with a thin layer of neat cement plaster and the tile shall then be pressed in the mortar and gently tapped against the wall with a wooden mallet. The fixing shall be done from the bottom of wall upwards without any hollows in the bed or joints. Each tile shall be fixed as close as possible to the one adjoining. The tiles shall be joined with white cement slurry. Any difference in the thickness of tiles shall be evened out in cushioning mortar to that all tile faces are in the vertical plane. The joints between the tiles shall not exceed 1.5 mm in width and they shall be uniform between the tiles in dado work, care shall be taken to break joints vertically. After fixing the dado, skirting etc. they shall be kept continuously wet for 14 days.

If doors, windows or other openings are located within the dado area, the sills, jambs, angles etc. shall be provided with white glazed tiles and appropriate specials according to the foregoing specification and such tiled area shall be measured net along with the dado.

Cleaning : After the tiles have been fixed the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. After the complete curing the dado or skirting work shall be washed thoroughly clean.

Item to include : The rate shall include all labour, materials, tools and equipment required for the following operations to carry out the item as specified above.

- Plastering
- Fixing the tiles including all angles, etc., after applying neat cement paste
- Jointing the tiles with white cement slurry
- Curing
- Cleaning the dado and skirting.

35.0 RUBBLE STONE SOLING

35.1 GENERAL

After the structural foundation, plinth construction and filling are completed, rubble soling of specified thickness shall be laid over the consolidated plinth filling, hand packed and compacted. The specification of the work as per PWD Standard Specification Bd.A-12)

35.2 MATERIALS

The stones to be used shall be broken rubble with fairly regular shape

and free from weathered, soft and decayed portion. The rubble shall be of sound stones of the type mentioned in the item and selected for their larger size. Stones shall be of the full height of the soling and the length and width shall not generally exceed 2 times the height. The stones to be used for wedging in the joints between larger stones, shall be chips of the largest size possible to fit in the interstices. All sound and suitable rubble obtained from the foundation excavation and approved by the (SCDCL) **Engineer** shall be necessarily made use of first unless otherwise directed.

35.3 CONSTRUCTION

The bed on which rubble filling is to be laid shall be cleared of all loose materials, leveled, watered and compacted and got approved by the (SCDCL)Engineer before laying rubble soling.

Rubble soling shall be laid to the specified thickness closely packed by hand and firmly with their broadest face downwards. The interstices between adjacent stones shall be wedged in with stones of the proper size and shape and well driven in with wooden mallets to ensure a tightly packed layer. Such wedging shall closely follow the placing of the larger stones. After hand packing and wedging, compaction of the soling shall be done thoroughly with log rammers. Adequate care shall be taken by the contractor while laying and compacting the rubble soling to see that the masonry or any part of the structure is not damaged. Rubble soling shall be started only after the masonry is fully cured.

35.4 BROKEN RUBBLE

- a) Supplying broken rubble of approved of approved quality and size at site.
- b) All labour, material, tools and equipment for handling, laying, hand packing and compacting the rubble.

Any other incidental charges to complete the work as per sanctioned plan.

36.0 PROVIDING AND APPLYING WASHABLE OIL BOUND DISTEMPER.

The surface to be distempered shall be cleaned and all cracks, boles and surface defects shall be repaired with gypsum and allowed to set hard. All irregularities shall be sand papered smooth and wiped clean.

The surface so prepared must be completely dry and free from dust before distempering is commenced. In the case of walls newly plastered, special care shall be taken to see that it is completely dry before any treatment is attempted.

The washable oil bound distemper of the approved shade of colour conforming to IS:428:1969, shall be used after applying priming coat of petrifying liquid or other primer as may be recommended by the manufacturers of the distemper.

The rate shall include all labour, material, equipments and tools for carrying out the following operations.

- Providing the primer and distemper and mixing the distemper.
- Scaffolding
- Preparing the surface to receive the primer and finishing coats.
- Applying the priming coat
- Applying the distemper as specified above in the number of coats, mentioned in the item.

37.0 PROVIDING PRESSURE

GROUTING

Providing pressure grouting at a pressure of 0.56 kg/sqcm in required row /zigzag fashion as specified at 1.50 m interval as per site condition to stop leakages through water retaining structures to the entire satisfaction of the Employer's Representative including material compound ,hardening materials, compressor equipment including scaffolding smooth finishing etc. complete.

38.0 DESILTING THE SUPPLY WELL

Desilting the Supply Well, Intake Well / Head Works, sump of water supply/ sewerage works etc. in wet or dry condition including lifts up to 9 M and lead up to 150 M as required beyond the work site, stacking, spreading, including necessary guarding, etc. complete, as directed by Employer's Representative.

39.0 LOWERING AND FIXING OF SLUICE VALVES/KINETIC AIR VALVES

This item includes fixing of valves at work site including cost of transportation, loading, unloading, etc. all materials and labours required for fixing, including testing. The size of nuts, bolts and packing shall be as per IS specifications and suitable for the type of valves and

as per the directions of the (SCDCL)'s representative. The location of the valves shall be decided by the (SCDCL)'s representative. Before any of these valves are fixed at the pre-determined position, these shall be cleaned, greased and it shall be checked that these are in proper working condition. Sluice valves shall be properly supported on wooden sleepers till the anchor blocks sets.

Sizes and type of Sluice valve ,Air valve (Double Ball) ,Kinetic Air valve shall be as per particular specifications.

Hydraulic Testing

The pipeline and valves should be hydraulically tested up to the required pressure as per IS, satisfactorily and leakages if any should be repaired at the time of hydraulic testing. The 15% amount of the lowering, laying and jointing the pipe shall be released after satisfactory hydraulic testing. Contractor should make his own arrangements at his own cost for water, for hydraulic testing of pipeline. He should not rely upon completion of the any other sub-works for such testing.

40.0 M.S. ROSE PIECES

The rose pieces shall be designed and fabricated out of 10 mm thick M.S. plates. The strength diameter shall be 1% times the diameter specified in the tender. The holes to be drilled in strainer portion shall be designed and got approved from SCDCL .The inside and outside surfaces of the rose piece shall be applied with three coats of anticorrosive oil paint and provide closing plate. The item includes cost of all material and labor required for the work, and this item will be executed as directed by the (SCDCL) Representative.

41.0 PROVIDING FUSION BONDED EPOXY COATING

Providing fusion bonded epoxy coating to reinforcement bars as per ASTM-755 specification for a thickness of 175 (+50) microns including extra cost on account of careful handling, extra cost on account of using PVC coated binding wire instead of G. I. wire, extra cost on account of touch-up material supplied by coating agency and repair work extra cost account of transportation to and fro from steel yard to work site plant by trailer, loading, unloading, including all taxes (Central and Local), etc. complete

42.0 PROVIDING AND LAYING C.C.FLOORING

Providing and laying cement concrete flooring 40 mm thick with cement concrete M-25 laid to proper line, level and slope in alternate days including compaction, filling joints marking lines to give appearance of tiles 30cm x 30cm or other approved design, finishing smooth (with extra cement) in approved colour as directed and curing etc. complete.

43.0 REFILLING OF TRENCHES OF PIPELINE

After lowering, laying, jointing and welding of pipe line, and concreting work, refilling of trenches with available excavated stuff shall be done. The available excavated stuff shall be laid in layers of 15 cm to 20 cm. Each layer shall be watered and compacted before the upper layer is laid till the required level is reached. First 2 layers of 15 to 20 cms shall be free from stones or chips or any harmful material, to protect the pipe from damage.

Only soil or soft murum shall be used for filling.

Originally filling shall be done 30 to 40 cms above natural ground or road level.

Sinking below the road or ground level, if noticed till the completion of work, the contractor shall have to make it level at his cost.

This item includes,..

- a) Clearing useful excavated material of rubbish breaking clods, stone, etc.
- b) Conveying the useful excavated material up to 500 M and filling in layers, watering and compacting.
- c) All labour, equipment and other arrangements necessary for the satisfactory completion and completion of the item.

Surplus excavated material is the property of Employer. So contractor is not empowered to sell this excavated material to any other agency.

This disposal will not be considered for initial 500 M lead from edge of pipe line trenches and so will not be paid for.

The material shall be conveyed by means of suitable devices/manner.

The material conveyed to the place of disposal shall either be stocked or spread as directed by SCDCL Representative.

The route opening and maintenance, payment of any royalties, compensation to land owners and for damaged of any etc. during the

process of conveyance etc. shall be the entire responsibility of the contractor.

44.0 MURUM BEDDING

General

The specification contained in the Standard Specification Volume-II published by Public Works and Housing Department, Govt. of Maharashtra, Chapter Bd.A-10, Page 263 shall apply. In addition to above, following specifications shall govern.

Murum bedding shall be done with approved quality of soft murum, selected from excavated stuff and approved by the Employer's Representative. The murum shall be collected from available excavated stuff and to be utilized if murum is not available from selected excavated stuff, it should be brought from outside and rates payable will be as stipulated in the tender item. Thickness of murum bedding will be 15 cm.. The contractor shall be paid for one Cubic Meter of the filling laid and compacted and will be paid upto two place of decimal of Cum.

Murum bedding shall be laid in exact 15 cm thickness for full width of excavation, it shall be well rammed with hand rammers so that pipe line is laid on firm bedding. Collection of murum from excavated stuff and carting up to the work site is included in the item and contractor shall make his own arrangement for procurement and carting of murum at his cost.

45.0 B.B. MASONRY CHAMBER

Providing and constructing B.B. masonry valve chambers of internal size as mentioned in particular specifications and as per approved drawing

The work is to be carried out as per type design or drawing approved by (SCDCL). Sizes of chamber mentioned in the item are the clear internal dimensions of the chamber after completion of plastering. Unless otherwise mentioned in the wording of item of the tender the rate for this item shall include following allied works.

- a) The cost of extra excavation in all types of strata which is in addition to the line trench, refilling the sides and disposing off surplus stuff will be paid separately under relevant item.
Excavation covered by pipe line trenches coming under M.H. chamber shall not be admissible.
- b) Providing and casting at site 15 cm thick bed concrete in CC M-100 below external size of complete chamber.

- c) Providing B.B. masonry side walls in 225 mm thick in CM 1:5
- d) Providing 20 mm thick plaster in CM 1:3 from inside.
- e) Providing cement plaster 20 mm thick in CM 1:3 from outside at least up to 30 cm below ground level.
- f) Providing top coping 15 cm thick in M-150 with smooth finishing to surface.
- g) Providing and fixing in position pre-cast RCC manhole frame cover.
- h) Unless otherwise directed by the department the finished top of the chamber constructed on road surface and shall not cause hindrance to traffic.

46.0 PROVIDING AND SUPPLYING C.I./D.I. FLANGED PIPES

The item includes supply CI/DI flanged pipes as per latest IS and approved by Employer's Representative. The cost of pipe should be including all taxes central and local, railway freight, transportation upto site of work or departmental store.

The item will be measured and paid as per running meter basis as per payment schedule.

47.0 PROVIDING AND SUPPLYING C.I.FLANGED / S/S SPECIALS

The item includes supply CI flanged/s/s specials as per latest IS and approved by (SCDCL) Employer's Representative. The cost of specials should be including all taxes central and local, railway freight, transportation up to site of work or departmental store.

48.0 PROVIDING AND ERECTING WIRE FENCING

Providing and erecting 1.5 meter high wire fencing with seven rows of barbed wire supported on mild steel angles (50 x 50 x 6 mm) at 2.5 meters center to center including excavating pit for foundation, fixing posts in cement concrete blocks of size 45 x45 x 45 cm, fastening the wire and painting the mild steel angles with one coat of red lead primer and two coats of painting etc. complete.

49.0 MS PIPELINES, APPURTENANCES SPECIALS ETC.

49.1 SCOPE

This specification covers the general requirements for supply, fabrication, delivery at site laying, jointing, testing and commissioning of all welded M.S pipeline, appurtenances, specials etc. above/below ground, including Civil works required for the same.

49.2 APPLICABLE CODES & SPECIFICATIONS

The following specifications, standards and codes are made a part of the specification. All standards, tentative specifications, specifications,

codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions. In case of discrepancy between this specification and those referred to herein, this specification shall govern.

Sr. No.	Code Number	Description
1	IS: 2062	Steel for general structural purposes
2	IS : 808	Dimensions for hot rolled steel beam, column, channel and angle sections.
3	IS : 814	Covered Electrodes for manual Metal Arc Welding of carbon and C-Mn steel.
4	IS : 3613	Acceptance Tests for Wire Flux combinations for Submerged - Arc Welding.
5	IS: 1367	Technical Supply Conditions for Threaded Fasteners (Parts 1 to 3).
6	IS: 2016	Plain Washers.
7	IS: 2074	Ready Mixed Paint, Red Oxide Zinc Chrome and Priming.
8	IS: 102	Ready Mixed Paint, Brushing, Red Lead, no setting, Priming.
9	IS: 1786	High Strength Deformed Steel Bars and Wires for Concrete Reinforcement
10	IS : 432	Specification for Mild Steel & (Part-I) Medium Tensile bars and hard drawn steel wire for concrete reinforcement : mild Steel & Medium tensile steel bars
11	IS.432	Specification for mild steel & (Part-II) Medium Tensile steel bars and hard drawn steel wires for concrete reinforcement : Hard drawn steel wire
12	IS : 269	Specification for Ordinary and Low heat Portland cement
13	IS : 8041	Specification for Rapid hardening Portland Cement
14	IS : 383	Specification for coarse and fine aggregate from natural source for concrete
15	IS :12330	Specification for Sulphate Resisting Portland Cement
16	IS : 456	Code of practice for plain and reinforced concrete
17	IS : 800	Code of practice for General Construction in Steel.
18	IS : 816	Code of practice for use of Metal Arc Welding for General Construction in mild steel.
19	IS : 4353	Submerged Arc Welding of Mild Steel & Low Alloy Steels – Recommendations.
20	IS: 817	Code of practice for Training and Testing of Metal Arc Welders.
21	IS: 1182	Recommended practice for Radiographic examination of Fusion - Welded Butt Joints in steel plants
22	IS: 2595	Code of Practice for Radiographic Testing.
23	IS: 3658	Code of Practice for Liquid Penetrate Flaw Detection
24	IS: 5334	Code of practice for Magnetic Particle Flaw Detection of welds.

Sr. No.	Code Number	Description
25	IS: 3600	Methods of Testing Fusion Welded Joints and weld metal in steel (Parts 1 to 9)
26	IS: 4853	Recommended Practice for Radiographic Inspection of Fusion Welded Butt Joints in Steel Pipes.
27	IS: 1239	Seamless or Electrically welded steel pipes for Water Gas and Sewage (Up to 166.5 mm Outside Diameter)
28	IS: 3589	Seamless or Electrically welded steel pipes for Water Gas and Sewage (168.3 to 2540 Outside Diameter)
29	IS: 6631	Steel pipes for Hydraulic Purposes
30	IS: 7343	Code of practice for ultrasonic Testing of Ferrous Welded Pipes and Tubular Products
31	IS: 2598	Safety Code for Industrial Radiographic Practice
32	IS: 5822	Code of Practice for Laying of Electrically Welded steel pipes for water supply
33	IS: 1608	Mechanical testing of Metals.
34	IS: 9595	Metal Arc welding of Carbon and Carbon-Manganese Steels.
35	IS: 2825	Code of unfired Pressure Vessels
36	IS: 5504	Code for Spiral Welded PIPES(457mm to 3250mm Outside Diameter)
37	IS: 10748	Requirements for Weld able Hot Rolled Carbon Steel Strip in Coils.
38	IS: 10234	Recommendation for radiography for general pipeline welding.
39	API-1104	Welding of pipeline & related facilities
40	ASTM E 94	Guide for Radiographic Testing
41	ASTM E 709	Guides for Magnetic Particle Examination.
42	ASTM E 165	Test Method for Liquid Penetrate Examination.
43	AWS: A-5.1	Specification for Mild Steel Covered Arc Welding Electrodes.
44	AWS: A-5.17	Specification for Bare Mild Steel Electrodes and Fluxes for Submerged Arc Welding
45	BS EN 499	Welding Consumables. Covered Electrodes for Manual Metal Arc Welding of Non Alloy and Fine Grain Steel. Classification

49.3 MATERIALS

Steel Coils - The steel Coils for pipes, fittings, specials and stiffeners shall be of mild steel conforming to IS: 10748 grade III and shall bear ISI mark

Welding Consumables - such as electrodes, filler rods and wires shall conform to IS: 814, IS: 3613, IS: 6419 and IS: 7280 . Before fabrication of pipes and specials/fittings is commenced, the copies of the mill sheets and the MANUFACTURER's test certificates for Coils and other materials required for the fabrication shall be submitted by the Contractor to the (SCDCL) for his approval. When requested by the (SCDCL) Engineer, the Contractor shall supply free of charge to the (SCDCL) Employer, for test-

ing suitable samples of the materials to be used/used in the Works. The cost of such tests shall be borne by the Contractor and shall be included in his quoted rates.

49.4 INSPECTION

All works and material under specification will be rigidly inspected during all phases of manufacture and testing and such inspection shall not relieve the Contractor of his responsibility to furnish materials and performed work in accordance with this specification. The Contractor shall notify the (SCDCL) Engineer, in advance of the production of materials and fabrication thereof, in order that the (SCDCL) Employer may arrange for mill and shop inspection. The (SCDCL) Engineer may reject any or all materials or works that do not meet with any of the requirements of this specification. The Contractor shall rectify or replace such rejected material/performed work at his own cost, to the satisfaction of the (SCDCL) Engineer. The (SCDCL) Engineer shall have free access to those parts of all plants or any other premises and sites that are concerned with the furnishing of materials or the performance of work under this specification. The Contractor shall furnish to the (SCDCL) Employer's inspector reasonable facilities and space without charge for inspection, testing and obtaining of any information he desires in respect of the character of material used and the progress and manner of the work. The Contractor shall supply free of cost required specimen of materials for testing by the Owner at any time during the progress of work and shall bear the cost of all such tests or retests to the satisfaction of (SCDCL) Engineer.

The Contractor shall provide 2 (two) sets of accurate 'Go' and 'No Go' ring gauges to measure the diameter of pipes specials and fitting for the use of the (SCDCL) Engineer at no extra cost.

49.5 FABRICATION OF PIPE

49.5.1 GENERAL

All Pipes (ISI Marked) and specials shall be manufactured as per IS: 1239 part 1/ IS: 3589 and IS: 5504 out of new mild steel HR Coils (IS: 10748 grade-III) which shall be free from any cracks, surface flaws, laminations, excessive fittings or any other defects. The pipes shall be truly cylindrical, and straight in axis. The ends shall be accurately cut and prepared for field welding. The external circumference of the pipe pieces which are to be fixed adjacent to flange adapter with fixed outer diameter shall not deviate from theoretical one by more than 1 mm. To obtain this accuracy the pipe shall be rolled several times, if necessary, as pipe pieces should be truly cylindrical. The external longitudinal welding of this pipe shall be ground smooth flush with surface to the satisfaction of the (SCDCL) Engineer, for a length of 200 mm. No extra cost shall be charged by the Contractor for this grinding work. However, the pipe shall be manufactured as per tender specification. Minor repair by welding or otherwise shall be permitted at the discretion of the (SCDCL) Engineer, but such repairs shall be done only after obtaining the previous permission of the (SCDCL)

Engineer. Any pipe or part thereof which develops injurious defects during shop welding or other operations shall be rejected.

49.5.2 PERMISSIBLE STRESS

The permissible stress in the pipe shell shall be related to yield stress (f_y) of pipe material making due allowance for weld efficiency of the joint.

a. working stress for combined bending and direct tensile stress shall not exceed 60% of yield stress of the material making due allowance for efficiency of welded joint (as per IWWA M-1).

b. Working stress for combined bending and direct compressive stress shall not exceed 50% of yield stress making due allowance for weld efficiency (as per IWWA M-1).

c. It is also necessary to check the shell thickness for adequate factor of safety against failure by buckling (as per IWWA M-11).

For field welded joint, efficiency factor of 80% is generally adopted, while for shop welding joint 90% efficiency is allowed (as per IS 5822).

49.6 FABRICATION

The Contractor shall get the fabrication work done in a duly valid licensed factory of his own or that of an approved nominated sub-contractor. This factory meant for fabrication of pipes, specials etc. shall also be involved with testing etc., machining as well as painting. For completing the work under the present contract within the contract period, the factory shall be equipped with adequate number of various equipment and plant such as :

a. Plate bending machines for rolling of pipe drums

b. Automatic welding machines (suitable for circumferential welding)

c. Hydraulic Testing Machines

d. Travelling gantry or crane of capacity 10 Tones or above.

e. Mobile cranes for loading/unloading of Coils, pipes etc. 15 tones capacity each

f. Lathe for machining of the flanges rings, Coils etc.

g. Equipment for sand blasting and applying paint by spray gun.

h. Equipment for cold pressing of Coils up to 25 mm thick to the required curvature (specials, plug Coils etc.)

i. Bending machine of adequate capacity for manufacturing ring girders and other necessary equipments.

The factory shall have adequate area, and shall also have stacking yard for the stacking of Coils, structural, fabricated pipes etc. and the scrap. The Bidder may establish pipe fabrication factory within the project site for minimizing the transportation of pipes after fabrication to bring the pipes to the trench where pipes are to be laid. Contractor shall furnish with his bid the details of the factory where he intends to get the fabrication done,

such as its location within the project site and the equipment, plant and other facilities available in the factory for the manufacture of M.S. Pipes and special required under this contract. This shall be as per the MOU executed with the pipe MANUFACTURER.

49.7 CUTTING OF COILS OR FROM COIL ROLLED AS PER REQUIRED SIZES

The Coils shall be indented in such length as to have minimum wastage and so as to make the pipe as far as possible. Before cutting, all the edges of the Coils shall be cleaned by brushing/grinding on both the sides. After the Coils are cut, the edges shall be made smooth and even by polishing with an electrical or pneumatic grinder to remove all inequalities. Care shall be taken to see that the cut edges of the plate are perfectly straight. Jigs to be used for this purpose shall depend upon the types of cutting machine used. The Coils cut to the required shape shall be checked for correctness before they are rolled into pipe drums. If any corrections are required, the Contractor shall do the same by re-cutting, if necessary.

49.8 ROLLING OF COILS

The Coils prepared as mentioned above are cut to the exact size shall be put into a rolling machine to form a pipe of the required diameter as under : The Contractor shall adjust the rolling machine so as to give a uniform curvature to the pipe throughout its circumference. The curvature obtained shall be checked by the Contractor's foreman during the process of rolling and if proper curvature is not obtained at any place including the ends, the rolling operation shall be repeated at this stage
Heating of Coils to obtain the desired curvature shall not be permitted.

49.9 WELDING

All components of a standard shell, either straight or bent etc. shall be welded, wherever possible by use of automatic arc welding machine by Submerged Arc Welding Process with alternating current. Generally hand welding shall not be permitted except specific cases, where it is absolutely necessary. This should be done in consent with (SCDCL) client's representative. Hand welding shall also not be permitted except for sealing runs and such other minor works at the discretion of the (SCDCL) Employer's Representative. The strength of the joint shall be at least equal to that of the parent material. The Contractor shall use electrodes of GWIL approved make and size, the size depending on the thickness of coil and the type of joint. It shall also be used with standard current and arc voltage required for the machine in use with such modifications as may be found necessary after experimental welding. For this purpose, samples of welded joints shall be prepared and tested in the presence of the (SCDCL) Engineer. The values once determined shall be maintained throughout the work and if any modifications are to be made, a written permission of the (SCDCL) Engineer shall be obtained. In the case of thin sheets, electric arc welding may not give satisfactory results and gas

welding shall be resorted to. Gas welding shall be subject to the same specifications and tests as those for electric welds. Welding should be carried out inside as well as outside. All the shop and field joints shall be welded, all welding shall conform to the requirements of IS 9595 and IS 4353. All circumferential joints shall be double welded butt joints. Field joints shall be from outside, with a sealing weld from inside. End preparation for such welding shall conform to IS: 2825. All circumferential welds involving Coils of unequal thickness shall be so kept that the inside surfaces of Coils match to provide stream lined joints without alteration in the internal diameter. As far as practicable, welding of dissimilar thickness of shells shall be carried out in the shops.

The welding shall be of the best workmanship free from flaws, burns, etc. and the Contractor shall provide for his own electrodes and equipments, ovens to keep the electrodes at the desired temperatures and dry. In order to maintain a good standard in welding, welders shall be tested by the Contractor with prior intimation to the client before they are entrusted with the job. Qualification standard for welding procedures, welders and welding operation shall conform to the requirements of IS: 7307 and IS: 7310 (latest). Periodical tests as regards their efficiency shall also be taken at intervals of about 6 months and those found inefficient shall be removed from the job. Only those who pass the test shall be posted on the job. If an incompetent welder has already welded some pipes, all welding done by him previously shall be fully checked by X-ray in addition to the regular X-ray inspections. The defects if any shall be set right to the satisfaction of the (SCDCL) Engineer. All such check tests and rectification of defects shall be entirely at the cost of the Contractor. No pipes or steel sections shall be erected unless the work of the welder concerned has been proved to be satisfactory. Specially selected welders shall do site welds. A record shall be maintained showing the names of welders and operators who have worked on each individual joint. Hand-welding shall preferably be carried out by a pair of welders (parallel welding putting two welders at a time both will be working in diametrically opposite side of the curvature. Welding shall be divided into 4 quadrants shall be welded simultaneously, so that by observing proper sequence, distortion can be avoided. A joint entrusted to a particular individual or a pair shall be as far as possible, completed by them in all respects, including sealing run. No helper or other unauthorized person shall be permitted to do any welding whatsoever. In case of infringement of above, the persons shall be punished as directed by the (SCDCL) Engineer. The welded joint after welding should not become brittle or sensitive to blows and there should be no loss of toughness due to welding or heat treatment. The material after welding and heat treatment is to be tougher than the base metal and is to retain its original ductility. No allowance will be made for thinning of weld and the weld should in no point be less than the nominal thickness of plate. Upon receipt of the order and prior to the start of fabrication, the Contractor shall submit to the (SCDCL) Engineer for his approval the "welding procedure" he intends to use in the shop work. Similarly, prior to the start of the field welding, procedure for the field welding must be submitted to the (SCDCL) Engineer for his approval. Manual welding shall be adopted only when machine welding is not possible.

49.10 ULTRASONIC & RADIOGRAPHIC TEST OF WELDED JOINTS

49.10.1 MANUFACTURED IN SITE FACTORY/WORKSHOP

For the mild steel pipes manufactured in site factory/workshop, fabricated from mild steel Coils, 100 % of weld length of each pipe shall be subjected to Ultrasonic Test either on-line or off-line. (As per API 5L) For the mild steel pipes manufactured in site Factory/Workshop fabricated from mild steel coils, 15% of weld length of each pipe shall be subjected to Radiography Test by Digital Image/ X-Ray Film Method. (As per API 1104 or IS:10234)

49.11 FIELD WELDED JOINTS

For Field welded joints, 100% of each welded joint shall be examined by Ultrasonic Test either online or offline and 15% weld length of each welded joint shall be examined by Radiography Test. In case of failure of any of the joint during RT, the contractor is to carry out radiography of thrice the number of field joints which includes 1 Repair and 2 Penalty shots. Subsequent to RT of thrice the number of field joints, if anyone of the joint fails the Contractor has to carry out RT of all field welded joints i.e. 100 % basis. All these testing's shall be carried out by the contractor at his own risk and cost. The weld ripples or weld surface irregularities, on both inside and outside shall be removed by any suitable mechanical process to a degree such that resulting radiographic contact due to any remaining irregularities cannot mark or be confused with that of objectionable defect. The radiograph shall be made in strict accordance with the latest requirements and as per the latest and most efficient technique either with X-ray or gamma ray equipment. The photographs are to be marked in such a way that the corresponding portion of the welded seam can be readily identified. All radiographs will be reviewed by the Engineer to identify the defect and determine those which must be removed. Defects that are not acceptable shall be removed by chipping, machining or flame gouging to sound metal and the resulting cavities shall be welded. After rectification, the joint is to be radio graphed again to prove the quality of the repair. The(SCDCL) Engineer based on the latest standards prescribed by Indian Standard specification will judge the radiographs as acceptable or unacceptable. All X-ray shall be made with equipment and by personnel furnished by the Contractor. Films shall be developed within 24 hours of exposure and be readily accessible at all times for inspection by the (SCDCL) Engineer. The Contractor shall provide for the use of the Engineer suitable X-ray viewing equipment. X-ray films shall be properly maintained by the Contractor and shall be handed over to the department on completion of the Contract. All films shall be identified by the No. and chart prepared indicating location of the joint each X-ray photo represents. In the event of additional radiographic inspections required of any work associated with the pipe erection, the Radiographer at the discretion of the Engineer shall perform such inspection.

49.12 RADIOGRAPHIC INSPECTION

49.12.1 GENERAL

The (SCDCL) Engineer shall assure himself that the welding procedure employed in the construction of pipes has been qualified. The Contractor shall submit evidence to the (SCDCL) Engineer that the requirements have been met. The Contractor shall certify that the welding of pipes has been done only by qualified welders and welding operators and the (SCDCL) Engineer shall ensure himself that only qualified welders and welding operators have been used. The Contractor shall make available to the (SCDCL) Engineer a certified copy of the records of the qualification tests of each welder and welding operator. The (SCDCL) Engineer shall have the right at any time to call for and witness tests of welding procedure or of the ability of any welder and welding operator. Radiographic Inspection of welded joints All welded joints to be radio graphed shall be examined in accordance with codes as specified below:

Sr. No.	Code Number	Description
1	IS : 2595	Code of Practice for Radiographic Testing
2	IS : 4853	Recommended Practice for Radiographic Inspection of Fusion Welded Butt joints in Steel Pipes.
3	IS :1182	Recommended Practice for Radiographic Examination of Fusion Welded Butt-Joints in steel Coils.

The reinforcement on each side of all butt welded joints shall not exceed 1.5 mm. A complete set of radiographs and records as described in IS: 2595 for each job shall be retained by the Contractor and kept on file for a period of at least five years. Radiographers performing radiograph shall be qualified in accordance with SNT-TC-1A. Supplements and Appendices ``Recommended Practice for Non-destructive Testing Personnel Qualification and Certification" published by the American Society for Non-destructive Testing as applicable for the technique and methods used. Final acceptance of radiographs shall be based on the ability to see the prescribed pentameter image and the specified hole. The acceptance criteria for radiography of the joint shall be as per IS-10234 or as per API - 1104 standard.

49.13 THERMAL STRESS RELEIVING

Not applicable

49.14 TOLERANCE

The shell in the completed work shall be substantially round. The difference between maximum and minimum inside diameters at any cross section shall not exceed 1% of the nominal diameter of the cross section un-

der consideration subject to a maximum of 10 mm. Machined parts shall be within the limits specified by IS 3589. Straight pipes shall have their faces perpendicular to the axis of the section with a maximum deviation of 2 mm on either side of the plane. Pipe ends shall be bevelled as per IS: 3589. The pipes shall be supplied in length of 10.5 m to 12.5 m. For the shell thickness, no negative tolerances are acceptable.

49.15 SHOP TESTING

After fabrication, but before application of protective coatings all pipes and specials shall be subjected to a shop hydraulic test (100%). Standard lengths of pipes shall be directly subjected to test and non-standard pipe and elbows can be tested as standard pipe before being cut to size.

49.16 FIELD HYDRAULIC TESTING

The Pipeline after lying at site shall be subjected to 100% Hydro testing. The test pressure shall be 1.5 times working pressure. or 6 kg/cm² whichever is higher. The pressure shall be maintained for a period of 24 hours. The length of pipe for hydro testing shall be generally 5 km as directed by . (SCDCL) Employer's Representative.

Each pipe shall be filled with water and the pressure slowly and uniformly increased until the required test pressure is reached. The pipe to be tested shall be given a serial no. which shall be painted on its inside together with details such as pipe No. Shell thickness, diameter, length etc. as directed. It shall be entered in the register to be maintained by the Contractor. Prior to testing, the pipe shall be inspected thoroughly and all the apparent defects in welding such as jumps, porosity etc. shall be repaired by gouge and re-welding. The hydraulic test shall be carried out under cover at the fabrication shop, in the presence of and to the satisfaction of the Engineer or the inspection agency appointed by the Employer. For indicating the pressure inside the pipe an accurate pressure gauge of approved make duly tested and calibrated for the accuracy of readings shall be mounted on one of the closures which close the pipe ends. The pressures shall be applied gradually by approved means and shall be maintained for a period of 24 hours. The pipe shall be hammered throughout its length with sharp blows, by means of a 1 kg. hand hammer. The pipe shall withstand the test without showing any sign of weakness, leakage, oozing or sweating. If any leak or sweating is observed in the welded joints, the same shall be repaired by gouging and re-welding after dewatering the pipe. The repaired pipe shall be re-tested to conform to the specified pressure. If any leak or sweating is observed in pipe shell the pipe under test shall be rejected temporarily. The Contractor shall stack such rejected pipes separately in his yard. The (SCDCL) Engineer shall inspect the same and after taking cuts if necessary, shall determine the nature of repairs to be carried out thereon and shall then decide as to how and where they shall be used. No payment shall be made for handling or carrying out repairs, but, payment for the fabrication and hydraulic testing of the pipe shall be released only after acceptance of the pipe with necessary repairs and subsequent testing etc. are carried out by the Contractor to the satisfaction of the (SCDCL) Engineer. The (SCDCL) Engineer shall

be supplied with two copies of the results of all the tests carried out. The Mechanical Tests for Pipe material at Manufacturers work shall be carried as per approved Quality Assurance Plan(QAP) and tests shall be as per IS:1239/ IS:3589/IS:5504.

49.16.1 Testing Of Site Welded Joints

The welded joints at site shall be tested for Tensile test, Bend test & Trepanned plug in accordance with procedure laid down in as per the latest edition of IS No. 3600 "code of procedure for testing of fusion welded joints and weld metals in steel". Test pieces shall be taken by the contractors from the welded joints at the position on fabricated pipes pointed out by the (SCDCL) Engineer

The sample so taken shall then be cut to the exact shape and dimensions and machined as described below and handed over to the (SCDCL) Employer's Representative for testing. All the work up to and including machining and arranging for test shall be done by the contractors.

49.17 SUBMISSION OF DAILY PROGRESS REPORT

The Contractor shall submit to the (SCDCL) Engineer a daily progress report in the proforma approved by the (SCDCL) Engineer, wherein all the details of the work carried out in the factory shall be fully recorded. Similarly, works done in the various units in the factory shall be separately mentioned. The Contractor shall maintain a register of all the finished materials giving dates of carrying out important operations such as testing, transport, etc. The register shall be presented at least once a week to the (SCDCL) Engineer who shall initial the entries after verification.

49.18 TRANSPORTING OF PIPES, SPECIALS etc.

All pipes and specials fabricated in the site factory / workshop and temporarily stacked in the Contractor's yard shall be transported to the site of laying after cleaning them internally, etc. The loading in the factory shall be carried out by means of either a crane, gantry or shear legs, so as not to cause any damage to the finished material. Similarly, while unloading and stacking, great care shall be taken to ensure that the material is not damaged or dented. The contrivances to be used for unloading will be different in different situations and in each case the one approved by the (SCDCL) Engineer shall be adopted. The material stacked at site shall be jointly inspected by the (SCDCL) Engineer and the Contractor and defect or damage noticed shall be repaired to the satisfaction of the (SCDCL) Engineer before payment is admitted. Props of approved designs for maintaining circularity having M.S. Angle/Pipe at both ends to avoid metal to metal contact shall be fixed to the pipes during transit to avoid undue sagging and consequent distortion. After the pipes are carefully stacked, props should be retained till pipes are joined in trenches and then props are re-used for subsequent similar operations. The stacking ground, both in the Contractor's yard and at the site of laying shall be selected in such a

way as not to get waterlogged during monsoon. If this cannot be done, the pipes shall be supported on sleepers to avoid contact with wet earth and subsequent rusting. In order to prevent sagging during transit, savings of steel Coils can be utilized by cutting to the required length and tacking the same to the pipe ends, in place of props, if approved by the (SCDCL)Engineer. As explained in earlier paragraphs, materials such as pipes, tapers, etc. may be transported to the site of laying as soon as the material is finished in all respects with the permission of the Engineer to avoid congestion in the Contractor's yard. However, materials such as expansion joints, composite bends, `T' branches and other complicated materials shall be stacked in the Contractor's yard until they are required for laying in the field. In view of this, the work of fabrication of such materials shall be properly synchronized as far as possible with the laying operations.

Fabricated materials such as specials, appurtenances, bolts, nuts, distance pipes, flanges, saddles, collars bypass arrangements etc. shall be transported to the site of laying from the fabrication shop according to the needs of the laying operations only. In regards

access roads, the Contractor shall note that access road may lead up to some points on the alignment the Contractor shall have to make his own arrangement for connecting approaches to transport the pipes cross country to the actual site of laying at his own cost. Whatever may be the mode of transport he uses it shall be incumbent on the Contractor to carry and stack the pipes and specials along the alignment as close as possible to the site of laying.

49.19 PROCEDURE FOR RECEIVING STEEL PIPES

1.19.1 General

To ensure that the work of erecting pipes is not held up at any stage and place, the Contractor shall maintain an adequate stock of standard specials, flange rings, plug Coils, manhole covers, etc. and short length of smaller diameter pipelines, etc. at site in his field stores, in consultation with the (SCDCL Engineer. Wherever possible, the Contractor shall arrange one full month's requirement of pipes, specials, etc. stacked along the alignment.

1.19.2 Stacking of Pipes, etc. and Inspection

The Contractor shall keep in each section a responsible representative to take delivery of the pipes, specials and appurtenances, etc. transported from the fabricating stockyard or received from any other work site to the site of laying and to stack along the route on timber skids. Padding shall be provided between coated pipes and timber skids to avoid damage to the coating. Suitable gaps in the pipes stacked shall be left at intervals to permit access from one side to the other. The pipes, specials, appurtenances so received on site shall be jointly inspected and defects recorded, if any, such as protrusions, grooves, dents, notches, damage to the internal coating etc. shall be pointed out immediately to the (SCDCL Engineer at the site and in the acknowledgement challans. Such defects

shall be rectified or repaired to the satisfaction of (SCDCL Engineer entirely at the Contractor's risk and cost.

1.19.3 Handling of Pipes, Special Appurtenances etc.

It is essential to avoid damage to the pipes, fittings and specials, etc. or their coatings at all stages during handling. The pipes and specials shall be handled in such a manner as not to distort their circularity or cause any damage to their surface treatment. Pipes shall not be thrown down from the trucks nor shall they be dragged or rolled along hard surfaces. Slings of canvas or equally non-abrasive materials of suitable width of special attachment shaped to fit the pipe ends shall be used to lift and lower coated pipes to prevent damage to the coating.

Great care shall be taken in handling the pipe right from the first operation of manufacture until they are laid and jointed. The Contractor will provide temporary props as described earlier in order to prevent any sagging of the pipes while they are stacked in their yard and while transporting to the site of delivery, i.e. laying. The props shall be retained until the pipes are laid and welded. If at any time these props are found to be dislodged or disturbed, the Contractor shall immediately reinstate them in such a way that the true shape of the pipe shell or specials is maintained to the satisfaction of the Engineer. No defective or damaged pipe or special shall be allowed to be used in the

work without rectification to the satisfaction of the (SCDCL Engineer. Any damage to the coating shall be repaired by the Contractor at his own cost to the satisfaction of the (SCDCL Engineer.

49.19.4 Dents

Whenever any dent, i.e. a significant alteration of the curvature of the pipe shell is noticed, the depth of the dent shall be measured between the lowest point of the dent and the pipe shell curvature line. All dents exceeding 2 percent of the outer diameter of the pipe shall be removed by cutting out a cylindrical portion of the pipe and replacing the same by an undamaged piece of the pipe. The (SCDCL Engineer may permit insert patching if the diameter of the patch is less than 25 percent of the nominal diameter of the pipe. Repairs by hammering with or without heating shall not be permitted. Any damage to the coating shall also be carefully examined and rectified.

31.19.5 Marking

The component parts of the pipes shall be carefully marked for identification in the field. The marking shall be on the side which will be the inside of the pipe after bending. The marking operation shall be conducted with full size rulers. Only blunt nose punches should be used. The Coils used for fabrication of pipes shall be laid out in such a way that when the shells are completed one set of original identification markings for the material will be plainly visible. In case these markings are unavoidably cut out, they shall be accurately transferred by the Contractor to a location where these markings will be visible on the completed work. After the hydraulic tests on the specials and other items, the number of

the shell in the line as it will be erected and the direction of flow shall be stamped in a prominent manner on each piece. A register shall be maintained in suitable Performa giving the following information for each shell tested: Serial No. Shell No. Date of test Thickness and specification of steel Weight of shell tested Maximum test pressure Details of test performance, Details of radiographic examination of welds, Name of (SCDCL) Engineer's representative witnessing tests

A copy of these details shall be furnished to the owner free of cost. No separate payment will be made for these markings and the rates for the items concerned shall be deemed to include the cost of such markings.

49.20 LAYING OF PIPELINE

49.20.1 General

Unless specified otherwise, the pipeline shall be buried with minimum cover at top, as shown on drawings and as specified. No material shall be erected unless it has been previously passed by the (SCDCL Engineer. Pipe shall be protected from outside with rock shield mesh/soft murrum/Sand wherever required/as directed by (SCDCL Employer's Representative. In such cases, the depth of soft murrum/sand shall be 300mm above top of pipe. The mesh shall be manufactured from HDPE material with weight per metre not less than 750 grams. The size of mesh shall be as per requirement of (SCDCL Employer's Representative. The mesh shall be of such strength to protect the external coating from impact of rock during back filling. The height of falling of rock shall range from 3 to 5 m over top of pipe. The mesh shall be spirally wrapped over pipe with suitable overlap and properly tied with non-metallic ties. The mesh shall be spirally wrapped over pipe with suitable overlap. After field joints and at all specials also shall be wrapped by rock shield protection mesh Erection of fabricated shells shall be carried out by the Contractor who shall equip himself, at his cost, with all necessary tools, machinery, labour, etc. required for the purpose.

49.20.2 Welding

Except for routine welding of joints, no other work shall be done in the absence of Contractor's engineer, either during the day time or at night. Chipping shall not be kept in arrears for more than 15 joints.

49.20.3 Temperature

The components of the pipeline such as base Coils, top Coils and pedestals have been so designed that the centres of the Coils and pedestals shall coincide at the Mean Temperature (30°). For this reason, all works such as fixing flanges, base plate etc. in true alignment and in correct position and tack welding pipes shall be done at the mean temperature. For ascertaining the temperature, the Contractor shall provide mercury cups and fix them to the pipe shell from outside and shall also provide thermometers of the required type and range. No extra payment shall be made for this.

1.20.4 Saddle supports

Unless otherwise specified pipeline shall be underground. However at unavoidable reaches it shall be on R.C.C. saddles spaced at about 6 m center to center. The material and construction of R.C.C./Steel structures such as saddles, anchor blocks, crossings etc. associated with the work of pipe line shall conform with the relevant IS codes, good engineering practice and as directed by the (SCDCL Engineer. The pipes to be laid on saddle supports shall be erected at mean temperature. Saddle supports shall either be sliding type or fixed type. For both the types of supports a 10mm thick double plate shall be welded to the part circumference of the pipeline that will make contact with the saddle and another similar plate shall also be embedded in the concrete saddle with necessary arrangement to facilitate welding it to the double plate welded to the pipe, in case of fixed support. In case of sliding support, the pipe shall be allowed to slide freely over the plate embedded in the saddle. Alternatively to achieve fixity, the pipe shall be anchored by providing suitable anchor block. The rate for laying the pipe on saddle support shall include for laying, aligning, tack welding, provision of rigging screws with screw eyes etc., complete. In addition to above, the pipe shall be held in position on saddles with two numbers 50mm x 8mm thick holding down traps fixed to the saddles with holding down bolts and nuts.

49.20.5 Erection of Shells

The erection shall be true to position, lines and grade of the trench prepared or as modified by the (SCDCL) Engineer. The Contractor shall provide at his cost necessary saddles, pads, spider etc., all necessary instruments and other materials and labour required for proper erection of shells in position and for the (SCDCL) Engineer in checking the correctness of the erection. Alignment of sections at edges to be butt welded shall be such that the maximum offset is not greater than the values given below:

Thickness 't' (mm)	Offset in Longitudinal joints (mm)	Offset in Girth joints (mm)
Up to 12	0.25 t	0.25 t
12 to 20	3 mm	0.25 t
20 to 40	3 mm	5 mm
40 to 50	3 mm	1/8 t
Over 50	Lesser of 0.0625 t or 10 mm	Lesser of 0.125 t or 20 mm

The best of welders as selected from their work in the Contractor's workshop shall be selected for in-situ welding of the shells. The relevant provision under welding such as qualification standard for welding procedures, tests on welder's work and removal of defects etc., shall also apply to in-situ welding.

49.21 General Sequence of Operations

Before commencing the work of pipe laying, the Contractor shall study the L-section of the pipeline for the section concerned. He shall also study the details of laying i.e. underground or aboveground. The underground pipeline shall be laid on sand cushioning/ bedding as shown on the drawing. The difference in depth due to uneven excavations shall be made up by sand cushioning. Pipe laying shall generally start from the fixity points on either side, the expansion joints if required for pipeline aboveground being provided last. Fixing points are at all anchor blocks. Where such blocks are not required for long lengths, fixity shall be achieved by fixing the pipeline to the special type of R.C.C. or steel saddles as specified. The distance between successive fixity points shall not exceed 300 m. Thrust and Anchor blocks shall be constructed before commencing the pipe laying work in any section. The construction of the blocks shall be carried out in 3 stages: in the first stage the lower part up to 150 mm below the invert of the pipeline including concrete chairs to support it shall be constructed; in the second stage the pipeline on this part of the block shall be laid; and lastly, the remaining block around and over the pipeline shall be constructed. The fixity saddles and ordinary saddles if the pipeline is aboveground shall be cast-at least 3 weeks before the pipeline is laid on them. After all saddles between successive fixity points have been cast, a line plan showing the actual position thereof shall be prepared, after taking levels and measuring distances. In case of any errors in casting the pedestals, corrections shall be applied. The pipe laying work shall then start from the fixity points and shall proceed towards the expansion joints. The method of jointing the pipes and erecting them on previously cast R.C.C. saddles shall be determined by the Contractor depending upon the type of plant equipment and personnel available with them. The pipe strakes shall be assembled in position on the saddles either by the cranes, portable gantries, shear legs or any other equipment approved by the (SCDCL) Engineer. Normally, not more than two pipes shall be aligned, tacked and kept in position on temporary supports. The Contractor shall not proceed with further work, until the circumferential joints of these pipes are fully welded. During assembly, the pipeline shall be supported on wooden sleepers and wedges, with the free end of the pipeline held in position by slings to avoid deflection due to temperature variations during the day. In general, the assembly of pipe strakes and one run of welding shall be done during the day time while full welding including the external gouging and sealing runs shall be done after 5 p.m. or so. The Contractor shall maintain the continuity of the work by adding two more pipes on the second day in a similar manner, after full welding of the previous joints is completed during the night. While this new work is being done, the Contractor shall proceed with the work of providing permanent supports for the pipeline assembled and welded previously.

49.22 Fixing Expansion Joint

The work of laying pipeline at above the ground, laying starts from the fixed points and proceeds towards the expansion joints. It shall be continued until the gap between the pipe ends is less than the lengths of the expansion joint plus pipe stroke length. At this stage, the exact gap between the pipe ends shall be measured at mean temperature of that locality. Let it be 'X'. Similarly, the exact length of the pipe stroke and the expansion joint bought at site shall be measured at the same temperature let these be 'Y' and 'Z' respectively. Normally, the length of the expansion joint ('Z') is standard.

1.22.1 Case when 'Y' plus 'Z' is more than 'X' or equal to 'X' (i.e. fixing of expansion joint without strip)

At mean temperature the exact gap between pipes shall be measured. Free ends of pipes shall be brought in a correct line and level; lateral movement, if any, shall be corrected. Then the gap between the free ends shall be made equal to the exact length of the expansion joint by cutting one of the pipe ends. Choice of the end to be cut must be made from the point of view of bringing the expansion joint to a central position. The expansion joints are normally supplied without packing. The normal length of the expansion joint shall be reduced by about 100 mm by cutting the inside locks and inserting the inner stroke by means of turn buckles. At mean temperature this expansion joint shall be inserted inside the gap (care being taken to keep the tapered portion on the down-stream side), and both ends shall be tack welded to the pipe ends, after pulling the expansion joint. (Tacks of these two joints shall be of longer length, approximately 100 mm long). Welding of these two joints of the expansion joints shall be started only after it is ascertained by taking observations that the expansion joint is functioning properly. The procedure to be followed for taking observations as specified.

49.22.2 Case when 'Y' plus 'Z' is less than 'X' (i.e. fixing of expansion joints with strap)

The expansion joint shall be laid in locked position. Before laying the pipes adjacent to the expansion joint, the exact gap between the pipes shall be calculated by taking measurements of the first pipe (upstream of the expansion joint), and the second pipe (downstream of the expansion joint) at Mean Temperature. If the gap is less than 100 mm, the second pipe shall be cut to make the desired gap of at least 100 mm. If the gap is more than 200 mm, suitable distance piece of not less than 600 mm shall be inserted after cutting necessary length of the first pipe. The second pipe shall then be laid in position. Then a strap of length equal to three times the gap length shall be welded to the pipe, overlapping the second pipe by the gap length. The other end of the strap shall be kept free. At mean temperature the other end of the strap shall be tacked to the first pipe, after checking of the line and level. Simultaneously, all the locks of the expansion joint shall be removed and chipped off properly. Welding of the joints between the strap and the first pipe shall be started only after observations are over and it is ascertained that the expansion joint is

functioning properly.

49.22.3 Observations

Before fixing the expansion joint, two mercury cups - one on the left and the other on the right side - shall be fixed on the pipe near the upstream side of the expansion joint. Immediately after the expansion joint in case (a) above or the strap in case (b) above is tack welded, observations for total expansion or contraction shall be started and continued for 48 hours round the clock. Similarly, the central and end fixity pedestals shall be kept constantly under observation. The expansion and contraction shall be measured by making a temporary marking on the inner strake (on the upstream side) and measuring the distance between this mark and the edge of the gland of the expansion joint. The observations shall be recorded in the following Performa;

Reading No.	Time	Shell temp on up-stream side	Shell temp on down-stream side	Atmospheric temperature	Dist between edge of gland and marking
1	2	3	4	5	6

In case the pipeline is laid in trenches as shown on the drawing, after welding and field testing, the trench shall be filled with selected material up to 300 mm above pipes. This backfill shall be provided in layers not more than 150 mm, with a density more than 70 to 80% of the standard proctor density. Samples shall be tested as directed by the Engineer. Remaining depth of trenches shall be filled with ground backfill material.

49.23 Specials

49.23.1 General

Specials, such as tees, Y-pieces, bends (single or composite), tapers, etc. shall necessarily be in steel and shall be manufactured as per standards and tested and laid in the same manner as the pipes. Small branches, single piece bends, etc. may be fabricated at site, care being taken to ensure that the fabricated fittings have at least the same strength as the pipeline to which they are to be jointed.

49.23.2 Bends

- a. Bends shall be fabricated taking into account the vertical and horizontal angles for each case.
- b. The bends shall have welded joints and the upstream and downstream ends of each bend shall have a straight piece of variable lengths as required.
- c. Bends shall be designed with deflection angle of maximum 10 deg. between segments.

d. When the point of intersection of a horizontal angle coincides with that of a vertical angle, or when these points can be made to coincide, a single combined or compound bend shall be used, designed to accommodate both the angles. The combined bend should have a pipe angle equal to the developed angle, arrived at from appropriate formula.

e. All joints in bends shall be thermally stress relieved as specified.

f. Details of thrust collars anchor bolts, holding down straps, saddle Coils should be furnished together with full specifications in Contractor's fabrication drawing.

49.23.3 Manholes

Manholes of 750-mm dia. shall be provided at both the sides of butterfly valves and as directed by (SCDCL) Representative. Manholes in the pipeline shall be placed in suitable position in the top quadrant.

- a. The Contractor shall fabricate different parts of manhole in conformity with relevant IS Specification, well-established practices and as directed by the (SCDCL) Engineer.

49.23.4 Closing or Make up sections

Closing or make up sections shall be furnished at appropriate locations on the line to permit field adjustments in pipeline length to compensate for shrinkage in field welded joints, differences between actual and theoretical lengths and discrepancies in measurements.

49.23.5 Heads

Test heads may be ellipsoidal, standard dished as per ASME code or hemispherical heads. They shall be welded in the shop and removed after the test. Allowance should be made in the length of the pipe section receiving the test head for the welding and removal of the head and preparation of the plate edges for the final weld after testing. No separate payment will be made for such test heads. The rate quoted for the hydraulic test shall be deemed to cover the cost of such installations.

49.23.6 Walkways, Stairs, Ladders, Hand Rails etc.

Walkways, stairs, rungs, ladders, hand rails, etc. shall be provided as shown in the drawings and/or as directed by the Engineer. They shall conform to well established design and construction for each accessory concerned.

49.23.7 Flanges

Flanges shall be provided at the end of pipes or special where sluice valves, blank flanges, tapers, etc. have to be introduced. The flanges received from the MANUFACTURERS will have necessary bolt holes drilled. The Contractor shall assemble the flanges in the exact position by marginal cutting, if necessary, so as to get the desired position of the sluice valves, etc. either vertical or horizontal and shall then fully weld the

flanges from both sides in such a way that no part of the welding protrudes beyond the face of the flanges. In case the welding protrudes beyond the flanges and if the (SCDCL) Engineer orders that such protrusions shall be removed, the Contractor shall file or chip them off. If required and when ordered by the Engineer, the Contractor shall provide and weld gusset stiffeners, as directed on site. The drilling pattern shall be matching with the drilling pattern of flanges of valves.

49.23.8 Blank Flanges

Blank flanges shall be provided at all ends left unattended for the temporary closure of work and also for commissioning a section of the pipeline or for testing the pipeline laid. For temporary closures, non-pressure blank flanges consisting of mild steel Coils, tack welded at the pipe ends may be used. For pipes subjected to pressures, the blank flanges or domes suitably designed as per (SCDCL Engineer's requirements shall be provided.

49.23.9 Stiffener Rings

The Contractor shall provide stiffener rings wherever required by design. The Contractor shall weld the same to the pipes with one circumferential run on each side. All fillet welds shall have a throat thickness of not less than 0.7 times the width of welding.

49.24 Field Hydraulic Test

After erection at site and after the concrete Thrust/anchor blocks have been constructed, the pipeline shall be subjected to a 100% hydraulic test. The pressure test shall be conducted in as per IS-5822. During the test, the pipe shall be struck sharp blows with 1 Kg hammer. Water shall not spout, ooze or sweat either through joints-welded or bolted or the body of the pipe. If any leakage noticed shall be repaired by the Contractor, which shall include coating and repairing of the damaged portion. Repairs and replacements and further testing including the cost of the Coils and other raw materials shall be carried out by the Contractor at his own cost. If any leakages are observed during the defects liability period due to defective workmanship or material supplied by the Contractor, he shall repair the same to the entire satisfaction of the (SCDCL Employer, at his own cost. / shall assist the contractor in identifying the source & in obtaining permission for drawl of water for field-testing of pipe. The contractor shall pay for the water and carry the water to the test location at his cost. The cost of hydraulic testing of the installation by providing necessary testing equipment, pumping the water, creating and maintaining pressure, and the necessary bulk heads and their fixtures, and their subsequent removal and restoring the installation to working trim shall be included in the rate for laying and testing of the pipe. / may also provide water for testing and civil construction work from its adjacent pipeline at a rate of Rs. 4/- per Kiloliter, if feasible. Contractor shall seek prior permission of (SCDCL) in writing and shall water meter at his own expense.

49.25 Progress in Laying

The TENDERER shall submit along with the tender his detailed bar chart for manufacturing and laying of the pipeline. While preparing his bar chart, the Tenderer shall plan his activities such that the laying of pipes shall closely follow the manufacturing schedule and no pipes shall remain stacked in factory or at site for a period more than two months.

It is mandatory that he shall submit an approach note on how he will carry out this Work within the contractual period and on the compatible resources in terms of construction equipment and other facilities that he shall utilize to complete the tendered Work.

49.26 Field Destruction Test

Contractor shall perform destruction test of any section of MS Pipeline which (SCDCL Engineer selects at every 5 KM pipeline laid and shall submit its result to him. The testing shall be done in the NABL approved laboratory in the presence of representative of the (SCDCL) employer.

49.29 PRESERVATION, MARKING AND SHIPPING PRESERVATION

49.29.1 Preservation

Cutback of minimum 50 mm +/- 10mm shall be provided over both ends of pipes on internal coating. The bare ends of each pipe shall be painted outside with a removable varnish as temporary corrosion protection during transportation. Spiders and/or Bevel protectors of a type to be approved by the (SCDCL) Engineer shall protect the bare ends of each pipe. Spiders shall be welded with pipes in such a way that inside coating do not get burnt.

49.29.2 Marking

In addition to the marking required by API 5L, the specification MO1 "Steel Pipes for Mainlines and other applicable project specifications, the Pipe Coating Contractor's unique coating number shall be marked to the internal surface or the pipe with synthetic resin paint. Further marking details like colour coding, etc. shall be agreed upon with the (SCDCL) Engineer. The marking shall have at least a distance of 150 mm to the pipe end.

49.29.3 Shipping

Shipping and Loading preparation shall be in accordance with API Specification 5L or otherwise stated in the contract documents. The Pipe Coating Contractor shall submit detailed loading, stacking- and shipping procedures for approval by the (SCDCL) Engineer.

49.30 DOCUMENTATION

49.30.1 Pre-Production Documentation

The Pipe Coating Contractor shall submit the following documents to the (SCDCL) Engineer for approval prior to commencing production:

- a. The MMANUFACTURER's trade name and data sheets for all proposed coating
 - b. Materials. This includes cleaning and abrasive blasting consumables.
 - c. Procedure for identifying or maintaining the identification of each coated item.
 - d. Handling procedure.
 - e. Stacking procedure.
 - f. Materials control and traceability procedure for the batches of coating materials.
 - g. Materials storage procedure (pipe and coating materials)
 - h. Procedure for steel surface preparation including materials, cleaning, inspection, verification of cleanliness and surface profile.
 - i. Coating application procedures, including Fusion Bonded Epoxy (FBE). Adhesive and polyethylene layers.
 - j. The results of the batch tests for batches to be used for pre-qualification tests.
 - k. Details of testing methods including instrument types and copies or current calibration certificates.
 - l. Details of inspection methods for bare and coated pipe.
 - m. Full test results from the coating Procedure Qualification Test (PQT).
 - n. Repair procedure and results or tests on demonstration of repairs.
 - o. Project specific Quality Plan.
- Work shall not commence until these procedures have been reviewed and approved by the Engineer. The selection of proposed coating materials shall be subject to (SCDCL) Engineer's approval.

49.30.2 Production Records

A daily log containing the following data shall be maintained and be available for inspection by the (SCDCL) Engineer during and/or after production. Data shall be recorded against the pipe unique identification number.

- a. Bare pipe inspection data
- b. Ambient temperature (every 4 hours)
- c. Humidity (every 4 hours)
- d. Coating progress (no. of items coated. including item serial numbers)
- e. Blast pipe surface amplitude

- f. Tests for cleanliness of blast surface
- g. Tests for cleanliness or blast medium
- h. Film thickness measurements
- i. Average, maximum and minimum coating thickness during each shift
- j. Details of any coating defects recorded and defect density on respective pipe lengths
- k. Details of any coating repairs
- l. The unique identification number of all items that are stripped for recoating
- m. Pipe coating test results

This log shall be available to the Engineer throughout all coating operations

49.30.3 Release Documentation

The Pipe Supplier and/or Pipe Coating Contractor shall submit to the (SCDCL)Engineer the following documentation in hard copy and softcopy (format to be agreed upon with the (SCDCL)Engineer with each batch of pipes released:

- a. Mill certificates for line pipe
- b. Production listing for each batch
- c. Unique pipe identification numbers
- d. Unique coating identification number (if different)
- e. Pipe length
- f. Length of the coated portion of each pipe and total coated lengths of all pipes.
- g. Reductions in lengths due to use in tests, damage or repairs, recorded against pipe unique identification number
- h. Date of coating
- i. Batch numbers of coating materials used

This shall be followed within two weeks by the following:

- a. Manufacturer's certificates for each batch of coating materials
- b. Certification/calibration certificates for all testing and coating equipment
- c. Inspection and test records, results, and other documentation of all materials and coating tests

All reports shall be signed by the Pipe Coating Contractor to signify compliance with the requirements of this specification.

INTERNAL LINING & EXTERNAL COATING: 3-LAYER POLYETHYLENE (3LPE)

49.31 SCOPE

This Specification defines the minimum requirements for the application of three-layer polyethylene lining & coating to the external surface of steel pipes and internal surface of steel pipes for water transmission pipe line.

49.32 CODES AND STANDARDS

This latest edition of the following codes and standards shall establish the minimum standards for the work

Sr. No.	Code	Description
1	ANSI/AWWA C213	Standard for Fusion-bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
2	ASTM D149	Standard test method for dielectric breakdown voltage and dielectric strength of solid electrical insulating materials at commercial power frequencies.
3	ASTM D257	Test methods for dc resistance or conductance of insulating materials.
4	ASTM D570	Standard test method for water absorption of plastics
5	ASTM D638	Standard test method for tensile properties of plastics
6	ASTM D746	Standard test method for brittleness temperature of plastics and elastomers by impact.
7	ASTM D790	Standard test method for flexural properties of unreinforced and reinforced plastics and electrical insulating materials.
8	ASTM D1238	Standard test method for melt flow rates of thermoplastics by extrusion plastometer.
9	ASTM D1505	Standard test method for Density of plastics by the Density-Gradient Technique.
10	ASTM D1525	Standard test method for Vicat softening temperature of plastics.
11	ASTM D1531	Standard test methods for relative permittivity (dielectric constant) and dissipation factor by fluid displacement procedures.
12	ASTM D1603	Standard test method for carbon black in define plastics
13	ASTM D1928	Standard practice for preparation of compression-moulded polyethylene test sheets and test specimens.
14	ASTM D2240	Standard test method for rubber property – durometer hardness.
15	ASTM D3417	Standard test method for enthalpies of fusion and crystallization of polymers by differential scanning calorimetry (dsc)
16	ASTM D4703	Standard test practice for compression Molding Thermoplastic Materials into Test Specimen, Plaques or Sheets.

Sr. No.	Code	Description
17	ASTM F372	Standard test method for water vapour transmission rate of flexible barrier materials using an infrared detection technique
18	AWWA C 200-97	Steel water pipe line
19	ASTM G8	Standard test method for Cathodic Disbonding of pipeline Coatings.
20	CAN/CSA Z 245:1	Internal fusion bond epoxy coating / lining of steel pipes.
21	DIN 30670	Polyethylene Coatings of Steel pipes and Fittings – Requirements and Testing.
22	DIN EN ISO 9001 2000	Quality management systems – Requirements
23	DIN EN ISO 8501-1	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings.
24	DIN EN ISO 8502-2	Preparation of steel substrates before application of paints and related products – Tests for the assessment of surface cleanliness – Part 2: Laboratory determination of chloride on cleaned surfaces.
25	DIN EN ISO 8502-3	Preparation of steel substrates before application of paints and related products – Tests for the assessment of surface cleanliness – Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)
26	DIN EN ISO 8502-4	Preparation of steel substrates before application of paints and related products – Tests for the assessment of surface cleanliness – Part 4: Guidance on the estimation of the probability of condensation prior to paint application.
27	DIN EN ISO 8502-9	Preparation of steel substrates before application of paints and related products – Tests for the assessment of surface cleanliness – Part 9: Field method for the conduct metric determination of water-soluble salts.
28	DIN EN ISO 8503-1	Preparation of steel substrates before application of paints and related products – Surface roughness characteristics of blast-cleaned steel substrates – Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast cleaned surfaces.
29	DIN EN ISO 8503-2	Preparation of steel substrates before application of paints and related products – Surface roughness characteristics of blast-cleaned steel substrates – Part 2: Method for the grading of surface profile of abrasive blast-cleaned steel – comparator procedure.

Sr. No.	Code	Description
30	ISO 8502-5	Preparation of steel substrates before application of paints and related products – Tests for the assessment of surface cleanliness – Part 5: Measurement of chloride on steel surfaces prepared for painting (ion detection tube method)
31	NACE RP0490	Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coatings of 250 to 760mm (10 to 30 mils)
32	NACE RP-01-75	Recommended practice: control of International corrosion in steel pipe line system.
33	SIS 05-5900	Preparation of steel substrates before application of paints and related products – visual assessment of surface cleanliness – PT 1: rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous.

49.33 GENERAL

49.33.1 Environmental Conditions

The environmental conditions operating conditions, product data, etc. under which the pipes shall operate and defined in Documents. Scope of Work, Project Design Data and Site Conditions and Specification for Pipeline construction.

49.33.2 Definitions

The terms “Contractor”, “Pipe Supplier”, “Pipe Coating Contractor”, “Engineer”, etc. used in this specification shall have the meanings defined in the General and Special Conditions of Contract.

49.33.3 Abbreviations

ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
DIN	German Standards Institute
ISO	International Organization for Standardization
NACE	National Association of Corrosion Engineers
NPS	Nominal Pipe Size
MPI	Magnetic Particle Inspection
UT	Ultrasonic Testing
SIS	Swiss standard
AWWA	American Water Works Association.

49.33.4 Conflicting Requirements, Exceptions

The Pipe Coating Contractor shall notify the Engineer of any conflict between this specification, the codes and standards and any other specifications included as part of the contract documents related with line pipes and coating. Any exceptions to this specification and referenced docu-

mentation shall be raised by the Pipe Coating Contractor and approved by the (SCDCL)Engineer in writing.

49.34 TECHNICAL REQUIREMENTS

49.34.1 HANDLING OF COATING MATERIALS

49.34.1.1 General

Materials shall be brought from the GWIL approved vendor list only and shall be handled and stored in accordance with the material manufacturer's recommendations, which shall be available for review by the (SCDCL)Engineer at the Pipe Coating Contractor's premises. Materials shall be stored in temperature controlled environment until required for use. Coating materials shall be segregated by type and batch during storage and handling. Materials from damaged containers shall be rejected unless otherwise agreed with the (SCDCL)Engineer. As a minimum, all packages of the coating materials shall be marked with the following data:

- a) Name of MANUFACTURER
- b) Complete material identification – trade name, chemical name and
- c) type of product details
- d) Batch number
- e) Date of manufacture
- f) Place of manufacture
- g) Shelf life/expiry date (if appropriate)
- h) Health and safety, and environmental instructions
- i) Hazard Warnings
- j) Storage instructions
- k) Quantity
- l) Manufacturing Standard

Any material not labelled with the above information shall not be used.

49.34.1.2 Abrasive Grit

The abrasive shall be steel grit, also in combination with steel shot of the required grade to achieve the specified surface profile. The use of sand is not permitted. Blasting abrasives shall be kept dry, clean and free from contamination. When recovered metallic grit systems are used, a stabilized working mix of blast cleaning material shall be established. This mix shall be maintained throughout the entire course of the production, by frequent small additions from fresh or cleaned stock at a rate sufficient to re-furnish consumption. Blasting and other dust producing areas shall be kept separate from coating application areas. The surface cleaning shall be degree of cleanliness as per SA 21/2 & ISO 8502-3.

49.34.1.3 FBE Powder

The FBE powder selected shall be suitable for use at the design temperatures in the proposed environment and be suitable for a three layer polyethylene coating system. The FBE shall be endorsed by the Pipe Coating contractor of the adhesive and Polyethylene as being compatible with

these products under the specified service conditions. Each batch of FBE shall be accompanied by a certificate stating the following tests have been carried out on every batch and results are in accordance with the coating material MANUFACTURER's product specifications;

- a. Gel Time
- b. Moisture content
- c. Particle size distribution
- d. Density
- e. Infrared Scan
- f. Thermal analysis

49.34.1.4 Adhesive

The adhesive selected shall be completely suitable for use at the design temperatures in the proposed environment and be suitable for a three layer polyethylene coating system. Each batch of adhesive shall be accompanied by a certificate stating the following tests have been carried out on every batch and results are in accordance with the coating material MANUFACTURER's product specifications:

- a. Adhesion
- b. Density
- c. Melt flow index

31.34.1.5 Polyethylene

The polyethylene selected shall be or high density and shall be completely suitable for use at the design temperatures in the described environment. The polyethylene shall be suitable for a three-layer polyethylene can be stabilized against UV-rays before or after granulating the material. Each polyethylene batch shall be accompanied by a certificate stating the following tests have been carried out on every batch and results are in accordance with the coating material MANUFACTURER's product specification:

49.34.2 PROPERTIES OF EPOXY POWDER & ADHESIVE

MANUFACTURER shall choose such a brand of epoxy powder and adhesive that will achieve the functional requirement and properties of coating system as specified and shall submit a compatibility certificate in this regard from the MANUFACTURER of materials. In absence of such certificate, compatibility test shall be conducted by the contractor by contractor at his own cost. In addition, the Manufacturer shall also furnish Infra-red Scan for each batch of epoxy powder. The coating materials Supplier shall issue test certificates as per EN 10204 for each batch of materials supplied to MANUFACTURER and the same shall be submitted to PURCHASER for approval prior to their use. Epoxy powder properties shall be as per CSA Z245.20.98 (latest revision). The colour of epoxy powder shall be either green or dark red or any other colour approved by COMPANY except grey colour. Copolymer grafted adhesive shall have the following properties.

Sr.No.	Properties	Unit	Requirement	Test Method
a.	Melt Flow Rate (1900C/216 kg)	g/10 minutes	1.0 min	ASTM D 1238
b.	Vicat Softening Point	0C	100 min	ASTM D 1525
c.	Specific Gravity	-	0.926 min	ASTM D 792

Properties of Polyethylene Compound

Sr.No.	Properties	Unit	Requirement	Test Method
a.	Tensile Strength @ + 25 0C	N/mm2	17 min	ASTM D638
b.	Melt Flow Rate (1900C / 2.16 kg)	g/10 minutes	0.25	ASTM D 1238 or DIN 53735
c.	Specific Gravity + 250C	-	0.926 min. (MDPE) 0.941	ASTM D 792
d.	Hardness @ + 250C	Shore D	50 min.	ASTM D 2240
e.	Water Absorptions, 24 hours @ + 250C	%	0.05 mz.	ASTM D 570
f.	Volume Resistivity @ + 25 0C	Ohm-cm	1015 min.	ASTM D 257
g.	Dielectric withstand, 1000 Volt/sec rise @ + 250C	Volts/mm	30,000 min.	ASTM D 149
h.	Vicat Softening Point	0C	110 min.	ASTM D 1525
i.	Elongation	%	600 min.	ASTM D 638
j.	Oxidative Induction Time in Oxygen at 2200C, Aluminium pan, no screen	Minutes	10 min.	ASTM D 3895
k.	Environmental Stress Crack Resistance (ESCR) (for F50) - Medium Density , Condition "C" - High Density, Condition "B"	Hours	300 300	ASTM D 1693
l.	Carbon Black Content	%	2 min.	ASTM D 1603

In addition to vendor's certificate, the MANUFACTURER shall draw samples from each batch of epoxy, adhesive and polyethylene in the presence of PURCHASER and the test for the following properties at the coating

yard at least one week prior to its use, to establish compliance with the Manufacturer's test certificates.

a. Epoxy Powder: Gel Time, Cure Time, Moisture content, Thermal Characteristics (Tg1, Tg2, ΔH)

b. Adhesive: Specific gravity, Melt Flow Rate, Vicat Softening Point

c. Polyethylene: Melt Flow Rat, Specific Gravity, Vicat Softening Point, Moisture content, Oxidative Induction Time.

In Case of the failure of any of the above tests in a batch, that batch of material shall be tested for all other tests required including the tests which failed. If all tests pass, the batch shall be accepted for coating. If any of the tests fail, entire batch of material shall be rejected and shall not be used for the coating. MANFUCATURER shall ensure that all coating materials are properly stored in accordance with the Manufacturer's recommendation at all times, to prevent damage and deterioration in quality prior to use.

Properties of coating System

Sr.N o.	Properties	Unit	Requirement	Test Method
a.	Bond Strength (using Type 2 test assembly i.e. Dynamometer) - @ 20+ /- 50C - @ 65 +/- 50C	Kg/cm	8.0 min 5.0 min	DIN 30670
b.	Impact Strength (Mon. of 30 impacts on body along the length. No breakdown allowed when tested at 25 kV)	Joules per mm of coating thickness	7 min	DIN 30670
c.	Indentation Hardness - @ 23 +/- 20C - @ 70 +/- 20C	mm	0.2 max 0.3 max	DIN 30670
d.	Elongation at Failure	%	300 min	DIN 30670
e.	Coating Resistivity (*)	Ohm-m2	108 min.	DIN 30670
f.	Heat Ageing (*)	-	Melt Flow	DIN 30670
g.	Light Ageing (*)	-	rate shall not deviate by more than 35% of original value Melt flow rate shall not deviate by more than 35% of original value.	DIN 30670
h.	Cathodic Disbandment - @ + 650C after 30 days - @ + 650C after 48 hrs	Minimum radius of disbandment (**)	15 max 7 max	ASTM G42
i.	Degree of Cure of Epoxy - Percentage Cure, ΔH - ΔTg	% 0C	95 +3/-2	CSA Z 245.20 – 98 (***)

(*) Test carried out in an independent laboratory of national / international recognition of PE top coat is also acceptable. (**) Disbandment shall be equivalent circle radius of total unsealed area as per ASTM G 42. (***) Temperature to which the test specimens are to be heated during cyclic heating shall however be as per the recommendations of epoxy powder MANUFACTURER.

49.34.3 Acceptance of Pipe Materials

49.34.3.1 Identification and Tracking

Upon receipt at the coating factory, the Pipe Coating Contractor shall record the following pipe information:

The unique pipe identification number, measured length, and measured weight (both to be found stencilled in paint on one end of the pipe). This data shall be used as a basis for monitoring pipe from the time of receipt until the delivery of coated pipe. The Pipe Coating Contractor shall identify (or maintain identification of) every coated item, by using a weatherproof mark on the inside of the pipe and on the outside of the coated item. The pipe identification shall be the unique pipe identification number (the number required by the applicable pipes specification). The pipe coating contractor may use additional tracking numbers at his discretion but these shall relate simply to the unique pipe number in the QC documentation. Pipe tracking shall be carried out in accordance with approved procedures.

49.34.3.2 Preliminary Inspection

The Pipe Coating Contractor shall carry out visual inspection of all pipes. The Pipe Coating Contractor shall record all external damage on pipes against the unique item serial number. This damage shall be brought to the attention of the (SCDCL)Engineer and the Pipe shall not be coated without prior release by (SCDCL)Engineer. Bevel protectors at each end of every pipe joint shall not be removed unless showing signs of damage or if removal is required to facilitate surface preparation, or they would be damaged by coating operations. If the protectors are removed the conditions of the bevel shall be recorded against the pipe serial number and any damage shall be brought to the attention of the (SCDCL)Engineer.

49.34.3.3 Damage to Pipe and Pipe Ends and Repair

No repair work shall proceed until a written procedure has been prepared by the Pipe Coating Contractor and approved by the (SCDCL)Engineer. Minor damage to pipe and pipe ends/bevels, identified either at time of receipt or after abrasive blasting shall be repaired by grinding. The number of such damages shall be not more than 3 per pipe. Repair by grinding on the pipe or pipe ends/ bevels outside diameter shall not reduce the wall thickness to less than the minimum requirements of the line pipe specification, when measured using ultrasonic thickness measurement equipment. All other damage to pipe ends/bevels shall be advised to the (SCDCL)Engineer for review. Subject to(SCDCL) Engineer's approval, these defects may be repaired by removal of damaged pipe material and re-bevelling. No welding on the pipe surface shall be allowed. Pipe identi-

fication numbers shall be preserved during repair. Any reduction in pipe lengths shall be recorded in the relevant forms and files.

49.34.4 Prior to Coating Application

49.34.4.1 Stages

The principle stages of pipe coating shall be as follows:

- a. Solvent cleaning followed by steam or hot bath cleaning (if required)
- b. Abrasive blasting
- c. Application of fusion bond epoxy (FBE) layer
- d. Application of adhesive layer
- e. Application of polyethylene layer

49.34.4.2 Cleaning Prior to Abrasive Blasting

All surface contaminants such as oil, grease, tar, salt, or other contaminants on the pipe shall be removed by solvent cleaning followed by steam or hot bath cleaning, in accordance with a procedure approved by the Engineer. Following the steam or hot bath cleaning the pipe shall be tested for salt and chloride contamination in accordance with the requirements of DIN EN ISO 8502-2, ISO 8502-5 or DIN EN ISO 8502-9. The removal of hydrocarbon contamination shall be confirmed by a water spray test, where a fine spray is applied to the surface and uniform wetting confirms the removal. This check shall be performed before and after blasting, as a pre-qualification test and as a minimum, once per 100 items during production, or when necessary. Items found to be contaminated shall be cleaned as above and re-blasted if testing after blasting establishes that salt, chloride or hydrocarbon contamination is still present. The remainder of the batch concerned shall all be checked individually. All water used for rinsing or cleaning purposes shall be potable with less than 200 ppm total dissolved solids and 50 ppm chlorides.

49.34.4.3 Abrasive Blasting

Blasting and other dust producing areas shall be separate from coating application areas. After cleaning and prior to abrasive blasting the pipe lengths shall be free from moisture, dust, and grease and free from other foreign materials. Abrasive and dust, which entered the inside of the pipe during blasting operation, shall be removed by suitable means. Weld joints, sharp-edge projections; weld spatter and slag etc. shall be dressed prior to blast cleaning. Using dry blasting techniques only, the exterior surface of the pipe joints shall be abrasively cleaned to remove all mill scale, and other impurities from the surface. No blast cleaning shall take place when the prevailing relative humidity is higher than 85 percent unless pipe is preheated to at least 3° C above the dew point.

Twice per shift, samples of the abrasives mixture shall be removed from the hopper and checked for hydrocarbon contamination. The sample shall be placed in a beaker to which de-ionized water is added. The beaker shall then be sealed and shaken vigorously. Once the grit has settled the surface of the water shall be examined for signs of hydrocarbon contamination. If any signs are found all the abrasive in the hopper shall

be rejected and not re-used. Additionally, abrasive materials shall be checked at least once per shift to ensure that only uncontaminated angular grit with an acceptable size distribution is used. As a minimum the following shall be carried out. Correct abrasive size distribution shall be carried out by sieve analysis. Placing a sample of abrasive on a clean, dry sheet of absorbent paper to determine water contamination. The surface of the pipes shall be blasted until a finish of Grade 2.5 to DIN EN ISO 8501-1 is attained. The surface profile shall be between 50 to 75 microns, measured in accordance with DIN EN ISO 8503-2. Profile measurements shall be made with a Keane Tator Profile Comparator, Testex Press –O-Film or other Engineer approved method suitable for the abrasive being used. Following abrasive blasting, the surface shall not be contaminated with dirt, dust, metal particles, hydrocarbons, water, chlorides, sulphates or any other foreign matter, which would be detrimental to the coating. Prior to the coating application, the exterior surface shall be thoroughly inspected under adequate lighting. Any damage such as surface imperfections, slivers, scabs, burrs, gouges, or sharp edged defects, shall be repaired in accordance with this specification. Pipes that have damage repaired by grinding and have ground areas greater than 50 mm diameter shall be re-blasted to meet the requirements. After grinding or mechanical repairs the wall thickness shall be ultrasonically examined and compared with the minimum requirements of the applicable code / standard.

Any dust or loose residue that has accumulated during blasting and/ or grinding operations shall be removed by the use of clean compressed air or by vacuum extraction. Alternative methods for removing dust and lint shall require approval of the Engineer.

The elapsed time between the start of blasting and the heating of pipe shall be indicated in the application procedure submitted by the Pipe Coating Contractor and shall be reflected on his plant scheme. The total elapsed time between the start of blasting of any pipe and the heating of that pipe to the specified temperature shall not exceed the following time-humidity table:

PERCENT RELATIVE HUMIDITY	ELAPSED TIME (HOURS)
85	0.5
80	1.0
70	2.0
60	2.0

Any pipe surface not processed within the above time-humidity table shall be completely re-cleaned and re-blasted before coating. The maximum time limit between blasting and coating for humidity below 60% shall be 4 hours. Note: The Method of Blasting will be finalized at the time of execution based on site condition.

31.34.5 Coating Application

49.34.5.1 General

The application of the coating shall be in accordance with the material MANUFACTURER recommendations and the procedure outlined below. The Pipe Coating Contractor shall perform coating procedure qualification testing (PQT) prior to commencing production or on his own risk at the start of production in accordance with this specification. Prior to start up of the coating process the powder application and recovery systems shall be thoroughly cleaned to remove any powder other than that is use, minimum once per day and the collected powder shall be disposed off.

49.34.5.2 FBE Layer

The FBE shall be applied to a minimum thickness of 200 microns. The pipe shall be uniformly preheated in accordance with the FBE MANUFACTURER's instructions. This temperature shall have been confirmed during PQT. The surface temperature shall not exceed 260 deg C in accordance with AWWA C213. Pipe temperature shall be checked periodically using pyrometer. The pyrometer shall be checked for error not less than every four hours against a calibrated temperature measuring instrument. The coating shall be applied by electrostatic spray with the pipe at earth potential and the epoxy powder charged to high potential. The use of reclaimed FBE powder is only permitted if the reclaimed powder is screened to remove foreign or deleterious material before being reintroduced into the powder application system.

The clean reclaimed powder up to a maximum of 20% shall be introduced back into the fresh virgin material by means of proportional weight.

During application, the bevelled ends and pipe bore shall be protected against mechanical damage and from contamination with coating material.

49.34.5.3 Adhesive Layer

The adhesive shall be applied to a thickness of 200 microns. The adhesive layer shall be applied before gel time of the FBE has expired. Application of the adhesive shall not be permitted after the FBE has fully cured. The Pipe Coating Contractor shall establish to the satisfaction of the Engineer that the adhesive is applied within gel time window of the FBE and at the temperature recommended by the adhesive MANUFACTURER. The Pipe Coating Contractor shall state the proposed minimum and maximum time interval between FBE and adhesive applications at the proposed pre-heat temperature.

49.34.5.4 Polyethylene Layer/Cutback

Nominal Size	Minimum Thickness in mm	
	Normal (n)	Increased (v)
≤ DN 100	1.8	2.5
> DN 100 to ≤ DN 250	2.0	2.7

> DN 250 to < DN 500	2.2	2.9
≥ DN 500 to < DN 800	2.5	3.2
≥ DN 800	3.0	3.7

The polyethylene layer shall be applied to a minimum thickness as per DIN 30670 over the pipe body and to a minimum of 90% body thickness over the production welds.

A polyethylene layer cutback of 150 mm (+10/-10mm) shall be provided at pipe ends. The polyethylene shall be applied over the adhesive within the time limits established during pre-production testing. The coating shall be cooled to below 60 deg C before handling. The ends of the coating shall be chamfered and bevelled to 30 to 45 deg. Immediately after the coating is fully cured, pipe identification marks shall be re-applied on the coated pipe using a method approved by Engineer.

49.34.6 INSPECTION, TESTING AND CERTIFICATION

49.34.6.1 GENERAL

In order to demonstrate that the MANUFACTURER's proposed coating procedure is capable of meeting the specification, the Pipe Coating Contractor shall undertake coating procedure qualification testing (PQT) prior to commencing production, or at his own risk at the start of production. The pipe coating Contractor shall also be required to test the finished coating during production to demonstrate continued compliance with this specification. Details of all inspections and testing shall be fully documented in accordance with this section. All states of the surface preparation, coating and testing shall be subject to 100% inspection by the Pipe Coating Contractor. (SCDCL) The Engineer shall be informed at least two weeks prior to the start of surface preparation to allow scheduling of inspection supervision work

49.34.6.2 Coating Procedure Qualification Testing (PQT)

Prior to commencing or at the start of full production five pipe joints of each diameter coated with FBE only and five pipe joints of each diameter with the full coating system shall be selected for PQT. All coating shall be in accordance with the coating procedure specifications and shall be witnessed by the (SCDCL) Engineer or its representative. The produced pipes will not be released until the successful results of the PQT can be provided. In case of long-term tests the PQT report shall be updated once the results can be provided. Any failure in meeting the specified acceptance criteria for the PQT will result in rejection of the coated pipes. (SCDCL) Engineer shall approve any remedial action, repairs or re-use. The test methods for all tests required for PQT on the FBE and the complete coating system shall be performed in the same manner as the production tests described in this specification. Pipes selected for PQT testing shall pass all the criteria containing before production commences. Any change in the coating material or coating procedure shall require re-

qualification. If any of the tests fails to meet the minimum acceptance criteria defined in this specification, then the pre-qualification pipes shall be rejected. Further pipes may be prepared and coated using revised procedures and further tests performed. Once acceptable results are obtained and approved by (SCDCL) Engineer, the Pipe Coating Contractor's quality plan and procedures shall be revised, and submitted to the (SCDCL) Engineer for approval. All items coated using the rejected procedures shall be striped and recoated to the revised procedures.

49.34.6.3 PQT Inspection and Test Summary

Inspection and testing summary for procedure qualification test (PQT) for three layer coating system for each pipe diameter:

Property	Acceptable Values	Frequency
On Arrival <ul style="list-style-type: none"> • Pipe Damage 	Minor damage/grinding <3 Per Pipe	Each Pipe
After Cleaning Chloride Oil Salt	2 mg/cm ² No contamination 3 mg/cm ²	Each Pipe
After Abrasive Blasting <ul style="list-style-type: none"> <input type="checkbox"/> Cleanliness <input type="checkbox"/> Profile <input type="checkbox"/> Contamination 	Sa 2.5 acc to ISO 8501 50 – 75µm No contamination	Each Pipe Each Pipe Each Pipe
property	Acceptable Values	Frequency of Tests
<ul style="list-style-type: none"> <input type="checkbox"/> Visual Inspection <input type="checkbox"/> Holidays <input type="checkbox"/> Thickness <input type="checkbox"/> Adhesion 	No surface defects No holidays Min/Max see as specified As specified	Each Pipe Each Pipe 10 per pipe 2 per pipe
Holidays Visual Inspection Coating Bare steel at pipe ends Production FBE PE cut backs	No surface defects 120+10/-0 mm width 10 to 40 mm width, Chamfered 150 + 10/-10 mm bevel 300 to 450	Each Pipe Each Pipe Each Pipe Each Pipe
Adhesion <ul style="list-style-type: none"> <input type="checkbox"/> Peel Test 	> 100 N/cm at 230 C ±50 > 50 N/cm at 500 C ±50	2 per Pipe 2 per Pipe
Impact Resistance	As specified	1 per pipe
% Elongation at Failure	As specified	2 per pipe
Cathodic disbondment	As specified	2 per pipe
DIN 30670	As specified	1 per pipe

49.34.6.4 PRODUCTION TESTING

Production testing shall be performed at the frequency shown below:

property	Acceptable Values	Frequency of Tests
On Arrival <input type="checkbox"/> Pipe Damage	Minor damage/grinding <3 Per Pipe	Each Pipe
After Cleaning Chloride Oil Salt	2 mg/cm ² No contamination 3 mg/cm ²	Each Pipe
After Abrasive Blasting Cleanliness Profile Contamination Pipe Damage	ISO-Sa 50 – 75µm No contamination As specified	Each Pipe 20 Each Pipe 20
FBE Layer <input type="checkbox"/> Visual Inspection <input type="checkbox"/> Holidays <input type="checkbox"/> Thickness <input type="checkbox"/> Adhesion	No surface defects No holidays Min/Max see As specified As specified	One pipe per day and one pipe when FBE batch changes
Coating Thickness (minimum)	As specified	Each Pipe
Holidays	No holidays	Each Pipe
Visual Inspection Coating Bare steel at pipe ends Production FBE PE cut backs	No surface defects 120+10/-0 mm width 10 to 40 mm width, Chamfered 150 + 10/-10 mm bevel 300 to 450	Each Pipe Each Pipe Each Pipe Each Pipe
Adhesion Peel Test	> 100 N/cm at 230 C +50	1 Pipe per 25 2 per Pipe
Cathodic Disbondment at Room Temperature	As specified	First pipe, last pipe and at intervals of every 500 pipes

The frequency of tests shown in the table above will be for normal production operations. This frequency of tests is subject to change at the discretion of the Engineer as a result of change of materials or consistent poor production performance.

49.34.6.5 HOLIDAY DETECTION

a. FBE Layer:

The FBE coating shall be 100 % holiday tested with a pulse type DC holiday detector equipped with audible signalling device. The test shall be carried out in accordance with NACE RP0490 or equivalent.

b. Final Coating:

Each fully coated pipe shall be inspected for holidays over 100 percent of

its coated surface using a high voltage DC detector. The detector shall be a type, which maintains complete contact with the coating. It may be either constant or pulsed voltage type. If constant voltage type, holiday detection shall be carried out on a dry coating. The operating voltage between electrode and pipe shall be checked at least twice per working shift, and shall be maintained at 10 kilovolt/mm of coating thickness.

The Pipe Coating Contractor shall demonstrate to the Engineer that the setting of the detector is satisfactory for detecting pinhole defects. This setting shall be checked once every two hours. The correct travel speed shall be determined by consistent detection of an artificial pinhole made in a good coating sample but shall not exceed 300 mm/s. All holidays and other defects shall be marked for subsequent repair and re-testing. On re-testing, no holidays shall be permitted in the final coating. The number of holidays for each pipe length shall be recorded. Coated pipe having holidays in excess of 1 per 1 square metre shall be stripped and re-coated. If there is an excess occurrence of holidays on successive pipes, the Pipe Coating Contractor shall immediately stop the coating operation to determine the cause and remedy it.

49.34.6.6 ADHESION (PEEL) TSET

a. FBE Layer:

With a sharp narrow bladed knife, two incisions (approximately 13 mm long) shall be made, in the form of an X, through to the metal substrate. At the intersection of the X, an attempt shall be made to force the lining from the steel substrate with the knife point. The point of the knife shall be inserted horizontally i.e., the flat of the blade under the lining at the point of intersection of the X such that the blade point is on the metal surface. Using a levering action, the flat point shall be forced away from the steel in an attempt to pry off the coating. Refusal of the lining to disband from the substrate shall be recorded as a pass. A pass shall also be recorded where the lining fails cohesively. Partial or complete adhesive failure between the lining and the substrate shall be recorded as a failure. Disbandment at the point of the intersection is common due to the action of marking the 'X' cut. Therefore for 1 mm away from the tip of the intersection any disbandment shall be ignored.

b. Final Coating:

The adhesion for the complete coating shall be determined in accordance with the requirements for bond strength in DIN 30670. The relevant test temperature and acceptance criteria for these tests shall be as specified. Automatic chart recording equipment shall be used and the average peeling force shall be recorded. The failure mode shall be recorded. The failure should occur at the adhesive/polyethylene interface or adhesive/FBE interface or cohesively in the polyethylene layer. If failure should occur at the FBE/steel interface this will be considered a total failure of the system.

c. Impact Test

A sample or coated pipe shall be impact tested in accordance with the procedures and acceptance criteria of DIN 30670.

d. Resistance to Indentation Test (Indentation Hardness)

Once per shift (and when the FBE or polyethylene batch is changed), the indentation hardness of two coated samples shall be measured (at 23°C ± 5°C and 70°C ± 2°C) in accordance with DIN 30670 Indentation depth shall not exceed 0.2mm at 23°C ± 5°C or 0.3mm at 70°C ± 2°C.

e. Percentage Elongation at Failure

This test shall be conducted in accordance with DIN 30670 on each of the full system pre-qualification pipes, but at least the coating of three pipes shall be tested for elongation at failure, from which five test pieces shall be taken. The percentage elongation at failure shall be at least 300% - on each of the full system pre-qualification pipes, 2 samples per pipe to the requirements of DIN 30670.

f. Other DIN 30670 Tests

The Pipe Coating Contractor shall demonstrate, for the same system to be applied for this order, attainment of DIN 30670 requirements for Coating Resistivity, to Thermal Ageing and Light Ageing as required by DIN 30670. .

g. CATHODIC DISBONDMENT TEST

Cathodic Disbandment testing shall be conducted: as a pre-qualification test - 48 hours duration at 65 +/- 2°C as a pre-qualification test - 28 days duration at 23 +/- 2°C as a production test - 48 hours duration, at the frequency of one test per 50D coated pipes at 65 +/- 2°C The test requirements shall be in accordance with ASTM G 8. The final unsealed diameter (including the initial holiday diameter of 6.35 mm) shall not exceed 15 mm. This shall apply to both, the 28 day test at 23 +/- 2°C and the 2 days test at 65 +/- 2°C. The Pipe Coating Contractor may propose alternative cathodic disbandment test standards provided the essential requirements of this specification are retained. Any such alternatives shall be submitted to the Engineer for review and approval. Every 24 hours the applied voltage and current flow shall be recorded. Any drift from the specified voltage setting shall be corrected.

h. DESTRUCTIVE TEST

A sufficient length of production pipe shall be cold cut to provide the required number of samples for conducting the coating destructive tests listed in this specification. Items that fail individual tests and that cannot be repaired shall be rejected. Subject to the approval of (SCDCL) Engineer,

the rejected coating shall be stripped and the joint shall be re-blasted and coated in the manner specified for new pipe in this specification.

Where a test relates to a quantity of coated items, e.g. 1 per 50 items or 1 per 100 items etc., the quantity or items represented by the item tested (e.g. 50 or 100) shall be considered to be a batch. If a test on an item in a batch fails then this item shall be rejected and two further items shall be randomly selected from the batch for repeat testing. If either of these tests fails then the whole batch shall be quarantined for review by Engineer. The cause of failure shall be established and reported to the (SCDCL) Engineer and if deemed necessary by the (SCDCL) Engineer the coating procedure shall be amended and re-qualified. The (SCDCL) Engineer will decide whether the whole batch is rejected and sent for re-blasting and re-coating or whether acceptance may be on the basis of acceptable tests carried out on individual items.

49.35 COATING REPAIRS

The Pipe Coating Contractor shall submit detailed coating repair procedures for approval by (SCDCL) Engineer. These shall include procedures for repair or 'pin-hole', 'small area' and 'large area' defects. The minimum and maximum areas for which each type of repair is applicable shall be stated taking into consideration the below mentioned requirements. The maximum number of coating defects allowable, before a joint of pipe shall be classed as rejected and recoated, shall not exceed 1 per 1 square metre (exclusive of damage caused by testing).

- Repair areas of sizes < 5 mm²

Pinhole damage shall be repaired by cleaning with an emery cloth followed by application of a two (2) pack epoxy repair kit or an approved hot melt mastic smoothed flush with the polyethylene surface. If the mastic is used, it shall be spread with the aid of a hot air or a propane torch.

- Repair areas of sizes > 5 mm² up to < 250 mm²

The area shall be cleaned with solvent and abraded with an emery cloth to ensure that the surrounding polyethylene is well bonded; the surface shall be roughened for a distance of at least 25 mm beyond the damage area. Approved hot melt mastic shall be applied to the damage area and smoothed flush. The mastic and surrounding area shall be warmed with hot air or propane torch until the surrounding polyethylene has a slight sheen. An approved polyethylene patch material shall be applied overlapping the damage but not overlapping the pre-abraded areas. Torch heat and smoothing pressure shall be applied to fuse the patch and ensure that no blisters are formed.

- Repair areas of sizes 250 mm² up to 625 mm²

Heat shrink-wrapping pipe sleeves shall be used for repair according to the following procedure: Thoroughly clean the area to be coated Bevel the extremities of the mill-coating with a rasp

Pre-heat the area to be coated to a temperature of approximately 700C.

Install the sleeve over the area to be coated Warm the shrink sleeve to a temperature above 150OC with a propane torch or a warm-air ring.

- Repair areas of sizes exceeding 625 mm²

No single defect shall exceed an area or 625 mm². Pipes with a coating defect exceeding 625 mm² shall be cause for rejection and shall be subsequently rejections and recoated. All rejections shall be recorded. Repairs shall provide a finished coating equal in effectiveness to that of the parent coating. The limit of the repair area shall be revised. Each repaired area shall be holiday inspected in accordance as specified. The Pipe Coating Contractor shall submit coating stripping procedure for pipes rejected for coating quality. The rejected coating may be stripped by heating in an oven. Under these circumstances, the temperature of the pipe joint shall not be allowed to rise above 400 OC.

49.36 HANDLING, TRANSPORT AND STORAGE

The Manufacture shall be responsible for any damage occurring to the pipes from unloading to reloading on the relevant transportation means. The Manufacturer shall consequently: - inspect the bare pipes upon delivery to check that they have suffered no previous damage, - take all necessary precautionary measures to prevent any deterioration during the following operations: - handling, - transfer tot storage yards. - storage, - loading of pipes for shipment. All repairs and inspections shall be at the Manufacturer's expense.

49.36.1 Handling

The pipes shall b e handled without causing damage to the pipe bevels and coating. Direct contact steel or hemp slings or with any material whose shape or nature may deteriorate the pipe coating shall be strictly prohibited. Polyamide slings or hooks fitted with thermoplastic protection may be used. Use of electromagnetic device is recommended.

49.36.2 Transfer to Storage Yard

During transport of pies to the storage yard of the Manufacturer, the latter shall take all their required measures to avoid pipe and coating damage.

31.36.3 Storage Yard of the Manufacturer

Stockpiling of coated pipes shall be made so as to avoid any deterioration of coating. Coated pipes, when non concrete weight coated, shall be protected against ultraviolet rays action in particular.

49.36.4 Pipe Loading for Shipment

When loading the coated pipes for shipment, the Manufacturer shall take all necessary measures to avoid the deterioration of pipes and coating during handling and transport.

49.36.5 End Caps

If the bare pipes have been delivered to the Manufacturer with end caps, these end caps or new ones) should be fitted again on the pipe ends after coating if required in the CONTRACT.

49.37 REPAIR OF COATING

MANUFACTURER shall submit to PURCHASER, (SCDCL) its methods and materials proposed to be used for executing a coating repair and shall receive approval from PURCHASER (SCDCL) prior to use. In open storage the repair materials must be able to withstand a temperature of at least (+) 800C without impairing its serviceability and properties. MANUFACTURER shall furnish MANUFACTURER's test certificates for the repair materials clearly establishing the compliance of the repair materials with the applicable coating requirements indicated in this specification. All repair material will be of Class C.70 as specified in the relevant DIN Standard. All pipe coating plan, shall have sound external with no holiday or porosity on 100% of the surface. Defects, repairs and acceptability criteria shall be as follows: - Pipes showing porosities or very small damage not picked up during holiday test and having a surface less than 0.5 cm² or linear damage (cut) of less than 3 mm shall be repaired by stick using material of same quality. - Damages caused to coating by handling such as scratches, cuts, dents, gouges, not picked up during holiday test, having a total reduced thickness on damaged portion not less than 2 mm and an area not exceeding 20cm² shall be rebuild as per approved method and without exposing to bare metal. - Defects of size exceeding the above and mentioned area of or holidays of width less than 300 mm shall be repaired as per approved method by exposing the bare metal surface.

- Defect exceeding the above and in number not exceeding 2 per pipe and their length not exceeding 500 mm shall be repaired as per approved method. - Pipes with bigger damage shall be stripped and recoated. - In case of coating defect close to coating cut back, MANUFACUTRER shall remove the coating throughout the entire circumference of the pipe down to the steel surface and increase the coating cut back length. Now, if the coating cut back exceeds by 30 mm than the specified cut back length, then the coating shall be repaired as per approved method thereby making up the coating cut back length as per specification. In case the defect exceeds 70 mm from the original coating cut back length, the entire coating shall be removed and the pipe shall be recycled through the entire coating procedure. Irrespective of type of repair, the maximum number of repair of coating shall be as follows: - Holiday repair of size ≤ 100 cm² attributable to process of coating application shall be maximum one number per pipe. - In addition to the above, defects to be repaired as per approved method shall be maximum 2 (two) per pipe. Defects exceeding the above limits shall cause pipe coating rejection, stripping and recoating. The above is exclusive of the repairs warranted due to testing as this specification. All repairs carried out to the coating for whatever reason

shall be to the account to MANUFACTURER. Cosmetic damages occurring in the polyethylene layer only need not be repaired by exposing up to steel surface, as deemed fit by the PURCHASER (SCDCL). In any case the MANUFACTURER shall establish his material, methods and procedure of repair that result in an acceptable quality of product by testing and shall receive approval from PURCHASER (SCDCL) prior to use. Testing of repairs shall be in the same form as testing coating. All repairs shall result in a coating thickness no less than the parent coating thickness. MANUFACTURER shall test repairs to coating as and when required as and when required by PURCHASER(SCDCL).

49.38 REPAIR MATERIAL

HTPL-80, PERP 80 PERP FILLER, S 1239 Epoxy or Canusa GTS-80, CRP 80 Mastic Filler, S/E/liquid epoxy and then should be followed by or equivalent material to be qualified by the material MANUFACTURER and approved by Purchaser.

- Any combination of epoxy, adhesive and polyethylene shall be tested and certified by an internationally recognized agency.
- In case the MANUFACTURER proposed coating material other than above mentioned combination of epoxy, adhesive and polyethylene, coating procedure and

qualification need to be carried out by an internationally recognized agency by the coating material Manufacturer.

- All materials to be used shall be supplied in sealed, damage free containers and shall be suitably marked with the following minimum information:
 - a. Name of the Manufacturer
 - b. Type of Materials
 - c. Batch Number
 - d. Place and Date of Manufacture
 - e. Shelf Life/Expiry Date (if Applicable)
 - f. Quantity

All materials noted to be without above identification shall be deemed suspect and shall be rejected by PURCHASER(SCDCL). Such materials shall not be used for coating and shall be removed from site and replaced by MANUFACTURER at his expense.

FIELD JOINT COATING : HEAT SHRINK SLEEVE (HSS)

49.39 SCOPE

This specification establishes the minimum requirements of materials, equipment and Installation of field joint anti-corrosion coating of buried onshore pipelines factory coated with three layer polyethylene coating, by heat shrink wraparound sleeves conforming to EN 12068. – Cathodic Protection – External Organic Coatings for the Corrosion Protection of Buried or Immersed Steel Pipelines used in Conjunction with Cathodic Protection

– Tapes and Shrinkable Materials” and the requirements of this specification. Unless modified/replaced by this specification, all the requirements of EN 12068 shall remain fully applicable and complied with. This specification shall be read in conjunction with the conditions of all specifications and documents included in the Contract between Company and Contractor. Unless specified otherwise, all sections of this specification shall apply to all specifications referred in this specification.

49.40 REFERENCE DOCUMENTS

Reference has also been made to the latest edition (edition enforce at the time of issue of enquiry) of the following standards, codes and specifications:

In case of conflict between the requirements of this specification and that of above referred Documents, the requirements of this specification shall govern.

The CONTRACTOR shall be familiar with the requirements of these documents and shall make them readily available at the site to all personnel concerned with carrying out the works specified in this specification.

Sr No.	Code	Description
1	ISO 8502-3	Preparation of Steel Substrates before Application of Paints and Related Products – Part 3 – Assessment of Dust on Steel Surfaces Prepared for Painting (Pressure Sensitive Tape Method)
2	ISO 8503-1	Part 1 Specification and definitions for ISO surface profile comparator for the assessment of abrasive blast cleaned surfaces
3	ISO 8503-4	Part 4: Methods for calibration of ISO surface profile Comparator and for the determination of surface profile - Stylus instrument procedure.
4	SIS 055900	Pictorial Surface Preparation Standard for Painting Steel Surfaces.
5	SSPC-SP1	Steel Structure Painting Council

In case of conflict between the requirements of this specification and that of above referred Documents, the requirements of this specification shall govern.

The CONTRACTOR shall be familiar with the requirements of these documents and shall make them readily available at the site to all personnel concerned with carrying out the works specified in this specification.

49.41 MATERIALS AND EQUIPMENT

Field joint anti-corrosion coating material shall be heat shrinkable wrap-around sleeve suitable for a maximum operating temperature of (+) 60°C (max. T) and shall conform to designation EN 12068-C-HT-60 UV. In addition, the field joint anti-corrosion coating shall comply the requirements

49.41.1 Heat shrinkable wraparound sleeves:

Heat shrinkable wraparound sleeve shall consist of radiation cross-linked, thermally stabilized, ultraviolet resistant semi-rigid polyolefin backing with a uniform thickness of high shear strength thermoplastic/co-polymer hot melt adhesive. The joint coating system shall consist of a solvent free

epoxy primer applied to the pipe surface prior to sleeve application. The backing shall be provided with suitable means (thermo-chrome paint, dimple, or other means) to indicate the desired heat during shrinking in field is attained. The sleeve shall be supplied in pre-cut sizes to suit the pipe diameter and the requirements of overlap. The total thickness of heat shrinkable wraparound sleeve in the "As Applied" condition shall be as follows:

Pipe Size (Specified Outside Diameter)	Thickness (mm)		
	On Pipe Body		On Weld Bead
	Average	Min.	Min
<30" (762.0mm)	2.0	1.8	1.6
>32" (813.0mm)	2.4	2.2	2.0

The heat shrink wraparound sleeve shall have the required adhesive properties when applied on various commercial pipe-coating materials. The pre-heat and application temperatures required for the application of the shrink sleeve shall not cause loss of functional properties of the pipe coating. The Contractor shall propose only those coating systems that have been previously used for pipelines of size same or higher than the size indicated in tender, for a length of 50 km and above in a single project for similar operating conditions.

49.41.2 Functional Requirements of Field Joint Coating

49.41.2.1 Properties of the PE backing shall be as follows:

S.N.	Properties	Unit	Requirement
a.	Tensile Strength @ +25o C	N/mm ²	>12
b.	Ultimate Elongation @ +25o C	%	>250
c.	Dielectric withstand with 1000 Volts/sec	kV	>30
d.	Water absorption @ +25o C For 24 hours	%	<0.05
e.	Volume Resistivity @ +25o C	Ohm-cm	>1015

49.41.2.2 Functional Properties of Joint Coating System (As supplied)

As applied field joint coating system shall comply the requirements of DIN EN 12068, corresponding to designation EN 12068 – C HT 60 UV, except as modified below: Cathodic Disbondment Resistance at Tmax i.e. 60oC shall be 20mm when tested as per Annexure K of EN 12068. Test shall be carried out at (+) 60oC. Peel Strength shall be as follows:

Peel Strength	Temp	Unit	Requirement for Mech. Resistance Class-C (minimum)
Inner to Inner (+) Outer to Inner	@ 23°C	N/mm	1.5
	@ Tmax	N/mm	0.3
Outer to Outer	@ 23°C	N/mm	1.5
	@ Tmax	N/mm	0.3
To Pipe Surface	@ 23°C	N/mm	3.5
	@ Tmax	N/mm	0.5
To Factory Coating	@ 23°C	N/mm	3.5
	@ Tmax	N/mm	0.5

Contractor shall obtain prior approval from Employer regarding the Manufacturer of the joint coating material and the specific grade of the joint coating system. Complete technical details along with test certificates complying with the requirements and shall be submitted to Employer for this purpose. The Contractor shall furnish test certificates from an independent DIN recognized/approved laboratory for all the properties required for the specified EN designation of field joint coating and the requirements of this specification

49.41.2.3 Cut back

Cut back length of the precoated pipes shall be 150mm \pm 10mm. Field joint coating system shall be of suitable width considering an overlap to the factory coated pipe coating by minimum 75mm on each side 3 LPE coated pipes. Hence considering the margin Sleeve width should not be less than 450mm.

49.42 APPLICATION PROCEDURE

49.42.1 General

The application procedure shall be in accordance with MANUFACTURER's instructions and the minimum requirements specified below whichever are the most stringent and shall be demonstrated to and approved by the Employer. Manufacturer's expert shall supervise the application and shall be available at site upon request during qualification of application procedure and during construction at Contractor's cost. Operators for coating application shall be given necessary instructions and training before start of work, by the Contractor. To verify and qualify the application procedures, all coating applied during the qualification test, shall be removed for destructive testing as detailed subsequently in this specification. Contractor shall only utilize those operators who have been approved/pre-qualified by the field joint coating MANUFACTURER. Oil, grease and salt shall be removed from steel surface by wiping with rags soaked with suitable solvents such as naphtha or benzene. Kerosene shall not be used for this purpose. Solvent cleaning procedure according to SSPC-SP1 shall be followed. Each field joint shall be blast cleaned using a closed cycle blasting unit or an open expendable blasting equipment. With the first equipment type, steel or chilled shot and iron grit shall be used and Garnet material with the second one (in case the authority having jurisdiction have no objection, the contractor may adopt sand blasting instead of garnet material). During blast cleaning the pipe surface temperature shall be simultaneously more than 50C and more than 30C above ambient Dew Point, while the ambient Relative Humidity shall not be greater than 85%. Prior to surface cleaning the surfaces shall be completely dry. The surface shall be cleaned to a grade Sa 2½ in accordance with Swedish Standard SIS-055900 with a roughness profile of 50-70 microns. Surface roughness profile shall be measured using an approved profile comparator in accordance with ISO 8503-1 and shall be calibrated prior to the start of the work in accordance with ISO 8503 or ISO 8503-4. The blast cleanliness shall be checked on every joint and the roughness

profile shall be checked 1 every 10 joints. Dust, grit or foreign matter shall be removed from the cleaned surface by an industrial vacuum cleaner. The dust contamination allowed shall be of a rating max 2 as per ISO 8502-3. The frequency of checking for dust contamination shall be 1 every 10 joints. Blast cleaned field joint shall be coated with 2-4 hours according to the conditions below:

- Relative Humidity (RH) >80% - 2 hours
 - Relative Humidity (RH) 70-80% - 3 hours
 - Relative Humidity (RH) <70% - 4 hours
- Pipes delayed beyond this point or pipes showing any visible rust stain, shall be blast cleaned again. The field joint surface shall be inspected immediately after blast cleaning and any feature of the steel surface such as weld spatter, scabs, laminations or other imperfections considered injurious to the coating integrity, made visible during blast cleaning, shall be reported to the Company Representative and on permission from Company Representative, such defects shall be removed by filling or grinding. Pipes affected in this manner shall be then re-blasted cleaned if the defective area is larger than 50mm in diameter. The ends of existing pipe protective coating shall be inspected and chamfered. Unbounded portions of the coating shall be removed and then suitably trimmed. Portions where parent coating is removed shall be thoroughly cleaned as specified. The adjacent chamfered areas of the line pipe coating shall be cleaned and abraded, to expose a clean uniform fresh surface of uncontaminated factory applied coating. All steel joint surfaces shall be thoroughly examined before the application of the coating in order to ensure the surfaces are free of oil, grease, rust, mud, earth or any other foreign matter. All these substances shall be removed before coating, to the procedures herein described. Protection coating shall be applied on the joints immediately after the completion of cleaning operation. Application Procedure for Heat Shrink Wraparound/Sleeves In addition to the requirements stated above, following shall be complied with: The wraparound sleeve shall be of a size such that a minimum overlap of 50mm is ensured (after shrinking) on both sides of the yard applied corrosion coating of pipes. In the cases where carrier pipe is installed by direct boring/jacking, the overlap on the mill coating for the leading edges of the joints shall be minimum 200mm. When this extra overlap is achieved by providing an additional patch of heat shrink tape/wraparound, it shall be applied in such a manner that the square edge of the patch on the joint coating is in the direction opposite to the direction of boring/jacking.

Before centering the wraparound sleeve, the bare steel surface shall be preheated either with a torch moved back and forth over the surface or by induction heating. The minimum pre-heat temperature shall be as recommended by MANUFACTURER and shall be checked by means of contact type temperature-recording thermometer (Digital Pyrometer with flat probe type contact). Temperature indicating crayons shall not be used. Pre-heat temperature shall be checked on every joint. Care shall be taken to ensure that the entire circumference of the pipe is heated evenly. Temperature measuring instruments

shall be calibrated immediately before the start of the works and thereafter at intervals recommended by the MANUFACTURER of the instrument. Upon pre-heating, the pipe surface shall be applied with two pack epoxy

primer of wet film thickness 150 microns or as per MANUFACTURER's recommendation whichever is higher, to cover the exposed bare metal of the welded field joint and 10mm min. onto the adjacent pipe coating if recommended by the MANUFACTURER. The wet film thickness of the primer shall be checked on every joint with a wet film thickness gauge prior to installation of sleeve. Thickness gauge shall be calibrated once per shift. Immediately after application of epoxy primer, the wraparound sleeve shall be entirely wrapped around the pipe when the epoxy is still wet. Sleeve shall be positioned such that the closure patch is located to one side of the pipe in 10 or 2 O'clock position, with the edge of the underlying layer facing upward and an overlap of min. 50mm. Gently heat by appropriate torch the backing and the adhesive of the closure and press it firmly into place. A heat shrinking procedure shall be applied to shrink the sleeve in such a manner to start shrinkage of the sleeve beginning from the centre of the sleeve and heat circumferentially around the pipe. Continue heating from the centre towards one end of the sleeve until recovery is completed. In a similar manner, heat and shrink the remaining side. Shrinking has been completed when the adhesive begins to ooze at the sleeve edges all around the circumference. The complete shrinking of the entire sleeves shall be obtained without undue heating of the existing pipe coating and providing due bonding between pipe, sleeve and pipe coating. The installed sleeve shall not be disturbed until the adhesive has solidified. The joint coating application shall be done under supervision of the MANUFACTURER's personnel during the field trial demonstration and testing work. Presence of MANUFACTURER's representative is a mandatory requirement and bidders are required to furnish specific commitment to this. Minimum 50 (fifty) field joint coating to be carried out under supervision of the joint coating supplier's representative. Application procedure and environment protection methodology demonstrated at the time of field trial shall be strictly followed during the entire work.

49.43 REPAIRS

If a field joint is detected to be unacceptable after testing as per relevant QA section of this specification the Contractor shall, at his own cost:

- a. Determine the cause of the faulty results of the field coating.
- b. Mobilize the expert of MANUFACTURER, if required.
- c. Test to the complete satisfaction of Company, already completed field coatings.
- d. Stop the field coating works until remedial measures are taken against the causes of such faults, to the entire satisfaction of the Company.

Contractor shall replace all joint coating found or expected to be unacceptable as per relevant section of this specification.

Contractor shall, at his own cost, repair all areas where the coating has been removed for testing by the Company. After the coating work on welded joints and repairs to the coating have been completed the coating as a whole shall be tested with a spark-tester before lowering or jacking the pipeline. Employer shall be entitled to check the coating on buried pipelines or parts of pipelines with equipment such as the "Pearson Meter"

and the resistance meter. If coating defects are established, the Contractor shall be responsible for excavation at such points, repairing the coating, spark testing and backfilling the excavations without extra charge.

49.44 DOCUMENTATION

Prior to procurement of coating materials, Contractor shall furnish the following information for qualification of the Manufacturer and material. Complete information as per DIN EN 12068 along with descriptive technical catalogues. Test certificates and results of previously conducted tests, for all properties listed. Reference list of previous supplies, in last 5 years, of the similar material indicating the project details such as diameter, quantity, operating temperature, year of supply, project name, contact person and feedback on performance. Once the Employer's approval has been given, any change in material or Manufacturer shall be notified to Employer, whose approval in writing of all changes shall be obtained before the materials are manufactured. Prior to shipment of materials from the Manufacturer's Works, Contractor shall furnish the following documents: a) Test certificates/results as per Manufacturer's Quality Control Procedure for each batch of material. b) Specific application instructions with pictorial illustrations. c) Specific storage and handling instructions. All documents shall be in English language only.

SPECIFICATION FOR EXTERNAL COATING FOR SPECIAL SECTIONS, CONNECTIONS & FITTINGS OF BURIED STEEL PIPELINES FOR WATER

49.45 General:

Special sections, miter bends, tees, connections, fittings in buried steel pipeline network shall be coated externally, with prefabricated polyolefin tape coating as per AWWA C 209-00. The Contractor shall perform all work in accordance with these specifications and the latest pipeline coating practices, and shall complete the work in all respects to the full satisfaction of the (SCDCL) Owner / Owner's Representative. The entire coating operation starting from cleaning and surface preparation till coating shall be performed under the supervision of skilled personnel who are well conversant with the work. Pipes which have been cleaned and primed, or cleaned, primed and coated, without having been inspected and approved shall be rejected. This specification is not intended to be all inclusive and the use of guidelines set forth here does not relieve the Contractor of his responsibility for the quality and performance of the applied coating system, and to supply coating material capable of performing its intended service.

1.45.1 Referenced Standards:

The following standards (latest revision) referenced below are a part of this specification. In case of conflict between this specification and the referenced standards, this specification shall apply.

- a. ANSI/AWWA C209 - Standard for Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
- b. ANSI/AWWA C214 - Standard for Tape Coating Systems for the Exterior of Steel Water Pipelines
- c. SSPC-SP I - Solvent Cleaning
- d. SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning

49.45.2 General:

The buried steel pipeline special sections shall be protected with hand or manual machine applied cold applied tape protective coating conforming to AWWA C209 - 00 (Cold Applied Tape Coating Systems for Exterior of Steel Water Pipelines). Protective coating shall consist of a coating system consisting of primer, inner - layer tape and outer-layer tape. Work or material that fails to conform to this standard may be rejected at any time before final acceptance

49.45.3 Coating system:

The pre-fabricated polyolefin tape coating system shall consist of the following layers to provide an applied coating system thickness of 100 mils (2.5mm) on the exterior of the special sections of steel pipes. A liquid adhesive layer. An inner-layer tape for corrosion protection having thickness of 30mils and applied with 50% overlap An outer-layer tape for mechanical and UV protection having thickness of 20mils and applied with 50% overlap.

49.45.4 Liquid Adhesive layer:

The liquid adhesive layer shall consist of a mixture of suitable rubber and synthetic compounds and solvent. The liquid adhesive layer shall be brush applied to the abrasive blasted prepared pipe surface before application of the inner-layer tape. The function of the liquid adhesive is to provide a bonding medium between the pipe surface and the inner-layer tape. The liquid adhesive shall be supplied by the MANUFACTURER that supplies the inner-layer tape. The liquid adhesive shall not settle in the container forming a cake or sludge that cannot be easily mixed by hand or mechanical agitation and it shall have good machine-application properties. **Table I - Physical Properties of the Liquid Adhesive**

Colour	Base		Weight	Flash Point
Black	Rubber and	Flammable	- 6-8 lb/gal (0.72 – 0.965g/l)	-10oF (- or greater
	Synthetic Resins	Non flammable	- 10 – 12 lb/gal (1.20 – 1.44 kg/l)	none

49.45.5 Inner-layer tape:

The inner-layer tape shall be a two-layer tape consisting of a polyolefin backing layer with a laminated butyl- based adhesive layer. The inner tape shall be compatible with the liquid adhesive. The MANUFACTURER shall certify that the backing material shall be polyolefin only, containing not more than 3.5 percent, by weight, of non- polyolefin material consisting of carbon black and antioxidants. The inner-layer tape shall be applied after the liquid adhesive and before the outer-layer tape. The backing and adhesive shall be made from materials that provide high electrical resistivity, resistance to corrosive environments, low moisture absorption and permeability, and shall provide an effective bond to a primed steel surface. The inner-layer tape shall be of material that will resist excessive mechanical damage during normal application operations and shall be sufficiently pliable for the intended use. The inner-layer tape shall withstand, without tearing, the tensile force necessary to obtain a tightly wrapped inner coating free of voids. The inner-layer tape shall be supplied in roll form wound on hollow cores with a minimum inside diameter of 38mm. The thickness of the inner tape shall be 30mils. To ensure a proper smooth coating by hand or by manual hand wrapping machine, the inner-layer tape shall be provided in standard widths of 4" or 6" as per MANUFACTURER recommendations consistent with the pipe diameter.

49.45.6 Outer-layer tape:

The outer-layer tape shall be a two-layer tape consisting of a polyolefin backing layer with a laminated butyl adhesive layer. The MANUFACTURER shall certify that the backing material shall be polyolefin only containing not more than 3.5 percent, by weight, of non-polyolefin material consisting of pigments, antioxidants and stabilizers. The outer layer shall be compatible with the inner-layer tape. The primary function of the outer tape layer is to provide mechanical protection to mechanical and outdoor weathering (UV) protection to the tape system, and secondarily, to contribute to the overall corrosion-protection properties of the system. The outer- layer tape backing shall be compounded so that it will be resistant to outdoor weathering.

The outer-layer should be of suitable quality for the local environment, as follows:

- Storage Temperature : 0 to 500C.
- Over-ground Condition : 0 to 600C.
- Under-ground Condition : 70C to 350C.
- Ultraviolet-ray Protection : Required in outer layer.

Materials used in the outer-layer tape shall have high electrical resistivity, low moisture absorption and permeability, and shall provide mechanical protection during handling and outdoor storage. The outer-layer tape shall be sufficiently pliable for normal application operations by hand or by manual hand wrapping machine and shall form an effective bond to the inner-layer tape. The outer-layer tape shall be supplied in roll form wound on hollow cores with a minimum inside diameter of 38mm. The thickness of the outer-layer tape shall be 20mils. To ensure a proper smooth coating by hand or by manual hand wrapping machine, the outer-layer tape shall

be provided in standard widths of 4" or 6" as per MANUFACTURER recommendations consistent with the pipe diameter.

49.45.7 Coating-system Thickness:

The installed coating system thickness shall not be less than 100 mils (2.5mm) and shall comprise of the following.

- A liquid adhesive layer (50-75 microns)
 - An inner-layer tape (Nominal 30 mils i.e. 0.75mm) applied with 50% overlap
 - An outer-layer tape (Nominal 20 mils i.e. 0.50mm) applied with 50% overlap
- The properties of the tape & coating system shall conform to the following requirements. Table– I - Physical Properties of Total System

49.45.8 Coating Application:

Property	Requirement	
	Minimum	Maximum
Thickness 100 mil, nominal	95 mil	105 mil
Dielectric breakdown	400v/mil	
Water-vapour transmission, max.	0.25 perms ([1.44ng/ (Pa.s.m2)])	
Insulation resistance	500,000 mega Ohms (min)	
Adhesion to Primed Steel	20 ozf/inch	

49.45.8.1 General:

The coating application shall be a manual operation starting with properly abrasive blasted pipe surface. Longitudinal & spiral welds of the pipe shall not exceed a height of 3/32 inch (2.4mm) above the pipe surface and shall be ground flush a full 18 inch (450mm) along the length of the pipe from both ends prior to the coating process. Steps, which shall be performed consecutively, shall consist of (1) liquid adhesive application by brush; (2) application of the inner-layer tape directly onto the prepared pipe surface with 50% overlap; and (3) application of the outer-layer tape directly on top of inner-layer tape with 50% overlap.

49.45.8.2 Pipe preparation:

a. Metal surface condition:

Bare pipe shall be free from mud, mill scale, mill lacquer, wax, coal tar, asphalt, oil, grease, or any other foreign material. Before blast cleaning, surfaces shall be inspected and pre-cleaned according to SSPC-SP 1 to remove oil, grease, and loosely adhering deposits. Visible oil and grease spots shall be removed using a solvent. Only solvents that do not leave a residue shall be used. Preheating to remove oil, grease, and mill scale may be used provided that entire pipe is preheated in a uniform manner to avoid distortion. After drying and removing all loosely adhering foreign materials, the pipe surface shall be cleaned by blasting with grit or sand to achieve a surface preparation at least equal to that specified in SSPC:

SP6/NACE3. The blast anchor pattern or profile depth shall be 1 mil to 3 mils (25 µm to 75 µm) measured in accordance with ASTM D-4417. The cleaned exterior pipe surface shall be inspected for adequate surface preparation. Surface imperfections, such as slivers, scabs, burrs, weld spatter, and gouges, shall be removed by hand filing or grinding if necessary to prevent holidays. Blast-cleaned pipe surfaces shall be protected from conditions of high humidity, rainfall, or surface moisture. No pipe shall be allowed to flash rust before coating. To ensure a dry pipe surface at the time of liquid adhesive application, the minimum steel substrate temperature shall be 21°C and at least 3°C above the dew point.

1.45.8.3 Coating Application:

a. Liquid adhesive application:

The liquid adhesive shall be applied in a uniform thin film at the coverage rate recommended by the MANUFACTURER. The liquid adhesive shall be thoroughly and continuously mixed and agitated during application to prevent settling. The liquid adhesive shall be applied to the entire exterior surface of the pipe by brush to cover the entire exterior surface of the pipe. The liquid adhesive coat shall be uniform and free from floods, runs, sags, drips, or bare spots. The liquid adhesive-coated pipe surface shall be free of any foreign substances, such as sand, grease, oil, grit, rust particles, or dirt. Before applying the inner-layer tape, the liquid adhesive layer shall be allowed to touch dry in accordance with the MANUFACTURER's recommendation.

b. Application of inner-layer tape:

The inner-layer tape shall be applied directly onto the prepared pipe surface by manual tape coating machine. When applied to spirally welded pipe, the direction of the tape spiral shall be generally parallel to the weld spiral. The minimum overlap shall not be less than 50%. When a new roll of tape is started, the ends shall be overlapped at least 150 mm measured circumferentially.

c. Application of outer-layer tape:

The outer-layer tape shall be applied over the inner-layer tape using the same type of manual tape coating machine used to apply the inner layer tape. The overlap of the outer-layer tape shall not coincide with the overlap of the inner-layer tape. The minimum overlap shall not be less than 50%. When a new roll of tape is started, the ends shall be overlapped at least 150 mm measured circumferentially.

d. Cutbacks

Coating cutback shall be 150 mm±10mm.

1.45.9 Material acceptance

Acceptance of the proposed coating materials shall be approved by the (SCDCL) Owner / Owner's representative.

The tape MANUFACTURER proposed by the Contractor should have supplied at least 30% quantity of tape required for this project and as per this specification in a single contract for pipe diameter $\geq 900\text{mm}$ in the last five years. Work completing certificates from End User & coating applicator will be submitted by the Contractor while submitting credentials of the proposed tape MANUFACTURER to the employer for approval.

31.45.10 Coating repair in field:

All holidays visually or electrically discovered either at the coating plant or in the field shall be repaired by peeling back and removing the outer and inner layers from the damaged area. The exposed areas shall then be coated with liquid adhesive and either (1) a length of inner-layer tapes shall be wrapped around the pipe to cover the defective area; or (2) a patch of inner-layer tape shall be applied directly to the defective area as specified by the Owner's Representative. The minimum over-lap at the damaged area shall be 100 mm all around. The repaired area shall be tested with a holiday detector as per specifications after the repair is completed. If holidays are not found, the repaired area shall be covered with the outer-layer tape with a minimum over-lap of 100 mm beyond the inner-tape patch.

31.45.11 Hoisting:

Special sections, fittings, mitre bends, etc. shall be hoisted using only wide-belt nylon slings or the equivalent. The use of calliper clamps, metal chains, cables, tongs, or other equipment likely to cause damage to the coating shall not be acceptable, nor shall dragging of the pipe be permitted. The Contractor shall allow inspection of the coating on the underside of the pipe while the pipe is suspended from the slings.

1.45.12 Shipping, handling and storage:

Coated pipe sections shall be handled, stored and shipped in a manner that will prevent damage to the coating. Pipe sections, fittings also shall be handled and stored in a manner to prevent damage to pipe walls and ends. Pipe sections or coating damaged in handling or other operations shall be repaired. Handling during the period of coating also shall be such as to avoid damage to the coating. Thermal expansion is a characteristic of the coating that may cause uneven areas on the coated pipe surface, but does not adversely affect the coating system's performance. These areas do not require any repair. Stacking: Sufficient spacers or padding shall be used to prevent damage to the pipe sections and coating. Shipping: Pipe sections, fittings etc shall be transported from the coating yard to the jobsite using sufficient shoring or tonnage, padding and banding to adequately protect the pipe and its coating.

Loading: Pipe sections, fittings shall be loaded for shipping in compliance with existing shipping standards and regulations. Trench-side Storage: Pipe sections, fittings stored along the trench side shall be suitably supported off the ground to avoid damage to the coating.

SPECIFICATION FOR GUNITING FOR UNDERGROUND PIPING

49.46 Protective cement mortar coating by gunite to External Surfaces

Not applicable

49.47 LOWERING AND JOINTING

The pipe shall be lowered into the trenches by removing only one or two struts at a time. It shall be seen that no part of the shoring is disturbed or damaged and, if necessary, additional temporary struts may be fixed during the lowering operations. It shall also be necessary to see that the outside coating of pipe is not damaged in anyway during the lowering and assembling .After the pipe is lowered into the trench, it shall be laid in correct line and level by using the levelling instruments, sight rails, theodolite, etc. Care shall be taken to see that the longitudinal joints of two consecutive pipes at each circumferential joints are staggered by 90°. While assembling the pipes, the ends shall have to be brought close enough to leave a uniform gap not exceeding 4mm. If necessary, a marginal cut may be taken to ensure a close fit of the pipe faces. For this purpose, only experienced cutters who can make uniform and straight cuts, shall be permitted to cut the faces of the pipes. No extra payment shall be made for such marginal cutting. There shall be no lateral displacement between the pipe faces to be joined. If necessary, spiders from inside and tightening rings from outside shall be used to bring the two ends in perfect contact and alignment. It may also be necessary to use jacks for this purpose. In no case shall hammering or longitudinal slitting be permitted. When the pipe is properly assembled and checked for correct line and level, it shall be firmly supported on wooden beams and wedges and tack welded. Some portion of the trench may be refilled at this stage so as to prevent the pipeline from losing its alignment. The tack welded circumferential joints shall then be welded fully. Only experienced welders, who shall be tested from time to time, shall be permitted to carry out the welding work. On completion of the pipe jointing and external protection, the trench shall be cleaned of outside coating rebound. The welding shall be filled and compacted in 150mm layers with the bedding material. Backfilling shall be carried out as detailed here under.

31.47.1 Precautions against Floatation

When the pipeline laid underground or above ground in a long narrow cutting gets submerged in water collected in the trench of cutting it is subjected to an uplift pressure due to buoyancy and is likely to float if completely or partly empty. In the design of pipelines, provision is to be made to safeguard against floatation providing sufficient overburden or by providing sufficient dead weight by means of blocks, etc. Factor of safety for calculations for check against floating shall be taken as 1.2. In the case of works extending over one or more monsoon seasons, however, special care and precautions are necessary during the progress of work on this account. The Contractor shall close down pipe laying operations well in time for the monsoon. The work of providing blocks, refilling the earth to the required level, compacting the same, etc. shall always be done as soon as the pipeline in the cutting has been laid. The Contractor shall see

that the water shall not be allowed to accumulate in open trenches. Where work is in an incomplete stage, precautionary work, such as blank-flanging in the open ends of the pipeline and filling the pipeline with water etc. shall be taken up as directed by the Engineer. Such works shall be to the Contractor's account and no separate payment shall be made for the same. The Contractor's rate for pipe laying shall be deemed to include such precautionary measures against floatation.

Protection of the pipeline against floatation during the Contract Period shall be the responsibility of the Contractor. Should any section of the pipeline float due to his negligence, etc. the entire cost of laying it again to the correct line and level shall be to his account.

49.48 CLEANING, DISINFECTING AND COMMISSIONING OF THE PIPELINE

Upon completion of a newly laid main, the main shall be disinfected as directed by the Engineer. The main shall be flushed prior to disinfection except when the tablet method is used. After initial flushing, the hypochlorite solution shall be applied to the water main with mechanically or electrically powered chemical feed pump designed for feeding chlorine solutions. For small applications, the solution may be fed with a hand pump. In the case of main of large diameter, water from the existing distribution system or other approved source of supply shall be made to flow at a constant measured rate into the newly laid pipe line. The water shall receive a dose of chlorine also fed at a constant measured rate. The two rates shall be proportioned so that the concentration in the water entering the pipeline is maintained at no less than 300 mg/l. The chlorine shall be applied continuously and for a sufficient period to develop a solid column of 'Slug' of chlorinated water that will as it passes along the line expose all interior surfaces to a concentration of at least 300 mg/l. for at least 3 hours. As the chlorinated water flows past tees and crosses related valves and hydrants shall be operated so as to disinfect the appurtenances. In the case of newly laid mains in which scrupulous cleanliness has been exercised the tablet method can be adopted and in this method, the initial flushing is dispensed with. The calcium hypochlorite tablets are placed in each section of pipe and also in hydrants, hydrant branches and other appurtenances. The tablets shall be attached by an adhesive and must be at the top of the main. The main shall then be filled with water and the water shall remain in the pipe for at least 24 hours. After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the mains is not higher than that generally prevailing in the system or less than 1 mg/l. After final flushing and before the water main is placed in service, a sample or samples of water shall be collected from the end of the line and tested for bacteriological quality and shall show the absence of coli form organisms. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory, samples are obtained before the main is placed in service. The Contractor is expected to carry out the disinfection work as a part of laying the pipes and his rates for lying the pipes

should include the disinfection and other connected works till the main is placed in service, unless otherwise specified in the schedule.

49.49 DISTANCE INDICATORS AND MARKINGS

The Contractor shall supply and fix indicators on either side of major crossings along the buried pipe line. Indicators shall consist of 10 cm x 10 cm precast concrete posts 1.25 m long, set 0.75 m into the ground and painted white above ground level. The description shall be written in blue at one face of the precast post. In case of the pipeline laid above ground details such as chain age, Invert levels of pipe, appurtenance number, pedestal / saddle number, culvert number, anchor / thrust block number etc., shall be suitably marked either on the pipeline or the supporting structure etc., in distinct colour. The Bidder / Contractor shall include the cost of this in his rates for the other items.

49.50 BEDDING:

The bedding of minimum 200 mm thickness and level shall be provided below pipe, prior to laying the pipe in trenches. It shall be compacted with a light hand rammer. Any reduction in thickness due to compaction shall be made up by adding excavated stuff during ramming. For the purpose of the bedding under this item only screened fine excavated stuff of grain size not larger than 2mm shall be used. The excavated stuff shall be clean, uncoated and free from clay lumps, injurious amounts of dust, soft particles, organic matter, loam or other deleterious substances. In no case shall excavated stuff containing more than 3.5 % by dry volume or 5% by wet volume of clay, loam or silt be accepted. Excavated stuff shall be stored on the works in such a manner as to prevent intrusion of any foreign matter, including coarser particles of sand or any clay or metal or chips. Tests as indicated above shall be performed if called for by the Engineer at the expense of the Contractor. During the work of providing bedding and laying the pipeline over it, loose material from the sides or edges of the trench shall be prevented from falling inside the trench, by providing shoring and taking other measures. Also where necessary, trench shall be kept dry by pumping out seepage water continuously.

31.51 REFILLING OF TRENCHES:

On completion of the pipe laying operations in any section, for a length of about 100m and while further work is still in progress, refilling of trenches shall be started by the Contractor with a view of restricting the length of open trenches. Pipe laying shall closely follow the progress of Trench Excavation and the Contractor shall not permit unreasonably excessive lengths of trench excavation to remain open while awaiting testing of the pipeline. If the Engineer considers that the Contractor is not complying with any of the foregoing requirements, he may prohibit further trench excavation until he is satisfied with the progress of laying and testing of pipes and refilling of trenches. The excavated material nearest to the trench shall be used filling. Care shall be taken during backfilling, not to in-

jure or disturb the pipes, joints or coating. Filling shall be carried out simultaneously on both sides of the pipes so that unequal pressure does not occur. Walking or working on the completed pipeline unless the trench has been filled to height of at least 30cm over the top of the pipe except as may be necessary for tamping etc., during backfilling work. The remaining portion of the trench may be filled in with a mixture of hard and soft material free from boulders and clods of earth larger than 150mm in size if sufficient quantity of good earth and murrum are not available. The trench shall be refilled so as to build up to the original ground level, keeping due allowance for subsequent settlement likely to take place. The top 300mm layer or fertile agricultural soil shall be kept aside during excavation and shall be laid in layers near ground level during refilling. To prevent buckling of pipe shell of diameters 1200mm and above, pipes shall be strutted from inside while the work of refilling is in progress, for which no separate payment shall be made. Strutting shall be done by means of strong spiders having at least 6 arms which shall be sufficiently stiff to resist all deformation. Spiders shall be provided at a maximum interval of 2m & shall be welded in such a way that internal coating does not get burnt. The (SCDCL) Engineer shall, at all times, have powers to decide which portion of the excavated materials shall be for filling and in which portion of the site and in what manner it shall be so used.

If any material remains as surplus it shall be disposed of as directed by the (SCDCL) Engineer, which includes loading, unloading, transporting and spreading as directed within all lead. If the Contractor fails to remove the earth from site within 7 days after the period specified in a written notice, the (SCDCL) Engineer may arrange to carry out such work at the Contractor's risk and cost or may impose such fine for such omission as he may deem fit. Particular care shall be taken to keep the trench dry during the entire refilling operation. If suitable material for refilling is not available for excavation the Contractor shall bring earth, murrum of approved quality as directed by the (SCDCL) Engineer. No mechanical plant other than approved compacting equipment shall run over or operate within the trench until backfilling has reached its final level or the approval of the Engineer has been obtained. Subsidence in filling in: Should any subsidence take place either in the filling of the trenches or near about it during the maintenance period of 12 months from the completion of the Contract Works, the Contractor shall make good the same at his own cost or the Engineer may without notice to the Contractor, make good the same in any way and with any material that he may think proper, at the expense of the Contractor. The (SCDCL) Engineer may also, if he anticipates occurrence of any subsidence, employ persons to give him timely notice of the necessity of making good the same, and the expenses on this account shall be charged to the Contractor.

49.52 BOX PUSHING THROUGH EMBANKMENT

Providing and casting reinforced concrete approved design mix design mix Box of the size as per GAD, including providing and casting steel cutting edge for front shield, MS rear shield R.C.C. M-20 for thrust bed, thrust

wall for pushing the box below railway embankment under railway / roads under running traffic condition as per contractors own design / drawing including arrangements for intermediate jacking station with provision of intermediate shield and its connections with the box drag sheets as may be required for smooth controlled pushing etc. complete in all respects, including cost of necessary excavation with its all lead & lift for constructing thrust bed at designed level as directed by Employer's Representative including providing all temporary works as required & approved by Railways authority, required protection of existing road pavement / railway tracks including providing water tight joints in R.C.C. box segments using CC grout with epoxy paint on exposed facing and providing R.C.C. saddles in the box as per details given with drawing for supporting pipe in the box as directed, including all plans and machinery, equipments, all labour, materials & all temporary works in all respects, dismantling and removal of temporary work, restoring ground to its original profile on completion of work. The work also includes sealing of box at both ends after completion, etc. as directed by Employer's Representative.

49.53 SPECIFICATIONS FOR CASTING RCC BOX & PUSHING THROUGH EMBANKMENT

In order to avoid interference to railway traffic / excavation on existing roads intercepted on pipeline alignment, BOX PUSHING technique is envisaged in preference to any other conventional methods for the laying of pipeline through such railway & road crossings intercepted. The R.C.C. box segments shall be cast using concrete grade of approved design mix in suitable segments as per the approved design, and pushed across the embankment by hydraulic jacks, of suitable capacities excavating manually the soil under the FRONT SHIELD of the box.

The thrust bed required for box pushing shall be of required width and of length and thickness as per design approved and laid along the longitudinal axis of proposed box. The thrust bed is envisaged in reinforced concrete using grade M-20 and designed to resist the reaction induced due to jacking force while pushing the box inside the embankment. The reaction due to jacking force shall mainly be resisted by frictional resistance between

thrust bed and the earth. However, additional keys provided at the bottom of the bed shall be made use of to develop more resistance due to passive pressure of the earth. The concrete below the bottom of each pin pocket shall be done first for positioning them. Aligning these pin pockets is very important aspect while casting the thrust bed in order to avoid any lateral shifting of the box with respect to its axis. Therefore, these boxes shall be held in position by welding MS bars between boxes in longitudinal and lateral directions. While concreting for entire thrust bed is carried out, two recesses shall be left along the entire length of the thrust bed at top for housing rails. Levelling of these rails shall be done by providing suitable MS packing Coils at suitable spacing. These recesses shall then be filled with screed mortar. Also, 50 mm thick screed shall be laid on top of the thrust bed and levelled such that the top of rails shall remain 2 mm protruding above top level of the thrust bed. The pin pockets shall be cov-

ered with precast cover slab before screeding. The thrust bed shall be laid in a slope of 1:700 to avoid lifting of box during pushing. In order to facilitate jacking and steering, it is envisaged to cast the box in segments of suitable lengths. The first box shall be provided with FRONT SHIELD and REAR SHIELD. The front shield shall consist of M.S. Plate with suitable stiffeners. Anchor bars, welded to the Plates shall be embedded in the concrete of the box. The front shield shall be 1.0 m wide on all four faces with 0.50 m width embedded in box concrete. Similarly, rear shield shall be provided at the rear end of each box. Half the width of rear shield shall be embedded in box concrete with outer face being flush with outer surface of the box. For the front 0.50 m length of box, the thickness of top and bottom slab and both sides shall be reduced by 30 mm. so that rear end of the first box and at front end of remaining box pockets, suitably lined with 6 mm thick M.S. Coils shall be provided to house hydraulic jacks for intermediate jacking. Two pockets shall be provided in the side walls of box, just below top Haunches and two shall be provided in bottom slab of box, next to Haunches. The box is designed as a normal box but subject to longitudinal thrust while pushing. 8 mm thick M.S. Plates shall be laid over rails placed in thrust bed to form bottom of box along the length. The bottom surface of these Coils shall remain flush with the bottom of the box. These Plates shall be anchored in bottom slab concrete with welded anchor bars. With this arrangement, while pushing the box over the thrust bed, the contact between steel to steel surfaces shall reduce friction. Before casting the box, polythene sheets suitably greased shall be laid on the top of thrust bed & bottom of box to prevent contact between thrust bed and bottom of box and facilitate pushing with very smooth, frictionless surface between the thrust bed and bottom of the box. To withstand reactions of jacking force, jacking pins are provided with M.S. bar handle to facilitate the lifting when required. The overall dimensions of the pins shall ensure smooth insertion and lifting inside pin pockets. A jacking rig, fabricated from M.S. Plates and structural steel shall be provided to ensure proper alignment of jacking force. One end of the jacking rig shall have saddles to house hydraulic jack. The clear width inside rig shall be more than pin pocket to ensure smooth sliding of rig. Spacers fabricated from M.S. Plates shall be used for filling gaps between hydraulic jack and jacking pin while pushing. These spacers shall be meant to rest against jacking pin at one end and jack ram at the other end. After completion of casting of box, pushing operation shall commence with the rigs laid on top of the thrust bed with one end of the rig resting against face of the rear end of bottom slab of the first box. The hydraulic jacks shall be properly housed in the rig so that one end of jack shall rest against the end plate of the rig. The other, ram side of the jack shall rest against face of jacking pin. When the jack shall be operated, the ram shall be pushed against the jacking pin. This will make the box to move in the direction of thrust away from jacking pin. When the full displacement of ram is obtained, the jacks shall be closed and spacers shall be inserted between the jacking pin and the jacks. The jacks shall be operated again and the box shall be pushed in the direction of thrust. When the rig travel to expose next row of pin pockets, the jacking pin shall be removed and installed in the next row of pin pockets. This

process shall be repeated till the front shield shall cut into the embankment for about 1.0 M. The excavation at the front end of the box shall be carried out manually within front shield. The muck shall be removed from the box. When about 0.50 M of excavation shall be done, the jacks shall be operated again so that front shield shall be pushed for 30 or 40 cm further inside the embankment. Again, the excavation shall be continued till the entire length of first box is fully pushed inside the embankment. When rear end of the first box shall be very close to the embankment, the second box shall then be cast and after adequate curing, pushed to lock inside the rear shield of the first box. Hydraulic jack shall be housed in intermediate jacking pockets and an intermediate jacking station shall be opened up. The operation of the jacks in the intermediate jacking station shall be similar to that in the initial stage. However, in this case, the ram shall rest against plate lining in pockets. After opening the intermediate jacking station, the intermediate jacks shall be operated while the rear end of 2nd box shall be made to anchor against the jacking pin through the jacks. **In General following sequence shall be adopted in carrying out the job :**

a) After casting thrust bed, polythene sheets suitably greased shall laid on the top of thrust bed as above explained to prevent contact between thrust bed and bottom of box.

b) The reinforcement cage required for base slab with reinforcement for side walls shall be placed in position on bed. The precast blocks or chairs for provision of cover shall be provided under the cage.

c) The base slab and side walls up to top of bottom haunch would be concreted with M-25 grade concrete in one operation leaving the top of side wall rough.

d) The reinforcement cage for side wall shall be laid in proper position. The lap length shall be provided properly. The side walls shuttering shall be provided by proper checking of alignment & vertically up to bottom of top haunch.

e) The surface of hardened concrete shall be thoroughly hacked, swept clean, wetted and covered with a layer of neat grout. The neat grout shall be applied to the top and this shall be followed by a 10 mm thick layer of mixed the same proportion as that of sand in concrete and concreting shall be resumed immediately thereafter. The first batch of concrete shall be rammed against the old work to avoid formation of any stone pockets particular attention being paid to corners and closed spots and the concreting of side walls shall be carried out up to the bottom of top haunch.

f) The reinforcement cage for top slab shall be laid properly on centring and chairs or precast units for providing cover shall be laid under cage. The centring shall be checked in alignment and props shall be of sufficient strength.

g) Concreting of top slab shall be carried out in the same manner as per 5 above.

h) Pushing of the completed segments of the box shall be commenced as per the procedure described in above paras till the entire length of the box in the embankment is built up.

i) After completion of jacking, pressure grouting of concrete shall be carried out of fill joint between segments to make then water tight and the inside face of the joint treated with smooth finishing and box indicators shall be placed at both ends of box showing necessary details of box and communication. Both ends shall be closed with BB Masonry keeping provision of air vents.

49.54 CROSSING: GENERAL SPECIFICATIONS

At public highways, or at such other crossings as are shown in the construction drawings prepared by contractor and approved by (SCDCL) the pipeline shall be installed in MS casing pipe conforming to the specifications given herein.

(a) The casing pipes shall be installed in accordance with the details given in approved drawing and the casing, bushing and insulators, etc., shall be installed on the carrier pipe as detailed in drawings. Casing pipe size shall be as per approved drawing of sanctioning authority(SCDCL), Casing shall be installed with even bearing throughout its length and shall slope towards one end, as specified or desired by the (SCDCL) Employer's Representative. The ends of the casing shall be sealed to outside of carrier pipe in accordance with the details given in drawing.

(b) Before installation, holes for installing vent pipes shall be cut and burrs if any shall be removed. The welding of both carrier pipe and casing pipe shall be done in accordance with the welding specifications, given herein. Before installing the casing pipe, it should be cleaned of all internal obstructions and during installation care should be taken to keep the inside clean.

(c) The section of carrier pipe to be placed in any casing shall be closed at each end, hydrostatically tested preferably with dead weight tester for at least two hours. Only on successful completion of this test, shall the carrier pipe section be inserted in the casing pipe. The installation of casing may open cut as circumstances may permit or require as directed by the (SCDCL) Representative.

(d) The installation of casing in bended section of the carrier pipe shall be performed by meter bends of the casing pipe provided that the length of each meter cut out of casing pipe shall be such as to provide a clearance of at least 1-1/2" between the inside of the casing pipe and the outside of the coated carrier pipe.

(e) Excavation for casing installation shall be immediately backfilled at the completion of the work with suitable solid matter and packed thoroughly to prevent seepage of water into the excavation.

49.55 ROAD AND IRRIGATION CANAL,RAILWAY CROSSINGS:

(a) At road and canal crossings the work shall be performed to the specifications of local authorities or such public bodies as may be in charge (S) of roads and canals to be crossed.

(b) In case, however the minimum requirements of the governing agencies are less than those set out in the drawing or the specifications given herein, then the requirements given in the drawings and the specifications given for encased line shall be followed.

(c) Whereas the casing pipe in the case of encased line to be laid normal by boring, tunnelling SCDCL'S Representative may at his discretion permit open-cuts to be made for the installation of casing provided, however, that the TENDERER shall procure the necessary permit / license for the same from competent authority. At locations wherein the open cut methods are permitted, the TENDERER shall pass the carrier pipe through the casing located in the trench after the approval of the (SCDCL)'s Representative in writing, if Open Cut method is not permitted by authority, pipe is to be laid through Push Through Method. and care shall be exercised to avoid damage to pipe coating and wrapping during this operation. The TENDERER shall produce a certificate in writing from concerned authorities for its satisfactory restoration and payment therefore.

(d) At all crossings the carrier pipe shall be laid straight without bends so that if necessary the pipe at a later date may be replaced without cutting the casing. The carrier pipe shall extend at least 2 m beyond the end of casing pipe at either end.

(e) At road crossings the TENDERER shall eliminate unnecessary bending of pipe to conform to the contour of ground by gradually deepening the ditch at such approaches as directed by the SCDCL's Representative. Where the installation of the casing has been made by open cut TENDERER shall install suitable temporary bridge work ensuring the safety of the traffic aids and safeguards for protection of the public safety, or he shall provide suitable diversions as desired by the SCDCL's Representative.

(f) At all railways pipeline crossings shall be bored with horizontal boring machine.

(g) The method of carrying out a cased crossing by boring for various crossings on this pipeline route shall be jointly inspected by the representative of the COMPANY and TENDERER for each category of work prior to commencement of actual work.

(h) Pipeline under Road Track and irrigation canal an applicable portion of the right-of-way shall be encased in accordance with the specification. This item of work shall include, necessary clearing and grading required therefore, trenching to the depths and widths required, welding of casing and carrier pipes, testing, lowering in, installation of vent assemblies, end seals, insulator and all other fittings that may be required, backfilling, clean up, complete restoration to the original condition and further

strengthening and protective works as may be required. The work shall be carried out in accordance with the drawings and as directed by the (SCDCL)'s Representative. For various operations mentioned above, the specifications pertaining to these operations shall apply in addition to the specifications given herein.

The TENDERER shall be permitted to use Williamsons type Neoprene seals in place of concrete end seals for the crossings. The item shall be procured by the TENDERER himself as per the provisions under the appropriate head of work in case TENDERER so desires. The representative of the COMPANY may also be associated to determine the quality of the material and its delivery schedule from the open market. However, the particular work defined under the proper head shall not be delayed on account of non-availability of Neoprene end seals. In such case, concrete seals may be provided.

On both ends of pushing concrete supports are to be provided as per direction of (SCDCL) Employer's Representative.

LOFC: LIST OF OPERATION OF FABRICATION AND CONTROL

Each LOFC must contain the following information as a minimum (all clearly marked and separated):

- a) Company name and references relating to the order;
- b) All technical and other information required in order to define the items covered.
- The area of application will be limited to that item or those items considered in fabrication and control as a natural unity.
- Details of plants, layout, capacity, production rate, testing equipment, yard facility
- c) A numerical sequence of operations with description will be built-up in a logical way of work progress.
- The first operation will be the control over the incoming material(s) and documents.
- The last operation will be the control over the final documentation.

The following operations have to be included (not limited to):

- Procedure prior to the commencement of production shall be approved by PURCHASER
- Each step which call for own quality control (eventually QA);
- Each applicable examination as part of this specification;
- Document control-stamping and final documentation.
- d) Each operation will be followed by the applicable specification or procedure number (with the latest revision).
- e) Columns to be provided for possible interventions of :
 - the manufacture's fabrication control;
 - the MANUFACTURER's quality control (eventually QA);

- inspection Agency;
- and place of intervention if not by the MANUFACTURER.

The interventions will be indicated per operations with H or W and/or R. H = hold point - no further steps may be undertaken before the intervention of the designated responsible takes place. W= witness point - the designated responsible has to be notified of the operation in advance, but production will continue whether the intervention took place or not. R= point for which a control report or a recording has to be made.

The MANUFACTURER will fill in his own H, W and R points. The inspection Agency will do the same in its designated column, but this will not implicate a relaxation or wearing of the requirements of the MANUFACTURER's controls. Each intervention has to be signed and dated by person acting as controller. Only the original documents will be presented for this purpose.

f) One column to be provided for report or record number (point marked R) and one for the review of these documents by the Inspection Agency.

g) Two extra columns may give reference to non-conformity report if any and to the resolution given to it.

Completion of the LOFC does not automatically rise to a release of the material or it must be stipulated otherwise in the contract. The steps indicated in the LOFC must be executed following the sequence as stipulated in LOFC.

Specifications for Providing and applying 3 layer polyethylene coating and internal fusion bonded epoxy lining for MS Pipes etc. complete.

Providing & applying 3 layers polyethylene coating of minimum 1000 micron composite coating and thickness as per standard and internal fusion bonded epoxy lining as per IS 3589 annex C of 400 micron thickness for underground laying MS Pipes, Similarly dual layer polyester coating of 400 micron externally and internal fusion bonded lining as per IS 3531 for above ground laying MS pipes. Pipe coating shall be done at factory. The external 3 LPE Coating is bonded to the carbon steel pipe surface by a FBE layer. The mean strength of adhesion of the FBE (both internal and external) to the steel surface is at least 125 Kg/cm². The pipes supplied prior to coating shall be cleaned by Grit blasting, M.S. pipe free from dust, oil grease and moisture prior to application of coating, loading, unloading and handling of pipe at factory. complete **ref.specification 49.31 to 49.45**

Name of work : AUGMENTATION TO SOLAPUR CITY WATER SUPPLY
SCHEME (UJANI DAM AS A SOURCE – 110 MLD)

OBLIGATORY REQUIREMENT FOR JACK WELL

The structural design for the Jack well with overhead pump house and Approach bridge shall be done as per standard specifications and code of practice of the IS.

The design shall be carried out in conformity with following latest IS code.

1. IS:456-2000
2. IS:875
3. IS:11682
4. IS:1893 with inclusion of seismic zones as per latest circular.
5. IS:1786 for cold worked steel high grade deformed bar (Tor steel of 415 and Mild steel of grade – I shall only be used).
6. IS:13920-1993 for ductile detailing. BSI Publication S.D. 34 (S & T) 1987.
7. IS:3370:2009 (Part – I to IV) for water retaining structures.
8. Trial pit details of work site shall be given. (Open rock is visible nearby bearing capacity shall be taken as 20 MT/Sqm for design purpose only).
9. Design shall be got approved from VJTI/IIT/VNIT/WCE/Government Engineering College/Reputed Consultants (approved by M.J.P.) at contractor's own cost.

All RCC work on Jack well and pump house shall be designed in M-250 and water retaining structure as well as structure whichever exposed to sever rain, alternate wetting and drying. According not less than 45 mm concrete cover shall also be provided. The item shall be executed as per IS Code and in M-300

JACK WELL

1. The arrangements of column and beams shown in the drawing enclosed shall be designed as per requirements.
2. The floor shall be provide with RCC M-300 concrete for which live load shall be 500 Kg/Sq.mtr.
3. The beams supporting pumps on the floor shall be designed for the load of pumps, motors and column assembly. The beams shall be so designed that in one bay five pumps will be installed at equal distance. The space left between the pumps shall be provided with M.S. grating.

The beams shall be capable of resisting impact load as per relevant IS for which load of 5 motor, and dynamic load of pump, including column assembly as 1.5MT.

4. There shall be a M.S. ladder from pump house floor to have access up to RL 480 M. The M.S. ladder shall have 0.50 m width with railing on both sides. This shall be designed for 300 Kg/Sq.mtr. live load.
5. The RCC wall panels on water side shall be designed for the critical loading as specified below.
 - a) Full water load from inside without any soil load from outside. The H.F.L. is 497.58 M which shall be considered for accounting of internal water pressure.
 - b) Saturated earth fill load from outside and having no water pressure from inside.
6. The columns shall be capable to taking load as well as bending moment due to load transfer from wall panels. The internal bracings/beams shall be designed for self-weight plus live load of 150 Kg/Rmt.
7. The well structure up to RL 499.75 M shall be designed for non-cracking condition.

JACK WELL FLOOR

The floor of Jack well (bottom slab of well) shall be designed for full uplift.

PUMP HOUSE

1. The two storied pump house shall be provided over the Jack well and it shall cover full area of Jack well as per drawing. The floor level shall be RL 500 M. The clear minimum size of the pump house shall be 21 m x 31 m. The outer column shall be continued up to roof level with internal beams/lintels etc. The total height of pump house shall be minimum 10 M up to top of roof slab as shown in drawings. There shall be continuous corbel beam with a corbel for supporting moving gantry. The capacity of gantry shall be taken 10.00 MT and the corbel beams shall be designed duly considering the impact load due to moving gantry.
2. Two rolling shutter shall be provided for the pump house and the size of rolling shutter shall be 5 x 5 m & other size shall be 1.50 x 2.50 m
3. Aluminum windows with glass shutters of size 2.0 x 1.20 M shall be provided with M.S. grill.
4. The paneling shall be with B.B. masonry 230 mm thick in cement mortar 1:4 proportion. Inside plaster 1:3 CM with neeru finish shall be provided and outside plaster in CM 1:3 with sand face surface.

5. Oil Bound Distemper of approved shade shall be provided from inside in 2 coats and Apex paint shall be provided in 2 coats from outside.
6. Jack well and Pump House building should be designed so that building should appear aesthetically well planned.

ROOF

The RCC slab shall be provided at the top of the pump house resting on beams and columns. There shall be 150 mm projection of roof slab and a normal slope to be given to drain off the rain water.

**Name of work : AUGMENTATION TO SOLAPUR CITY WATER SUPPLY
SCHEME
(UJANI DAM AS A SOURCE -110 MLD)**

OBLIGATORY CONDITION FOR JACK WELL

1.	HEAD WORKS		
I	Jack Well		
a)	Location	:	Upstream side of Ujani Dam
b)	Type of Construction	:	R.C.C. M – 300
c)	Average of bed level of Jack well	:	495.00m.
d)	Floor level of jack well	:	500.00M
e)	Size of Jack well	:	28X18 X 25 M (Approx.)
f)	Depth of Jack well	:	(Top RL 500 - Bottom RL476) = Total 24 m
g)	Leveling course	:	PCC M-200
h)	Ladder	:	MS ladder of 0.50 M wide.
i)	Vertical wall	:	0.50 M thick (minimum)
j)	Floor Jack well	:	RCC M-300.
k)	Floor beam	:	Location of floor beam and foundation block for pumping machinery shall be confirmed from Engineer in charge and then assembly design shall be submitted.

Floor slab of Jack well should be designed for dynamic loading and vibration load.

II	OVER HEAD PUMP HOUSE.		
a)	Size of pump house	:	double storied .30X15X10 M.
b)	Clear height of P.H.	:	10 m for two floor
c)	Construction	:	RCC Framed structure with B.B. Masonry works
d)	Top RL of pump house	:	510 m.
e)	Opening at floor level of pump house	:	Opening around the pumps should covered with holding.
f)	Continuous Corbel beam	:	Continuous corbel Beam shall be designed to sustain the load of 10.00 MT gantry crane
g)	Rolling shutter	:	With width 5 m extension
h)	Aluminum windows	:	2 X 1.2 m 32 No's
j)	Lintel (RCC)	:	Over windows and rolling shutters.
k)	Chajja (RCC)	:	Over rolling shutter and window of size 0.75 M.
l)	Cement plaster	:	20 mm for outside and inside face with neeru finish in CM 1:4
m)	Flooring	:	Polished tandoor stone flooring
n)	Distemper	:	Oil bound distemper inside of pump house.
o)	Apex paint	:	Outside of pump house and expose face of Jack well.
p)	Top Slab	:	Must be inverted beam with slope both sides along with water drain arrangements.
q)	Gantry	:	At 5.50 M from panel floor with Gantry top width 0.50 M
r)	Opening of Inlet	:	1.0 x 1.0 M – 2 Nos.
s)	Baffle walls	:	5 Nos. 1.25 M Height
t)	Pipe carriage way	:	2.0 M Width

DATA SHEET FOR HEAD WORKS SUB WORK

Providing and constructing RCC Jack Well, & Overhead Pump House.

All above obligatory levels and sizes of said components of the complete structure may change as per instruction of (SCDCL) Representative without any extra compensation above the respective notes quoted against the various items.

All foundation level and strata shall be inspected by (SCDCL) Representative and only after approval of foundation strata further casting of respective footing should be conduit.

All necessary soil testing should be carried out as per instructed by (SCDCL) Representative at own cost of agency.

Designing of R.C.C. Jack well and Pump House from reputed structural consultant, getting approval of the same from proof consultants approved by Indian Institute Technology Bombay at contractors own cost. After due approval of said design & drawing , construction of the RCC Jack well and Pump House shall be carried out as per specification & condition of the agreement till its satisfactory completion .

**Name of work : AUGMENTATION TO SOLAPUR CITY WATER SUPPLY
PROJECT
(UJANI DAM AS A SOURCE – 110 MLD)**

DETAIL OBLIGATORY CONDITIONS FOR R.C.C. BRIDGE

SCOPE :

Designing of R.C.C. Bridge from reputed structural consultant, getting approval of the same from proof consultants approved by Indian Institute Technology Bombay at contractors own cost. After due approval of said design & drawing in construction of the RCC bridge shall be carried out as per specification & condition of the agreement till its satisfactory completion .

Design :

The following details should be taken into consideration while carrying out design.

Clear width of RCC bridge shall be 6 m for vehicle movement with provision of chairs for carrying 1296 mm dia. OD MS pipes along with cable trench / tray.

Length of bridge shall be 120 m

The height of bridge shall be 1.0 m above the highest flood level.

IS to be referred :-

1. IS:456 (latest edition). Water retaining structure / water container shall be Constructed in M300 and remaining structures shall be constructed in M-250
2. IS: 3370 :1965 Part-I, Part-II and Part-IV .
3. IS:1893:1975 (Latest edition)
4. IS:875:1964
5. National Building Code of practice ,Government of India Latest edition , Publication of ISI.
6. Any other IS Specification , not mentioned above but relevant in the design , construction etc. shall be made applicable. for such application no extra claim shall be payable to the Contractor.
7. IS:13920 for Seismic Zone-IV

Width of foundation :-

Depending upon the safe design of the structure but not less than 2 M.

Height of Bridge :-

The height of bridge shall be 1.0 m above the highest flood level and should be in level with floor level of RCC Jack Well and the Jack well slab and bridge dock slab shall be monolithic to avoid overturning of Jack well.

DRAWING :-

Drawing should be based on the actual survey & investigation done at the site and submitted along with Field Book for the said purpose . The detailing of each aspect of the work thus designed should be incorporated in the drawing.

CONSTRUCTION :-

The entire work shall be carried out as per the specification laid down in the document and as directed by (SCDCL) Employer's Representative in the matter.

The foundation of the bridge shall below 3.0 m below respective ground level of cross section of bridge.

The entire structure of RCC Bridge shall be in designed in M-250 mix and shall be constructed in M-300 mix with required reinforcement. There should be provision for RCC chairs for carrying 1016 mm dia MS Rising Main and cable carrying tray.

The deck slab of RCC bridge shall be designed in such a way that it should be monolithic with floor slab of Jack Well to avoid overturning of Jack Well.

Length of the bridge shall be 120 m.

The said work also includes the cost of necessary coffer dam, dewatering , diversion of flow of water during construction.

TERMS OF PAYMENT :-

As per Annexure 2 of Bid Document.

All other relevance guidance shall be taken from other obligatory data condition enclosed in this document.

- Seismic Zone – IV shall be considered for effect of earth quake while designing.
- Check for eccentricity shall be carried out as per I.S. 456 (Latest edition)

- Design with limit state method is not acceptable
- Irrespective of the design, minimum dia. Of the bars to be used in concreting shall not be less than 8 mm dia. Tor steel.

CONSTRUCTION :-

The construction shall be in R.C.C. carried out as per –

- i) Current I.S.S.
- ii) Standard specification latest edition of Maharashtra Publication.
- iii) Foundation shall be designed for saturated soil condition and permissible stresses shall be reduced as per I.S.3370/1967 and sub sequent amendments.

BEARING CAPACITY :-

The agency should take necessary core samples across the length of bridge @ 30 M. c/c to decide the bearing capacity and shall be approved from competent authority.

GUARANTEE FOR :-

Contractor shall stand guarantee for the stability of the structure and due performance of all the works included in the tender for the period of 5 yrs. from the date of completion of the work. The Contractor shall be responsible for the technical correctness of the design submitted by him. The structure shall be as per the best recognized Engineering practice . If any provisions are found to be inadequate, faulty or not in accordance with best Engineering practice , necessary modifications will have to be carried out by the contractor at his own cost ,at any stage during execution of the work and no extra payment shall be made for such modification.

PROGRAMME OF WORK :-

On acceptance of the tender the contractor shall submit his programme of carrying out the work giving due bar charts & target dates of completion . The surplus excavated stuff shall be removed from the site of construction without any extra charges as directed by(SCDCL Representative).

METAL :- -The metal required for the work of R.C.C. Bridge should be black basalt and it should be brought from approved quarry only .

SUBMISSION OF DESIGN AND DRAWINGS :-

After finalization of Tender , the contractor shall design R.C.C. Bridge from reputed structural consultant , getting the same approved from proof consultants approved by Indian Institute Technology, Bombay at contractors own cost. Any addition data that may be required by the SCDCL with reference to the offer have to be submitted by the contractor and shall furnish five sets of design and drawing finally approved by the SCDCL before the execution of work is actually started.

BASIC DESIGN REQUIREMENT & OBLIGATORY LEVELS OF BPT

AND

SPECIAL OBLIGATORY CONDITIONS FOR WATER RETAINING STRUCTURE

The basic design requirements, criteria and dimension mentioned hereafter shall be strictly adhered to.

The intending tenderer should acquainted himself thoroughly with the site conditions as well as needs of before tendering and designing the schedules. The contractor should make his own arrangement about probable depth and strata for resting foundations.

OBLIGATORY LEVELS AND REQUIREMENTS (Parameters)

DETAILS OF RCC BPT

R.C.C. BPT:-

Sr. No.	Location of BPT	Cap. in Liters	Avg. Ground Level	Low supply level and full supply level and Numbers
1.	Near Varawade Toll Plaza	500000	543 M	LSL - 560 M FSL - 565 M

Note: No change in these levels will be permitted & RCC design will not be accepted by (SCDCL) if changes are made.

DESIGN CRITERIA & ASSUMPTIONS

DESIGN STANDARDS

The structural design of the tank shall confirm to the following standard specifications and code of practice of the BIS,IS:456-Code of practice of plain and reinforced cement concrete (latest revision),

IS:3370 –Code of practice for concrete structures for storage liquids Part-I to IV(latest revision),

IS : 875-Code of Practice for structural safety of building, loading standards (latest edition),

Part-I.....Dead Load

Part-II.....Imposed Load

Part-III.....Wind Load

IS : 1893-Criteria for earthquake resistance design of structures (latest edition)

IS:1682-1985 -Code of Practice for criteria for design of RCC staging for overhead water tanks (latest edition) and various standards issued by BIS.

DESIGN OF STRUCTURES

The above Indian Standards current on the date of tender shall be applicable to the design of structure. Item which is not specifically covered by Indian Standard Code of Practice, reference shall be made to the relevant standard specifications.

Construction of various capacities RCC MBR/ESR / SUMP

1. The reservoir will be a covered RCC container supported on RCC column footing and termed as braces, etc as per drawing.
2. Suitable RCC spiral stair case should be provided with landing parapet, RCC pardi for approach to the Gallery and top of the ESR, RCC cantilever catwalk (gallery) of 1.20 m width, GI pipe railing shall be provided at floor level, preferably at junction of floor slab and vertical walls and GI pipe railing with RCC post of 1.0 m c/c interval at the roof slab level of the container.

Ventilators shall be provided on top slab of ESR. One number of C.I. manhole frame and cover shall be provided and fixed in the roof of the tank. One S.S. ladder shall be provided and fixed for access into the tank through manhole left in the Roof. Ladders shall be provided as per specifications. Water level indicator (Mercury) assembly of approved type shall be provided and installed.

Lightening arrestor as per IS specifications and confirming to IE rules shall be provided and fixed. Vertical & horizontal pipe of CI, D/F flanged pipes, M.S./C.I. specials of required sizes for inlet, outlet & overflow arrangements together with suitable Sluice Valves shall be provided as per drawings. For washout, one tee shall be fixed on the outlet pipe with one valve of suitable size. Sluice Valves of required size shall be fixed for inlet, outlet & washout. These valves shall be supplied by the contractor, confirming to relevant IS code and of **approved makes**.

Required no. of B.B. masonry chambers of suitable sizes directed with C.I. manhole frame & covers shall be provided & constructed at suitable locations for Sluice Valves. Water proof cement plaster of CM(1:2) proportion, 20 mm thick shall be provided for inside surface of water tank, including roof slab bottom & epoxy painting in two coats be provided as per specifications.

Outside surface of tank, exposed faces, columns, braces, catwalk bottom

portion of slab & exposed surface of the tank shall be provided with cement plaster of CM(1:3) proportion ,20 mm thick with smooth finish\and then 3 coats of water proof cement paint approved by shall be rendered.

Letters indicating capacity of tank, name of scheme and the year of construction shall be either embossed or engraved on vertical wall of tank and shall be painted with suitable shade of oil paint in 2 coats.

On the completion of work hydraulic test or water –tightness test shall be given as per standard specification. Therefore required water arrangements shall be made by the contractor at his own cost.

Since this a lump sum offer, the interim payments will made at different stages of works contract, as per break-up schedule enclosed. Which is to be approved by the competent authority.

Since this is water retaining structure, contractor shall give a satisfactory hydraulic test of the tank. This test shall be considered as water tightness test and accepted if the structure appears bone dry from outside after filling the water up to full supply level & the drop in water level is not more than 40 mm in 7 days. For this purpose the water filling arrangements shall be made by the contractor at his own cost, including cost of water pumping arrangements; etc.

If during testing any damage occurs to the structure, it will be responsibility of the contractor to rectify the same. Until satisfactory water tightness test is given on completion of work, interim payments to be made at different stages of works as per break-up of payment schedule enclosed.

**MATERIALS REQUIRED FOR
CONSTRUCTION**

1. Sand, Metal & Bricks

Sand, metal & bricks of best quality will be insisted. Samples of these will have to be got approved prior to use on work.

2. Cement

OPC of 43 grade in jute/polyethylene bags (weighing 50 Kg each) shall be used for all water retaining Structures & for all works. The cement shall be used of following brands (1) Ultratech, (2) Birla and (3) Ambuja. Super plasticizer in the proportion of 0.5 % (0.25Kg/cement bag) should be used.

3. Reinforcement

Tor steel of 415 grade & mild steel grade-I shall only be used as per design. /The steel to be used shall be of grade Fe-250, Fe-450 as per design.

The Contractor shall have to procure the steel from open market .The steel procured by Contractor shall be only tested one and the Contractor shall produce manufacturer's test certificate without which it shall not be accepted. Further the Contractor shall arrange to get tested any sample from steel brought at site by him in laboratory at his cost and results should be submitted to the . Defective steel brought by Contractor shall be rejected and will not be allowed to be used. Test certificate stating the chemical composition & characteristics of the product should also be produced.

At least three samples of each diameter should be tested from every 5 tons (MT) or part thereof. Tested lots only will be permitted to be used.

4. Concrete

The PCC and RCC work shall be as per IS 456:2000.(OR LATEST REVISION) Concrete mixer shall be used for preparing concrete.

Vibrator shall be used to consolidate concrete while placing in position. Mix design will be allowed only if required for minimum infrastructure like weigh batching plant, Needle vibrator and proper form work is provided.

While concreting, representative samples in form of Test Cubes shall be taken by the supervisor and shall be tested under his supervision, charges of testing shall be borne by the Contractor .Frequency of taking cubes(sampling, accepting criteria, standard deviation values, carting of concrete cubes ,test procedure etc.) should be followed by contractor as per IS:456.

5. Water Level Indicator Assembly

Mercury water level indicator with 15 mm dia. required GI pipes (medium duty), stop cocks (2 nos.), necessary fixtures suitable for staging height up to 15 M and water depth up to 5 M to represent depth of water in tank, etc. shall be provided and fixed by the Contractor as per direction of . The indicator should be fixed to exterior face of column at about 1.5 M above ground level at site or as per requirement of (SCDCL)Engineer –in-charge.

6. Lightning Arrestor

Lightening arrestor conforming to IS and Indian Electricity Rules shall be provided. The lowermost portion of tape for 2 meters above ground level and 2 meters below ground level shall be enclosed by 50 mm GI pipe of 'M' class.

7. Pipe Railing at free end of Catwalk

Railing shall be of GI pipes 'A' class not less than 25 mm diameter in two rows and shall be fixed in position to RCC posts or M.S. angle posts of size 65 mm x65 mm x 6 mm,1.0 metre in height, located at a maximum distance of 1.5 M C/C. The railing and the posts shall be provided with two coats of oil paint of approved shade.

8. M.S. Ladder

M.S. Staircase with one meter width from ground level to bottom slab, gallery to roof slab with intermediate platforms .The ladder should be fabricated from heavy angles, steps & railing as directed by Employer's Representative.

9. S.S. Ladder in container

Two nos of heavy type S.S. Ladder & of required length & design as approved by Department shall be provided by the contractor for each ESR. This shall be for the access inside the tank .The contractor shall furnish to the the various manufacturers of the ladder.

10. Centering Work

Before starting the work of ESR, the Contractor should submit design of centering and its detailed drawing for approval by . This set of drawings shall be kept at site. This condition shall be applicable for the ESR with Contractor's design.

Designing, Providing & Constructing RCC ESRs Own Design

Specification and Design Criteria for RCC ESR/MBR/GSR/Sump with Contractor's own Design-Designing, Providing and Constructing RCC

ESR/MBR

1. General Note

- 1.1** The Contractor shall quote his offer in Schedule 'B' for the complete work of constructing RCC ESR to be carried out as per his own design based on given data i.e. he shall tender the offer in Schedule 'B' for construction of elevated tank of required capacity including fixing pipes, specials, valves and providing and fixing, lightning conductor, C.I. manhole frame and cover, water level indicator ventilator, etc. complete with his own design and drawings.

The design shall be got checked from the institutes like Government Engineering College. Remarks shall be complied and scrutiny charges shall be borne by the Contractor.

- 1.2** The Contractor shall submit the name, qualifications and experience of Design Engineer who has prepared detailed RCC calculations or how will prepare design and drawings on acceptance of the tender. The authorized representative of the designer will have to inspect and certify the works at foundation level and every beam level.
- 1.3** The design Engineer has to prepare and submit a note on design methodology and construction and drawings in two copies through the contractor. The note should indicate general description, and salient features of the design covering the following points
- a) Capacity
 - b) Shape and type
 - c) Staging height of tank indicating various levels
 - d) Safe bearing capacity assumed in the design of safe bearing capacity of strata based on actual investigation report of laboratory and type of foundation provided with proper justification.
 - e) Maximum and minimum subsoil water level.
 - f) Site plan showing location of ESR.
 - g) Line diagram showing dimensional and sectional elevation with important levels.
 - h) Design parameters proposed to be adopted for detailed design.
- 1.4** This note on design will be subjected to thorough check by the Employer's Representative of the owner and the tender will be accepted and work order issued by the competent authority only after verification that the design to be offered will fulfill the requirements of the design as per tender specifications.
- 1.5** After acceptance of tender, the Contractor will have to submit three copies of

detailed design and drawings of the structure within 15 days of acceptance of the tender.

- 1.6 The Design Engineer will be required to attend the office of Employer's Representative for preliminary discussion for scrutiny remarks, etc. whenever required with all reference data, books, IS specifications, etc. at his own cost.
- 1.7 It will be binding on the Design Engineer of contractor to clarify, modify, redesign and prepare drawing after compliance of scrutiny remarks by the owner or his representative such as an Engineering College, within 15 days of communication of remarks. Even though design will be approved by owner, it will be the entire responsibility of the Design Engineer and the Contractor.
- 1.8 On approval of the design, contractor shall supply, free of cost, eight sets of design and drawing duly bound for use of the Owner. The Contractor shall also furnish the details of steel requirement along with programme of execution for completion of work within the time limit stipulated in the tender.
- 1.9 Security deposit of the tenderer shall be forfeited if he fails to modify his design as per scrutiny remarks within specified time after levy of compensations as per tender agreement.
- 1.10 Even though the design and drawing submitted by the Contractor are approved by the Owner/Employer's Representative, the Contractor will not be relieved of his contractual obligations to hand over the structure in sound condition, duly tested.
- 1.11 In case of any damage/failure either during construction, testing or after commissioning, whether due to faulty design or defective construction, all repairs or reconstruction of the structure shall have to be carried out by the contractor, entirely at his risk and cost. No claim for such repairs/reconstruction shall be entertained.
- 1.12 The design should be with consideration of uplift pressure & seismic pressure.

Design Conditions

The Contractor shall quote with his own design with following conditions:

1. The design of R.C.C. ESR shall be carried out by a designer having minimum Qualification of Post Graduate in Structural Engineering. He shall sign the design and affix his name and stamp.
2. The design shall be carried out in conformity with following IS code.

- a) IS 456:2000
- b) IS 3370 -Part I and IV
- c) IS 875: 1987 Part I to Part IV
- d) IS 11682:1985 for RCC staging of overhead tanks.
- e) IS 1893:1984 with inclusion of seismic zones as per latest circular.
- f) IS 1786 for cold worked steel high grade deformed bars
(Tor steel of Fe-415 grade & mild steel grade-I shall only be used.)
- g) IS 13920:1993 -for ductile detailing, applicable for ESRs under seismic zone III, IV and V. (Recent editions of IS shall be referred.)
- h) B.S.I. publication S.P. 34 (S and T) 1987.
- i) IS;13928:Ductile detailing of RCC structure.

3. **Foundation for ESR**

The foundation should have the required safe bearing capacity. Minimum depth of foundation shall satisfy the following criteria.

- a) Depth in soft rock shall not be less than 1M or depth in hard rock shall not be less than 0.5 M.
 - b) The total depth in all strata put together shall not be less than 1.50M.
 - c) In B.C. Soil, raft shall be provided at minimum of 3M, No extra payment shall be given to the contractor on increase in depth of foundation.
4. The free board shall be included in the depth of water for design purposes.
 5. Minimum free board shall be 300 mm; measured below bottom of roof beam.
 6. Maximum actual water depth shall not exceed 5.0 M.
 7. Clear cover for reinforcement shall be provided as below :
 - a) Footing/Raft 50 mm. at bottom and sides & 40 mm. at top
 - b) Columns 40 mm.
 - c) Braces, beams, slab (Bottom and roof), 40 mm vertical wall, gallery.
 8. Minimum thickness of container members shall be as below.
 - a) Bottom slab and vertical wall 200 mm.
 - b) Roof slab 120 mm.
 9. The design and casting of container members which includes bottom and roof beams, bottom slab, roof slab, vertical wall and gallery, shall be done in M-30 grade of concrete
 10. The staging of ESRs (Columns, braces, footing/Raft) shall be designed in M-25 Grade of concrete, however, casting shall be done in M-300 grade of concrete. The concrete of grade M-15 shall be used for PCC work.
 11. The staging shall be designed for ductile detailing as per IS 13920/1993, wherever applicable.
 12. The width of braces shall be maximum of the following in case of Earth Quake Zone (as applicable) and above.
 - a) 250 mm.
 - b) There shall be a minimum distance of 75 mm between two adjacent

- reinforcement bars provided in the braces as well as beams.
13. Minimum width of brace – 300 mm.
 14. Width to depth ratio in case of braces shall preferably be more than 0.30
 15. Increase in permissible stresses in braces, for Earth Quake/ Wind force design, will not be allowed.
 16. The centre to centre distance between braces shall not exceed 4.50 M for ESR/MBR of capacity less than 5 Lakh liters and 6.0 M for ESR/MBR of capacity above 5 Lakh liters. At the joints of braces and columns, the links to the column bars shall be tied properly and this shall be thoroughly checked before concreting.
 17. Wherever annular raft is provided, the inside and outside width of raft shall be provided in such a way that the center of gravity of upward reaction shall co-inside with column/raft beam center.
 18. Uplift pressure on the foundation of structure should be considered as per available water table at site in rainy season However, minimum uplift up to 50% of depth of foundation below ground level should be considered in the designs.
 19. Epoxy paint as per specifications & 20 mm. thick cement plaster with CM 1:2 proportion with water proof compound shall be provided to the container from inside (including roof beams and roof slabs/dome, etc.)
 20. The shape of container may be square or circular. Similarly the column shape may also be square or circular.
 21. Minimum size of column (width or diameter) shall not be less than 400 mm. columns, if required to be provided inside container, for supporting roof ring beam/ dome/ slab, may be provided as per design requirements, with minimum size (width or diameter) requirements of 200 mm. Centering should be designed by the contractor . Same should be approved by the Competent authority before construction. Only steel/ plywood centering shall be used. For design having more than 6 columns, provision of internal bracing is obligatory. All columns shall have the same foundation level as far as possible. In any case the foundation level difference between any two columns shall not exceed 1.50. In such case 'Sway Analysis' of the staging shall be done and additional reinforcement or increase in sizes shall be provided if necessary. When safe bearing capacity of foundation is less than 15Tones/m² only raft foundation should be provided.
 22. Minimum dia. of main bars in the footing shall be 10 mm. and minimum clear distance between reinforcing bars shall not be more than 180 mm.
 23. Water density shall be taken as 1000 Kg./Cum and live load on gallery shall be considered as 300 Kg./ m². Minimum load of water proof treatment on roof slabs be taken as 100 Kg./ m²
 24. The diameter, weight per meter, tensile strength and minimum elongation properties of steel, brought by the contractor/supplied by the department, shall be got tested from the approved laboratory before using it. It shall be used

only when the test report indicates that the steel is in accordance with the I.S. specifications and design presumptions.

25.
 - i) The inlet, outlet, overflow and bypass piping shall be of cast iron D/F. pipes only.
 - ii) Spout type overflow arrangement shall not be allowed. Overflow arrangement shall be from top to bottom as a vertical pipe assembly with proper drainage arrangement.
 - iii) For all duck foot bends for inlet, outlet and overflow arrangements, individual columns with footings resting at foundation level of ESR, columns/raft shall be provided.
 - iv) The manhole frame and covers, provided in the roof slab, shall be of cast iron only. Mild steel covers shall not be allowed.
The above four conditions i.e. 25 (i), 25 (ii), 25 (iii), 25(iv) shall be followed without substitutes and equals. No M.S. piping and spout type overflow arrangement shall be accepted, even if rebates, etc. are offered.
 - v) Inlet, outlet, bypass and scour valves with chambers shall be provided. The horizontal piping for inlet,, outlet, overflow, bypass upto 8 M from outer brace shall be provided \ and laid without any extra cost.
 - vi) Lightning conductor, water level indicator, central ventilator and M.S. ladders/RCC staircase shall be provided as per department specification.
26. The design submitted by the Contractor, shall be got checked from the nearest Government Engineering College/ Government Polytechnic/ reputed Engineering College/reputed Consultants, for which the scrutiny charges shall be borne by the contractor. The delay in checking designs from third party as above shall be treated as the delay on the part of contractor for operation of tender clauses.
27. Size of inlet, outlet, overflow, bypass piping and valves including scour valve shall be specified as per actual requirements & makes of valves shall also be approved by the Employer's Representative.
28. Capacity of the container of the tank shall be the volume of the water it can store between the designed full supply level and the lowest supply level.
29. Height of staging shall be the vertical difference between lowest supply level and the average ground level and the site of tank.
30. **Rectification of Defective Members**
If it is found that certain members are defective and are found giving acoustical or vibration disturbances even though these may be structurally sound, rectification of such members should be done by the contractor free of charge and to the satisfaction of Employer's Representative.

CRITERIA FOR DESIGN OF RCC ESR

1. The structural design of water tank shall confirm the following standard specification & codes of practice of IS.(latest revisions or editions).
IS:456-Code of practice for plain & reinforced concrete
IS:875-Code of practice for structural safety of building standards
IS:3370-Code of practice for concrete structures for storage of liquids(Pat-I to IV)\
IS:1893-Criteria for earth quake resistant design of structures.
2. Capacity of the container of the tank shall be the volume of the water it can store between the designed FSL & LSL.
 - 2.1 Free board is the indication of space provided above FSL & shall be measured at a vertical distance above FSL up to soffit of beam supporting the roof slab/dome. Free board shall be minimum 30 cm below soffit of beam or slab, in case of domed roof ; Free board may be reduced up to 15 cm.
 - 2.2 The walls of the container shall be designed for free board full condition.
 - 2.3 The tank foundation & other members of the structure shall also be designed for free board full condition.
 - 2.4 Part of the tank in contact with stored water & enclosing water vapor above FSL shall also be constructed in M30 grade of concrete.
 - 2.5 The allowable bearing pressure or safe bearing capacities are indicated in the annexure. The tenderer is, however advised to verify actual strata before tendering & designing the structure & offer suitable modification with full justification.
 - 2.6 Notwithstanding anything mentioned above if directed by Employer's Representative the contractor Shall carryout strata exploration mentioned in Para 0.2 of IS:1892:1979 through a Govt. Lab. And adopt bearing capacity so arrived for design.
 - 2.7 The factor of safety shall be adopted as per clause 6.1 of IS:6403:1971.
 - 2.8 If the foundation consists of individual column footing, minimum clear distance between center of column shall be equal to the twice the width of footing & clear distance between edges of footing shall not be less than width of footing. All columns shall have same foundation level as possible. In any case the foundation level difference between any 2 columns shall not exceed 1.50 M . In such a case sway analysis of the staging shall be done & additional reinforcement or increase in size shall be provided if necessary.
 - 2.9 The foundation should be checked for negative pressure on soil due to combined direct & bending stresses .Negative pressure shall not be allowed on the foundation soil. 2.10 Classification of soil & characteristics of soil relevant to SBC & ABB shall be as per soil investigation reports of Govt. institution/Govt. approved investigators.
 - 2.11 For the design of foundation of the solid raft type, the plate theory shall be adopted.

- 2.12 In normal circumstances, min 100 mm thick PCC with 100 mm projection all around in M10 with coarse aggregate as metal shall be provided as leveling course. Where injurious soils aggressive water anticipated the leveling course shall be of not weaker than M15 & if necessary Sulphate resisting or other special cement shall be used & the thickness of leveling course shall not be kept less than 150 mm. The ground level within the foundation area of structure shall be consolidate properly with suitable slope to drain out rain water outside the foundation zone.
- 2.13 In the vicinity of mines, collieries & blasting sites or areas which may be subjected to blast or shock, the tank shall be designed for dynamic forces adopted to shock.
- 2.14 Column may be assumed as fixed at the top of footing,
- 2.15 Following shall be the minimum thickness of various members of the tank container.
- | | |
|------------------------------|-------|
| Roof Slab..... | 120mm |
| Bottom slab..... | 200mm |
| Roof Dome..... | 100mm |
| Vertical Wall container..... | 200mm |

3. **Loads**

- 3.1 For all RCC & PCC components unit weight of concrete shall be taken as 2500 Kg/M3 & 2400Kg/M3 respectively.
- 3.2 Water load as snow load shall be taken as per IS: 875:1964 or Latest revision, Seismic forces shall be as per IS:12893(its latest revision).

4. **Design**

- 4.1 Shape of the structure shall be most economically as directed by Employer's Representative. & shall be selected depending upon site conditions.
- 4.2 Design shall be based on worst possible combination of various loads, moments, shears & resultant stresses in the tank in following cases:
- 1) tank full
 - 2) tank empty
 - 3) uplift pressure, if any.
- Tank full means depth of water inside the container is up to full height of container including free board.
- 4.3 Design shall be based on accepted bases & methods of design as well as the provisions of IS:3370,IS:456,IS:1343,code of practice for pre-stressed concrete IS:2210 (all latest editions shall be referred.)
- 4.4 Design of members more than those excluded by Cl.5.4 above (i.e. roof walls, floors etc. of the container) shall be based on consideration of adequate

resistance undertaking as well as adequate strength. Calculation of stresses shall be as per Para 3:3:2 of IS:3370,Part-II (latest version)

5 **Permissible Stresses in Concrete for resistance to Cracking.**

5.1 For calculation resistance of members to Cracking the permissible stresses tension (direct & due to bending) & shear shall conform to the values specified in table 1 of IS:3370 (Part-II) "The permissible tensile stresses due to bending apply to the face of the member in contact with the liquid". In members with thickness less than 225 mm & in contact with the liquid on one side, these permissible stresses in bending shall apply also to the face remote from liquid.

5.2 **For Strength Calculation**

For Strength Calculation, the permissible concrete stresses shall be in accordance with Para 44 of IS: 456:2000 where the calculated shear stress in concrete alone exceeds the permissible value, reinforcement acting in conjunction with diagonal compression in concrete shall be provided to take the whole of the shear. The maximum reinforcement shall conform Cl.25.5.1.1&25.5.1.2 of IS: 456:2000.

6. **Permissible stresses in steel.**

6.1 For Strength Calculation,(concrete assumed to be cracked)the Permissible stresses in steel reinforcement shall be as per Table II of IS:3370(PartII)(its latest revision).For Tor steel the stress shall be as per IS:1786:1979 for cold worked steel high strength deformed bars for concrete reinforcement or its latest revision.

6.2 The modular ratio 'm' for different concrete mixes shall be as under.

Grade of Concrete	Modular Ratio 'm'
M15	19
M20	13
M25	11

6.3 Modulus of Elasticity of concrete E_c shall be taken as $5700 E_{ck}$ where E_c is the characteristic cube strength of concrete in N/mm² as per Cl.5.23.1 of IS:456.

7. **Age Factor**

7.1 Age Factor for increasing strength shall not be considered for the design.

8. **Units**

Design should be in Metric units only.

9. **Detailing**

9.1 Minimum reinforcement for water retaining members Minimum reinforcement in walls, floors, roofs in each of 2 directions at right angles shall have an area of 0.3% of the concrete section in that direction for sections up to 100 mm thick. For thickness greater than 100 mm & less than 450 mm the minimum reinforcement in each of the 2 directions shall be linearly reduced from 0.3% for sections of 100 mm thick to 0.25 for 450mm thick section. For section of thickness greater than minimum reinforcement in each direction shall be kept at 0.2% .In concrete sections of thickness 225 mm or greater, two layers of reinforcing steel shall be placed one over each face the section in make up the minimum reinforcement specified in the clause.

9.2 The minimum reinforcement specified in 9.1 above may be decreased by 20% in case of high yield strength deformed bars conforming to IS: 1786 or IS 1139 (latest version of IS shall be followed).

9.3 **Covers to Reinforcement**

9.3.1 Minimum clear to reinforcement shall be as per IS: 456 and IS: 3370 (latest version of IS shall be referred).

9.3.2 For members of structures in contact with water effective shall not be more than 60 mm. for bars subjected to pure tension the effective cover shall not be more than 75 mm

9.4 **Spacing of Reinforcement**

9.4.1 Spacing of reinforcement shall be as per Para 25.3 of IS:456-1978

9.4.2 Spacing of lateral ties of column shall satisfy the provisions of Para 25.5.3.2 of IS:4562000.

9.4.3 Reinforcement steel which accounts for resisting moment, tension etc. i.e. other than temperature and shrinkage steel, shall comprise minimum 8 mm diameter, For ribbed bars and 10 mm diameter or mild steel bars, for compressive members, the minimum diameter of main reinforcement shall not be less than 12 mm.

NOTES

In case of dispute regarding interpretation of any of the above classes, the decision of the owner or his representative will be final and binding on the

designer and contractor. In case of any clause not included in the above criteria, the decision of the owner or his authorized representative will be final and binding on the designer and contractor.

DESIGN CRITERIA AND ASSUMPTIONS

DESIGN STANDARDS

The structural design of the tank shall conform to the following standard specifications and code of practice of the ISI, IS:456, codes of practice of plain and reinforced cement concrete (latest edition).

IS:3370 _ Code of practice for concrete Part-I to IV structures for storage of liquids (latest edition) ISI, IS:875 (Revised-1984).(Latest edition)

Part – I	Dead Load
Part – II	Imposed Load (87)
Part - III	Wind Load (87)

IS:1682-1985 Criteria for design of RCC staging for overhead water tanks issued by Bureau of Indian Standards.

DESIGN OF STRUCTURES

The above Indian Standards current on the date of tender shall be applicable to the design of structure on item not specifically covered by Indian Standard Code of Practice Reference shall be made to relevant standard specifications.

Construction of Various capacities RCC ESR

1. The reservoir will be a covered RCC container supported on RCC column with footing and intermediate braces, etc. as per drawing.
2. Suitable RCC spiral stair case should be provided with landing parapet RCC pardi for approach to the gallery and top of ESR. RCC cantilever catwalk (gallery) of 1.20 M width G.I. pipe railing shall be provided at floor level, preferably at junction of floor slab and vertical walls and G.I. pipe railing with RCC post of 1.0 M c/c interval at the roof slab level of container.

Ventilators shall be provided on top slab of ESR.

One number of C.I. manhole frame and cover shall be provided and fixed in the roof of tank.

One M.S. ladder shall be provided and fixed for access into the tank through manhole left in the roof. Ladders shall be provided as per specifications.

Water level indicator (Mercury) assembly of approved type shall be provided and installed.

Lightening arrestor as per IS specifications and confirming to IE Rules shall be provided and fixed.

Vertical and horizontal pipe of CID/F flanged pipes, M.S./C.I. specials of required sizes for inlet, outlet and overflow arrangements together with suitable sluice valves shall be provided as per drawings. For washout one tee shall be fixed on the outlet pipe with one valve of suitable diameter.

Sluice valves of required size shall be fixed for inlet, outlet and washout. These valves shall be supplied by the contractor, confirming to relevant IS and of makes approved by SCDCL.

Required number of B.B, masonry chambers of suitable size as directed with C.I. manhole frames and covers shall be provided and constructed at suitable locations for sluice valves.

Water proof cement plaster of CM 1:2 proportion 20 mm thick shall be provided for inside surface of the tank, including roof slab bottom and epoxy painting in two coats be provided as per Specifications.

Outside surface of tank, exposed faces columns, braces, catwalk bottom portion of slab and exposed surface of the tank shall be provided with cement plaster 20 mm thick with CM 1:3 with smooth finish and then 3 coats of approved water proof cement paint by the SCDCL shall be rendered.

Letters indicating capacity of tank, name of scheme and year of construction shall be either embossed or engraved on vertical wall of tank and shall be painted with suitable shade of oil paint in 2 coats.

On completion of work hydraulic test or water tightness test shall be given as per standard specification. Therefore, required water arrangements shall be made by contractor at his own cost.

Since this is lump-sum offer, the interim payments will be made at different stages of works contract, as per break-up schedule enclosed. Which is to be approved by competent authority.

Since this is water-retaining structure, contractor shall give a satisfactory hydraulic test of the tank. This test shall be considered as water tightness test and accepted if the structure appears bone dry from outside after filling with water upto full supply level and the drop in water level is not more than 40 mm in 7 days. For this purpose the water filling arrangements shall be made by the contractor at his own cost, including cost of water pumping arrangements etc.

If during testing any damage occurs to the structure, it will be the responsibility of the contractor to rectify the same. Until satisfactory water tightness test is given on completion of work, interim payments to be made at different stages of works, as per schedule of breakup of payment enclosed.

DESIGN CRITERIA AND ASSUMPTIONS

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If during testing any damage occurs to the structure, it will be the responsibility of the contractor to rectify the same. Until satisfactory water tightness test is given on completion of work, interim payments to be made at different stages of works, as per schedule of breakup of payment enclosed.

Mode of Payment- As per Annexure 2 of Bid Document.

DETAILED SPECIFICATIONS

Due to Geographical situation the levels may vary, while execution of work. Hence, the agency is requested to get the levels confirmed. The material shall be procured after confirming and approval of actual head of pumps, make and size of all respective equipments by the Superintending Engineer (M). The pumping machinery and allied equipments will be allowed to supply after completion of head works, BPT so as to synchronize the commissioning of the scheme.

Agency has to submit the layout drawing of pumping machinery, sub-station and individual drawing of all equipments for approval well in time or as directed by the Executive Engineer (M).

Test Certificate and Manuals

The successful tenderer shall submit the test certificate for various components as called for in the specification if necessary and required by the (SCDCL)Engineer. Certificate for material of construction of equipment shall be furnished. The successful tenderer shall also submit instruction manual in duplicate covering operation, maintenance and repairs of all equipment's including wiring diagrams and charts in duplicate for periodical maintenance of equipment.

Rectification of any defects during guarantee period of pump, motor, transformer and all allied electrical and mechanical, civil work shall be carried out immediately, so that water supply should not be hampered.

The necessary opening required for erection of pump set, cable, entry pocket, cable duct etc. shall be discussed during joint visit, so that during casting of floor, beams suitable arrangement is made.

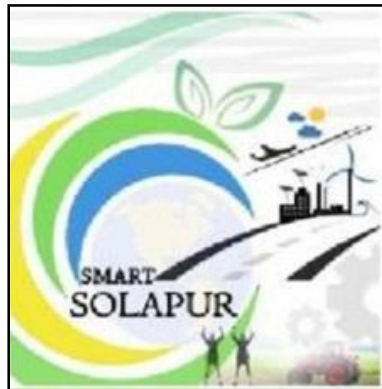
The guarantee period starts from date of commissioning of the equipment. The defect liability period for the pumping machinery will be counted from the date of Trial Run of entire scheme for a period of 12 months. During this period all wear and tear to pumping machinery is to be borne by the Contractor. Considering this offer may be quoted

Mode of Payment

Break-up of the payment admissible for pumping machinery and other Electrical, Mechanical items shall be as per payment schedule :



Solapur City Development Corporation Limited



Tender No.

Augmentation to Solapur City Water Supply Project (Ujani Dam as a source – 110 MLD) on Design, Build, Maintain, Operate and Transfer (DBMOT) Basis

PART II – PARTICULAR SPECIFICATION

NOVEMBER 2018

SECTION 6C.1

SYSTEM AND HYDRAULIC DESIGN REQUIREMENTS

SUB-SECTION 6C.1: SYSTEM AND HYDRAULIC DESIGN REQUIREMENTS

1.1 General Requirements

Flow diagram, P&I diagram and other applicable tender drawings show water supply system from the Jackwell at Ujani Dam, raw water transmission to BPT and Raw Water gravitated to Treatment Plants at Pakni & Soregaon.

The water supply system (WSS) shall operate @ 22 hours per day to supply daily flow rates. Daily water supply to Solapur City are as under.

Beneficiary	Bulk Supply Point & Capacity	Quantity
Solapur City	Pakni WTP and Soregaon WTP	110 ML/day
	Total	110 ML/day

The pipeline should be designed for 110 MLD flow upto Soregaon WTP. The daily quantity supply are obligatory.

Gravity main is to be designed such that water will flow from BPT at Varwade to Soregaon WTP of length 81.50 KM with flow rate of 110 ML in 22 Hours and further up to proposed Aherwadi WTP for three project affected villages which is 18 KM away from Soregaon WTP with flow rate of 1.25 ML in 22 Hours. Execution of gravity main from Soregaon WTP to proposed Aherwadi WTP is not in the scope of contract.

1.2 Water Levels at Jackwell & BPT

The water levels at Jackwell and top water levels at BPT are obligatory and are as under.

Table 1.1 : Water Levels at Jackwell & BPT

Ujani Dam	Length	2540 M
	63.665	
Capacity	TMC	53.579 TMC
Dam Top Masonry	501.4	
Dam Top Earthen	499.87	
HFL	497.58	
FSL	497.33	
Av. Water LVL	495.00	
MDDL	491.03	
Spillway LVL	490.83	Gate 12 x 7 m = 41 Nos
CBL	487.20	

Augmentation to Solapur City Water Supply Project (Ujani Dam as a source – 110 MLD) on Design, Build, Maintain, Operate and Transfer (DBMOT) Basis

Lowest Water LVL	485.75	
Bhima River Bed	458.17	
Jackwell		
GL	495.00	
Bottom	475.00	
LSL	480.00	
Pumphouse		
Pump FI Lvl	500.00	
Motor FI Lvl	503.70	
Gantry Lvl	507.50	
Slab Lvl	510.00	
Raw Water Pumping Machinery	110 MLD	
BHP	750.00	
LPS	365.00	
Head	112.00	
No Of Pumpsets	4+2	
Approach Channel	L – 100 m	Width – 4.5 m
GL	495.00	
Bottom	480.10	
LSL	481.00	
Approach Bridge	L – 120 m	Width – 6.0 m
GL	497.00	
Top	500.00	
Approach Bund	L – 120 m	Width – 6.0 m
GL	497.00	
Top	500.00	

The Jackwell shall be designed on basis of above water levels. Low water level (LWL) at Jackwell shall be based on permissible head loss at Inlet to Jackwell as specified in design criteria for Jackwell.

Sr. No.	Location of GSR/ Sump / BPT	Cap. in Liters	Avg. Ground Level	Low supply level and full supply level and Numbers
1.	Near Warawade Toll Plaza	500000	543 M	LSL - 560 M FSL - 565 M

- LWL is not obligatory and the contractor can vary LWL and water depths in the tanks.

1.3 Hydraulic Design

The hydraulic design of the WSS shall be based upon following criteria and basis covering;

- Flow rates in various components taking into account losses in WTP and transmission system
- Friction loss, formula to be used, values for frictional coefficient shall be over design life of 30 years
- Minimum hydraulic grade level
- LWL in BPT
- Design pressure and test pressure
- Residual head

1.3.1 Flow rates in various Components

Losses in transmission pipelines cannot be totally eliminated. Similarly, some quantity shall be required in WTP for washing filter beds and desludging. Losses as under are considered.

- i) 0.5% of flow rate per 10 km of transmission mains
- ii) 2.5% of flow rate in WTP

On above basis and considering 22 hours daily operation, the flowrates are determined as per **Table 1.1** below.

Table 1.2 : Calculation for Daily Quantity / Flowrate in various Components

No.	Parameter	Quantity/Flowrate	
		ML/d*	m ³ /h
	Net bulk supply to WTP at Soregad Solapur City	110	5000

*ML/day in 22 hours

Above flowrates in various compartments are obligatory and shall be basis for system design

1.3.2 Determination of Friction Loss

Friction losses in the transmission system shall be computed on basis of following criteria. The criteria are obligatory and no variation is permitted.

- The friction losses in pipeline shall be calculated by use of Hazen William's equation. No other formula is acceptable
- The diameter for computation shall be finished inside diameter of the pipeline, fittings
- Hazen William's coefficient 'C' shall be of following two values to cover likely variation in 'C' values over entire life period of 30 years

- For Pipeline

C = 130 for new pipes

- Minor losses due to friction resistance in valves, fitting and other appurtenances, Inlet loss, exit loss shall be computed @ 10% of friction losses determined as per Hazen William's equation.

1.3.3 Residual Head and TWL of BPT

Margin in the form of residual head is provided to account for minor variation in length and assumed friction coefficient.

Residual head = 5.0 m shall be added to computed HGL @ BPT at C = 130 to determine TWL at BPT. This residual head is obligatory.

1.3.4 Minimum HGL V/s Profile of Transmission System

Minimum HGL required at BPT shall be worked out on basis of

C (pipeline) = 130 plus 10% minor losses and nil residual head.

The minimum hydraulic grade line shall be drawn on combined longitudinal section of BPT – Pipeline – WTP system to demonstrate that the minimum HGL does not cut profile of transmission system.

It is desirable to the extent feasible that at least 5 m pressure is available above the profile of transmission system to ensure effective air exit through air valve.

1.3.5 Design Pressure and Field Test Pressure

i) Raw Water Pumping Mains

- Design pressure for this pumping main shall be higher of following two sums. No reduction in water hammer head due to control device shall be accounted for determining design pressure.

- Maximum working head over profile
+
Water hammer head without protection

OR

- Maximum static head over profile
+
Water hammer head without protection

- Class of all valves, dismantling joint, flange adapter etc. shall be selected such that seat test pressure is not less than working pressure and body test pressure is not less than above design pressure

- Field test pressure for hydraulic testing of pumping main shall not be less than the design pressure

ii) Gravity Pipeline downstream of BPT

- Design pressures gravity mains

- Design pressure for the respective gravity pipeline shall be 1.5 times maximum static head based on TWL in BPT and lowest invert level over entire length of pipeline in that stretch

- Class of all valves, flange adapter etc. shall be such that seat test pressure is not less than maximum static head and body test pressure is not less than above design pressure

- Field test pressure for hydraulic testing of pipeline shall not be less than above design pressure

SUB-SECTION 6C.2

JACKWELL AND RAW WATER PUMPING STATION

2.1 General

Raw water Jackwell is planned in impounding reservoir upstream of Ujani Dam. Functions of the Jackwell are;

- To abstract raw water into Jackwell
- To pump raw water for transmission BPT located at about 28.50 KM distance

The reservoir data are as under:

High Flood Level (HFL)	497.58 m
Full Reservoir Level (FRL)	497.33 m
Minimum Draw Down Level (MDDL)	491.00 m
Live Storage	117.23 TMC

2.2 Requirements of Jackwell

The Jackwell and pumping station shall be suitable to meet following requirements.

- To abstract raw water as near water surface level as possible.
- To prevent ingress of vegetation and floating matter into Jackwell by providing screens.
- The inflow velocity shall be sufficiently low to enable fishes to swim away against stream so as to prevent fish nuisance.
- To admit water in Jackwell through sluice gates and rose pieces at minimal head loss over entire range of water levels in the impoundment. Each gate shall be suitable to function as port as well as weir.
- To ensure streamlined flow at permissible flow velocity to Inlet bell mouths of vertical turbine pumps as well as meeting all other parameters such as approach length, spacing of bell mouths, minimum submergence etc. ensuring that the requirements for vortex-free operation of pumps are fulfilled as given in following literature.

- Hydraulic Institute Standard
Ohio, USA, HI 9.8 / American National Standard for Jackwell, ANSI-1998
- Standard by British Hydrodynamic Research Association (BHRA)
- IS 1710 for V.T. Pumps
- Pump Hand Book, 4th Edition, edited by Karassic etc.

vi) To house adequate margin below bellmouth level for deposition of silt as silt cannot be removed frequently.

vii) To house openings and facilities for periodical removal of silt from pump well.

viii) To house required number of vertical turbine pumps including standby pumps and spare bays for future pumps.

ix) To house motors, motor control center, delivery piping, valves, common header.

x) To house control room for control and automation equipment.

xi) To provide lifting equipment for handling of pumps, other electromechanical equipment, screen and stop-log gates.

xii) To provide well designed ventilation system so as to remove excess heat and maintain temperature rise within acceptable limit.

xiii) To stop inflow to the Jackwell or Jackwell compartment by providing stop log gate(s).

2.3 Obligatory Parameters and Values

i) Flow rates

The Jackwell shall be designed to handle flow rate

Q = 300 MLD

Pumping Hours = 22 Hours

ii) Design WL in Jackwell shall be;

HFL	=	497.58	m	}	Head loss in screen and gates to be ignored being small
RL					
FSL	=	497.33	m		(based on head loss 0.8 m below MDDL
RL					
permissible					
LWL	=	480.00	m		
RL					
Mean WL	=	495.00	m		
RL					

The mean WL shall be design WL for determining pump head.

iii) Detention Period = 30 Minutes

iv) Shape and number of compartments

- Shape of Jackwell, pump well and superstructure shall be rectangular
- The Jackwell shall be in two compartments from bottom of well to TWL

v) Number of floors shall be two; lower floor for pump installation and accommodating piping end valves and upper floor for operation and electrical panels

vi) Lower floor i.e. pumps floor shall be at least 2.0 m above the HFL

vii) Number of pumps shall comprise required number of duty pumps as per Contractor's design plus minimum two number standby pumps + empty bay for additional two pumps to provide for additional 200 ML /day abstraction

viii) The pumps shall be self water lubricated vertical turbine pumps

2.4 Components in Jackwell

The Jackwell shall accommodate following components.

- i) Stop log gate, one for each compartment to stop flow; with arrangement for access and handling of stop-log gate with lifting equipment. Seal level of stop-log gate shall be at MDDL.
- ii) Inlet channels from stop log gates to screens; the walls of diverging channel shall be at 45° to approaching flow path.
- iii) Bar screens at Inlet face of Jackwell well.
- iv) Multiple sluice gates for each pump bay.
- v) Pump well.
- vi) Pump mounting floor (lower floor) above HFL.
- vii) Operation floor (upper floor) with adequate head room between two floors.
- viii) Truck access bay.
- ix) Suitable opening's in both floors of each compartment for silt removal from Jackwell bowl to operation floor.
- x) Superstructure to accommodate lifting equipment
 - Electrically operated travelling crane for pumps and associated equipment
 - Monorail for lifting up for cleaning and placing down screen
 - Structural steel section placed vertically above gates so as to mount chain pulley block or suitable lifting tackle to lift any gate
- xi) Approach channel with UCR guide wall at bottom and at Ground level
- xii) Approach Bridge and Approach bund

2.5 Combination of Pumps for Raw water

Combination of pumps needs to be decided for planning & space requirement in Jackwell and pumping station. Design parameters are as under:

- Type of pumps is VT pump – 6 No. (4 + 2)
- Number of duty pumps suitable for pumping combined flow **5256**
m³/h
- Minimum standby pumps and spare pump bays
 - 2 numbers standby
 - 2 numbers spare pump bays for future pumps
- Combination of pumps shall be optimum combination from the following.
 - 3 (duty) + 2 (standby)
 - 4 (duty) + 2 (standby)
 - 5 (duty) + 2 (standby)
- RPM ≤ 1500 (synchronous)
- Parameters for optimum selection
 - Specific speed - 250 RPM
 - Maximum attainable efficiency above 80% or as per CPHEEO manual
 - Preferable shape / curve of H-Q characteristic for the specific speed
- Stable / rising so as to be suitable for parallel operation
- Lesser variation in Q for relatively more variation in H

- Wear and tear v/s speed
- Magnitude of required submergence as per HI 9.8 / ANSI - 1998
- Dynamic load on foundation
- Space requirement for the size and number of pumps

2.6 Hydraulic Design of Jackwell for Vortex-free Operation of Pumps

2.6.1 Parameters for Vortex-Free Operation Pumps

Following parameters for vortex-free operation of pumps MUST be satisfied on basis of criteria given in HI 9.8 / ANSI – 1998 and pump well need to be planned accordingly.

- Streamlined uniform flow from Inlet gate to pump centre at low velocity
- W, spacing between bellmouths of adjoining pumps
- S, submergence from minimum WL (LWL) in pump bay to lip of bell mouth
 - X, straight approach length from Inlet to bellmouth centre
- No obstruction and change in flow direction in approach bay
- Any structural column coming in flow path shall be rounded /ogive

2.6.2 Mitigation measures for parameters not satisfied

Mitigation measures for not satisfying following two parameters shall be adopted as recommended in HI 9.8/ Jackwell / Sump design

- C, bottom clearance required under bellmouth (generally $D/2$, where D = bell mouth diameter)
- B, back clearance (generally $0.75 D$) Preferable mitigation measures are;

- RCC cone under bell mouth
- RCC splitter under bell mouth

Mitigation measure for vortex prevention shall preferably not cause any dead spot resulting in nuisance in movement as well as obstruction for silt removal

Any other parameter for vortex free operation not stated above, but required as per HIS 9.8 / ANSI shall be satisfied.

2.6.3 Silt Deposition Allowance

Silt deposition in Jackwell bowl cannot be avoided. Hence, silt allowance is required.

Silt allowance shall be minimum 0.8 m. The silt allowance is measured between bottoms of pump well floor to dynamic WL under bell mouth given by the following,

$$\text{Dynamic WL under bell mouth} = \text{Lip of bell mouth (-) } D/2$$

$$\text{Where } D = \text{bell mouth diameter}$$

2.7 Criteria for General Arrangement of Pumping Station

2.7.1 Design Velocity

$$V_{\text{bell mouth}} \leq 1.5 \text{ m/s}$$

$$V_{\text{column}} \leq 2.0 \text{ m/s}$$

$$V_{\text{delivery}} \leq 2.0 \text{ m/s}$$

2.7.2 Valves in Individual Delivery

- NRV / DPCV
- BFV (long body)
- SV / Knife gate valve (KGV)

2.7.3 Space Requirements

- Clear space between foundation frames / sole plates of two adjoining pumps shall be minimum 1500 mm
- Spacing between end pump and side wall shall be such to obtain clear space of minimum 1000 mm from delivery valves / piping as well as to ensure that the crane hook reaches is at least up to centre of end pump
- Clear space between two adjoining motors or adjoining valves shall be minimum 1000 mm
- End space between downstream SV / KGV and wall shall be minimum 1000 mm
- Rear space behind MCC / Panel shall be minimum 1000 mm
- Clear space between MCC / Panel and wall of panel room shall be 1000 mm higher than draw out position of circuit breaker
- Clear space between motor and wall of panel room shall be minimum 1000 mm

2.7.4 Floors in Pump Room

- Floors in pump room shall be two numbers, one lower and second upper
 - Pumps and motors shall be founded on lower floor
 - Panel shall be mounted on upper floor in separate room
 - Head room between the two floors shall be minimum 3.5 m
- Control room for automation and SCADA either on upper floor or additional room above upper floor shown in conceptual drawing
- Removable grating shall be provided in upper floor above delivery line to facilitate handling of pumps, motors and valves

2.7.5 Pump Foundation

The structural members for founding pump shall be designed for dynamic load of pump and motor. The dynamic load shall be worked out as per IS: 2974 Part IV – code of practice for design and construction of machine foundation for rotary type machines of low frequency.

2.7.6 Truck Access Bay

A purpose designed access bay for truck shall be provided in pump room so as to facilitate truck entry and loading or unloading of pump, motor and other equipment by means of EOT crane onto / from truck. The entrance door shall be designed accordingly.

2.7.7 GA of Superstructure

- Superstructure shall house panel / MCC, other indoor electrical equipment, ventilation system and electrically operated double bridge girder travelling (EOT) crane, service / maintenance bay, tool room and external side shall accommodate EOT monorail for lifting screen, head stock for manual operation of all gates

- The general arrangement shall include an opening of 0.9 x 0.9 m in pump floor & motor floor slab for removal of silt in well with EOT

- Corbel level shall be such that EOT crane can be erected with minimum clearance of 500 mm above upper most part of crane.

- Head room up to crane hook (uppermost position) shall be at least 1000 mm higher than any equipment, column pipe and line shaft required to be lifted up during dismantling of any item of equipment

- EOT monorail on external side shall be suitable to handle screen for cleaning

- Slit with removable grating shall be provided for above operation of screen

2.7.8 Other Facilities

Following facilities shall be required.

- Access staircase from Pump floor level to bottom of Jackwell well
- Access staircase from motor floor to pump floor & control room at upper floor

2.8 Mechanical Equipment

2.8.1 Stop-log Gate

The stop-log gate shall be provided in each of two Inlet channels. The stop- log gate shall generally conform to IS 5620-Recommendations for Structural Design Criteria for Low Head Side Gate.

Suitable monorail / with lifting beam as per IS 13591 shall be provided as shown in conceptual drawing for handling stop-log gate.

2.8.2 Bar Screen

Vertical bar screen shall be provided at Inlet of each pump bay including two spare bays for future pumps. Screens shall be designed for easy cleaning by manual raking. The screen shall be as per IS 11388 and shall be fully galvanized.

Bar screen shall be fabricated from SS 316 flat 50 mm x 10 mm minimum. The spacing between two flats shall not exceed 25 mm.

Screen bars shall be provided with stiffeners for reinforcement, and the stiffeners shall be designed and installed to avoid impeding raking.

Four rakes shall be provided, each designed for use by one man. Rake handles shall be of non-corrodible lightweight tubular alloy. Rake spikes shall fit the screen apertures and shall be of softer material than the screen bars to ensure bars are not damaged by raking.

Four rakings containers shall be provided, designed for ease of handling and lifting. The weight of loaded containers shall not exceed 50 kg. They shall be free draining, with mesh apertures not larger than 25mm square. They shall be fitted with lifting handles designed for use by hand or with the hoist.

A manual wire rope hoist with supporting derrick shall be provided to raise the containers to the structure top level for safe disposal. The hoist shall be fitted with a suitable hook, designed for quick attachment and release, and shall be designed for operation by one man.

The safe working load of the hoist and associated equipment shall be not less than 75kg.

2.8.3 Sluice Gate

Manually-operated thimble mounted sluice gate shall be installed inside the pumping station to shut off each of the 6 inlets bay, as shown on the drawings. Minimum two number of sluice gate per pump bay shall be provided. The upper gate shall be positioned to draw water as near FRL as possible. The lower gate shall be positioned about 800 mm below MDDL so as to draw full quantity at sea level.

Both gates shall be suitable to operate as port and weir. Each gate shall be provided with a headstock mounted at floor level complete with extension shaft and couplings.

Sluice gate and their frames shall be cast iron, and the frames shall be provided with cast iron mounting thimbles for building-in the frame to the structure.

The gate shall be the seating type, with rising spindles. The gate opening shall be rectangular.

The sluice gate shall be designed for the maximum pressure to which they could be subjected in service.

2.9 Raw Water Pumps

2.9.1 General requirements

The Contractor shall review the pumping station design and the pump mounting, and shall ensure that the pumps he provides will operate satisfactorily as specified in all possible operating conditions, including any possible water level with any combination of pumps running. Contractor may select a different arrangement which complies with the Specification.

The design of the pump wells shall be in collaboration between pump supplier and civil works designer to ensure the required hydraulic conditions are met in any possible operating condition.

All Pumps shall be identical and of type vertical turbine pump with water-lubricated bearings. Unless otherwise approved, no pump shall incorporate more than four stages. Pumps shall be driven by directly-coupled, vertical-shaft induction motors, as described in the Electrical Specification. Speed of pump shall be maximum 1480 RPM (Syn).

Bowl efficiency shall not be less than 80%. Velocity in column pipe shall not exceed 2.0 m/s.

Length of each column pipe shall be 1500 mm. Velocity of entrance of bellmouth shall not exceed 1.5 m/s.

Unless otherwise approved, pump casings shall be of close-grained cast iron, and impellers and guide vanes of stainless steel CF8M.

If the Contractor's design includes the need to streamline the flow into the pump inlet bellmouths, this may be achieved by providing flow straighteners within the bell mouths using integrally-cast vanes.

2.9.2 Pump Duty Conditions

Conceptual design envisages 4 number of duty pumps with 2 number of standby to pump 5256 m³/hr. Duty head of the pump is 112 m.

The contractor shall review and recalculate duty head which shall be sum of the following five elements.

- i) Static head from Lowest WL in Jackwell to RL of BPT
- ii) Friction losses in raw water rising main @ $C = 130$
- iii) Minor losses due to fitting and valves at 10% of (ii) above iv)
Station losses about 2.0 m
- v) Residual head 1.5 m

The pump shall also be suitable for operation when Jackwell WL falls to LWL which is about + 10% variation. The pump shall also be suitable for head when WL in Jackwell rises to HFL which is about – 25% or as per site condition.

Covering above variation operation head range of the pump shall be +10% and -30%. (As per site condition considering HFL with single pump in operation)

2.10 Valves and Pipework

2.10.1 General Requirements

Pump valves, pipework, and their supports shall be designed to withstand the maximum stresses imposed by any operating condition, including the shock resulting from pump starting when the advancing inrush of water strikes the closed non-return valve.

The design maximum velocity through the valves and pump branch pipework shall not exceed 2m/s.

The design pressure rating of valves and pipework shall be 1.5 times the pump shut valve pressure or PN 1.6, whichever is greater.

2.10.2 Valves - General

Each pump shall be provided with a delivery non-return valve, a delivery isolating valve, additional isolating valve and an automatic air inlet/release valve. The air valve shall be fitted to the delivery pipework near to the discharge bend and upstream of the non-return valve.

Pump delivery isolating valves shall be sluice valves, fitted with electric actuators. Valve operation when manual shall be by handwheel through integral reduction gearing.

Additional isolating valve shall be non-rising spindle sluice valve. This valve shall be manually operated.

Non-return valves shall be of the swing-check type, designed for rapid closing as soon as forward flow stops. Alternately, dual plate check valve as per standard specification can be accepted.

2.10.3 Pump Automatic Air Inlet/Release Valves

Each pump air inlet/release valve shall be designed and sized to ensure:

- a) On pump stopping, the pump column pipe drains into the pump well so that negative pressures which could be damaging when the pump is restarted cannot occur.
- b) On pump starting, air is expelled from the column pipe fast enough to prevent air being forced past the pump non-return valve and into the delivery manifold, and the air cushion in the column pipe prevents damage to pipework or non-return valve from the advancing water column.

2.10.4 Pipework -General

Pump delivery pipework shall be fabricated steel, with flanged connections. Pressure ratings shall match those for valves as given above.

Dismantling joints shall be incorporated with each pump delivery to facilitate the removal of pumps and valves. The dismantling joint shall be suitable for pump duty and when assembled shall be suitable to withstand tensile force imposed due to thrust at end of delivery piping at manifold.

Pipework shall be protected from corrosion as detailed for exposed steel pipes elsewhere in the Specification.

2.10.5 Pump Common Delivery Manifold

The pump deliveries shall be joined to a fabricated-steel delivery manifold, with flanged connections which shall be connected to the raw water pipeline delivering to the treatment works. The manifold shall be of nominal diameter minimum 1000 mm. The manifold shall be connected to the raw water pipeline, generally as shown on the drawings.

The manifold design pressure rating shall be 1.5 times the pump shut valve pressure or 160 m, whichever is greater. Protection shall be as specified for pump delivery pipework.

2.10.6 Valves on Common Delivery Manifold

Two valves as under shall be provided on downstream of common delivery manifold.

- 1000 mm diameter PN 1.6 rating non-return valve or dual plate check valve
- 100 mm diameter PN 1.6 rating butterfly valve
- Flange adopter between the two valves

2.11 Electric Overhead Travelling Crane and Other Lifting Equipment

An electric overhead travelling crane shall be provided in the raw water pumping station, designed to serve the pumps and all the plant installed in the motor hall, and to lift and lower the skips provided for de-silting the pump wells. Enough hoisting cable shall be incorporated to lower skips to the bottom of the pump well.

The Contractor shall determine the maximum Safe Working Load required for the crane, which shall be not less than 10 MT.

The pendant control shall be designed for operation from the upper hall floor. Crane operating speeds shall be as follows:

- Long travel : Not more than 40m/min
- Cross travel : Not more than 25m/min
- Hoisting and lowering : Not more than 10m/min

A fixed ladder with safety handrailing shall be provided for access to the crane for servicing, and to gain access the maintenance platform for use when servicing high-level lighting and ventilation units.

Other lifting equipment shall include monorails for screens and stop-log gates and hoist for raking containers.

2.12 Ventilation System

The upper floor pumping station shall be provided with a ventilation system designed to limit the air temperature rise to not more than 5 deg. C. when the plant is operating. The system shall be designed to provide uniform ventilation throughout the pumping station, to promote plant cooling and eliminate pockets of stagnant air.

The system shall be sized based on the maximum number of motors operating together, with all the lights switched on, and with three operating personnel present, but the design ventilation rate shall be not less than five air changes per hour for the complete operating area.

The ventilation system shall be combination of forced ventilation system and extraction / exhaust system. Essential features and requirements are as under:

- i) Wall mounted Air supply fans and exhaust fan shall be positioned staggered to avoid short circuit.
- ii) Ventilation ducts shall be provided such that forced air flow out at about 750 mm above operating floor and extracted out of exhaust at about 2000 mm above the floor level.

- iii) Ventilation fans shall be sized for 75-85% exhaust and 100% air supply.
- iv) The air velocity in duct shall not exceed 20 m/s.

Fans shall be controlled from wall-mounted contactors, accessible from pumping station floor level.

Exhaust fans shall be provided between two floors to achieve minimum four number of air changes per hour.

Pump well ventilation system

General

A ventilation system shall be provided to supply fresh air to the bottom of the dewatered pump well during de-silting, to promote safe working. Only one half of the pump well will be de-silted and need ventilation at any time. De-silting is expected to last for up to 24h, and to be needed not more often than once every three months. The design shall provide not less than four air changes per hour for one pump well.

The system shall include one or more wall-mounted electric fan units, designed to draw fresh air from outside the pumping station, and to deliver it to the pump wells through fixed and flexible ducts.

Fans

Fans shall be sized to deliver required fresh air through the duct system, discharging at the bottom of either pump well. Fan motors shall be rated for continuous operation.

Fan inlets shall be protected from ingress of harmful foreign matter by robust grilles at the inlets.

Ducts

Fixed ductwork shall lead the airflow from the fan to a suitable point near the top of each pump well. If a single fan is used, a damper shall be provided to direct airflow to the selected well. Fixed ducts shall end with a spigot and

clipping arrangement, designed for connection to the flexible duct, which will be used only during de-silting.

Fixed ducts shall be of fabricated galvanized sheet steel or other approved material. Ducts shall be reinforced or protected where they could be damaged by the passage of personnel or goods in transit. Rectangular or circular sections may be used. Ducts shall be manufactured and installed to an approved code.

Flexible ducts shall be of tough, flexible, non-metallic construction, designed for hard wear in the conditions at Site. The length of flexible duct provided shall be not less than 25 m. One end of the duct shall be arranged to connect to the fixed duct and the other to discharge safely at the bottom of either pump well, with an outlet which can be secured and directed as required.

Fixed and flexible ducts shall be sized to limit air velocity to not more than 20m/s.

2.13 Provision of safe access

RCC access platforms and ladders shall be provided wherever needed. The arrangements shall ensure that all parts of the plant are made readily accessible for maintenance or operation in safety.

2.14 RCC platform of size 28 x 18 m for Sub station and meter room at Bridge level of size 20 x 7.5 x 4 m is required.

SUB-SECTION 6C.3

MS PIPELINE

SUB-SECTION 6C.3: MS PIPELINE

3.1 Scope and Extent of Works

This sub- section covers particular requirements applicable to supply of pipe and pipe laying works, fittings, valves other appurtenances, internal-external protection of pipeline and testing.

The works for the transmission main shall include manufacturer, supply, transportation, excavation, laying, jointing, testing, backfilling and reinstatement of roads. The works shall also include all valves i.e. air valves, line valves, washouts, all related pipeline works, chambers and all works and items necessary for transmissions pipelines.

The total length of MS transmission mains is approximately 110 km as per particulars and conceptual design in the Table 3.1 below. The table also shows category of road on pipeline route.

Table 3.1: Details of transmission main

From	To	Nature of Main	Length (m)	Outer Diameter x Shell Thickness (mm x mm)	Category of Road on Pipeline Route
Jackwell	BPT	Raw Water Pumping Main	28500	1296 x 14	Initial 2 KM Village Road remaining length Along NH 65.
BPT	WTP at Soregaon	Raw Water Gravity Main	23100 14850 43550	1321 x 10 1296 x 10 1168 x 10	Along NH 65, MDR, ZP Road which includes Railway, NH, SH, Canal, River and other Road Crossings.

A preliminary estimate of the length, diameter and the like of the pipelines is given in the price schedule. The actual pipe length shall be subject to be measured on site after the pipelines are installed, in accordance with the agreed pipeline route between the Contractor and the Employer's representative.

3.2 Variation in Pipe Diameter and Determination of Shell Thickness

3.2.1 Permissible Variation in Diameter and Corresponding Shell Thickness

The tenderer is permitted to vary the diameter to one size higher or one size lower diameter as available in Maharashtra Jeevan Pradhikaran (MJP) Current Schedule of Rates (MS Pipeline section) corresponding to diameter mentioned in Table 3.1

Shell thickness shall be calculated as per formula given below:

Thickness for Design Test Pressure

Hydrostatic Pressure

$$P = (2 \times S \times T) / D$$

Where,

P – Hydraulic Test Pressure in Mpa

S – 60% of Specified minimum yield stress in Mpa

T – Specified thickness of tube in mm

D – Specified outside diameter in mm

- Includes minimum 1.5 mm corrosion allowance as per IS:2825 Clause
3.2.2

3.2.2 Tolerance in Shell Thickness

Only Positive tolerance allowed.

Negative tolerance NIL

3.3 The Site

5.3.1 General Requirements

The Contractor shall carry out a detailed survey of the pipeline route and draw up plans in consultation with Employer's representative, indicating the working width available. Plans and L-Section shall be drawn at **1:1000 scale**. If the

Contractor considers that at any location there is insufficient working width, then he shall indicate this on the plans, and produce a schedule of the locations with proposals for achieving the working width whilst taking into consideration the requirements of the regulating authority regarding movement of vehicular traffic etc.

The plans shall be submitted to the Employer's representative for approval. The plans shall be submitted well in advance of the date scheduled for commencement of pipe laying as specified in the Specifications and Employer's Requirements. The handing over of the site shall be generally made such that 200m length of pipeline is available for the Contractor for pipe laying at any time.

The Contractor shall provide road reinstatement depending on the particular type of road, should open trench pipe laying method be adopted for that particular road. National and State Highways and those maintained by the Public Works Department shall be permanently reinstated up to the top of the base course in accordance with the type of the road to be reinstated and as per the Standard Specification and Project Brief and Project Requirements. Depending on the requirements from the National highways, State highways and Public Works, the final reinstatement of the running surface shall be done directly by these authorities. In such case, a temporary wearing course shall then be laid down by the Contractor, or as otherwise in a way as directed by the Employer's representative. Under this scenario, final reinstatement of the road surface shall be done by the authority. Roads under the authority of local panchayat or any other municipal authority shall be fully reinstated by the Contractor in accordance with the constructed road and Specification. The Contractor shall also be responsible for maintaining existing road at Ujani jackwell and Zilla Parishad Road in the motorable condition by filling potholes and required metalling and asphaltting.

3.3.2 ROW and Constraints of Construction

Available RoW on all roads is generally 4000 mm which is just adequate to make trench and lay buried pipeline to required depth. Cover above the top of pipeline shall generally be as under:

Soil Cover	
Minimum	1000 mm

Thus for 1296 mm diameter pipeline with 200 mm bedding at bottom, depth of trench shall be 2500 mm. Similarly for 1321 mm diameter pipeline, depth shall be 2521 mm. It is obvious that it may not be possible to make such deep trench with natural slope. The tenderers shall therefore, be responsible to develop methodology for excavation, providing shuttering, sheet piling etc.

The pipeline alignment shall generally be at 4000 mm distance from edge of the ROW of road along SH, NH and 2000 mm from edge in case of ZP road.

3.3.3 Shifting of Utilities and Crossings

If required for facilitating the work to be carried out, the Contractor shall be responsible for shifting utilities such as service lines, cables, gas pipes, water pipes and drainage pipes, overhead or buried, after obtaining permission from

relevant utility authority. The role and involvement of the Employer at all these works will be to provide endorsement letters with the Contractor's letters to these authorities to make application for the aforesaid shifting of utilities by the utility authorities and the contractor. In case the Contractor could not get permissions from these authorities on time and the works are delayed, the Employer shall not make any compensation and all time and financial impacts shall be borne by the contractor. The Contractor shall assist these authorities to carry out their diversion work which shall include all other necessary work not within the scope of these authorities and its cost shall be deemed to be included in the price of the Contract.

3.3.4 Tree Cutting

The Contractor shall be responsible for felling or transplanting any trees as necessary after obtaining permission from the relevant authority.

3.3.5 Additional Working Area

The Contractor shall make his own arrangements and pay all expenses for any additional area that he may require outside 4000 mm wide available RoW, in order to complete the pipeline work. The Contractor shall obtain the consent of the Employer's representative of such arrangement prior to proceeding with the work.

3.4 Pipe Laying

The pipeline shall be generally buried except for bridge if any and rocky hillocks in alignment. Soil cover shall not be less than 1000 mm. Minimum cover specified is obligatory.

The trench width shall be equal to pipeline outside diameter +600 mm. The pipeline shall be laid in proper slope without any kink or dip in profile so as to facilitate air flow towards air valve for further release to atmosphere. The slope shall generally not be less than 1:500 for ascending section and 1:400 for descending section. Where such minimum slope cannot be achieved, the lesser slope shall be adopted with prior approval of Employer's representative

. Spacing between air valves in section with lesser slope shall be less than general spacing detailed for air valve.

Bedding shall be as specified in standard specifications. Sand boxing for pipeline shall be provided for Black cotton (BC) soil portion and rubble soling of minimum 300 mm shall be provide for slush muddy/ marshy/ slushy soil. Bedding material shall be as specified for each zone. Compaction of each layer shall be achieved, tested for proctor density and recorded duly signed by the Employer's representative and contractor's representative.

Above ground pipeline shall restricted to minimum where below ground laying is either not economical or not feasible such as pipeline passing over bridge if any or rocky hillock. Contractor shall take proper care such as expansion joint as necessary between two ends and the pipeline shall be on ring girder. Suitably designed thrust block shall be provided to restrain pipeline.

No extra payment is allowed if pipeline is laid above ground level.

The contractor shall prepare working drawings on basis of topographical survey done by him for final pipeline route and exact locations of fittings and valve chambers which shall be agreed on site between the Contractor and the Employer's Representative.

3.5 Valves on Pipeline

The selection of the type of the valve i.e. butterfly valve as line valve, sluice valve as wash out and air valves, the detailed design, and the precise location of each valve shall be carried out as follows:

Valves shall be in accordance with the Specification. The Contractor shall use the uniform types and the single manufacturer for each type of valve, throughout the Works.

5.5.1 Air Valve

Supplying at site ductile iron / Spheroidal Graphite (S.G.) iron single / Double chamber tamper proof air valve without isolating Sluice Valve. Valves in accordance with BSEN 1074-4 of PN 10/16 rated, with body and bonnet of ductile iron conforming to EN 1563/IS 1865 GR. 500/7 or Gr. 400/15 floats, float guide, seat ring of stainless steel 1.4436/1.4306, seat ring gasket of WRAS approved EPDM rubber (suitable for drinking water), internal fasteners of stainless steel A2. Body & Bonnet coated inside & outside with electrostatically applied epoxy powder coated blue colour (suitable for drinking water) as per DIN 30677-2 & GSK guideliness with a coating thickness of min. 250 microns. Flange connections as per IS 1538 raised face & pressure testing at manufactures works shall be done as per IS 14845.

200 mm diameter of rating PN 1.6, tamperproof air valve with isolating sluice valve shall be provided. The location of air valve shall at every peak on pipe section and peak on hydraulic grade line, on upstream end of pipe section for crossing river, nala and other minor crossings and on inlet and outlet shafts of tunnels. Spacing between two air valves shall be 500 m for all diameter pipeline. Above spacing is for pipeline section with minimum slope of 1:500 for ascending section and 1:400 mm for descending section. If flatter slope is unavoidable, number of air valves shall be increased. Air valves shall be in properly designed BBM chamber having Clear Size 1.50 x 1.50 x 2.1 m.

3.5.2 Line Valve

The line valve shall generally be provided at 5 km interval so as to isolate pipeline and prevent unnecessary draining of pipeline during repairs and maintenance.

Supplying at site of ductile iron / spheroidal graphite (S.G.) iron D/F double eccentric resilient seated short body Butterfly Valves with gear box and handwheel, without bypass arrangement. Valves in accordance with BS EN 593 of PN-10/16 rated, with body and disc of ductile iron conforming to EN 1563 / IS 1865 Gr. 500/7 or Gr. 400/15, Body seat of integral SG Iron / S.S. AISI 316, seal retaining ring of steel C45/ S. S. 1.4436, Shaft of S. S. 1.4021, Perif disc seal and "O" rings of WRAS approved EPDM rubber (suitable for drinking water), Internal fasteners of stainless steel A2. Body and disc d inside and outside with electrostatically applied epoxy

powder coated blue colour. (suitable for drinking water) as per DIN 30677-2 & GSK guidelines with a coating thickness of min. 250 microns. Valves should be 100% tight shut-off. Face to face as per IS 13095 short body. Flange drilling as per IS 1538 raised face & pressure testing at manufactures works shall be done as per IS 13095.

Diameter of line valves shall be 1000 mm. Line valves shall be short body butterfly valve and of rating PN1.6. Flange adapter of adequate pressure rating shall be provided in combination with BFV to facilitate repairs, seal replacement and maintenance of BFV. The line valve shall be in BBM chamber having Clear Size 1.50 x 1.50 x 2.1 m. The reducer and enlarger shall be eccentric type so as to allow air movement.

Manhole shall be provided at one end of BFV as approved by the Employer's representative and blank flange with dish shaped flange .

3.5.3 Wash Out

Supplying at site of ductile iron / spheroidal graphite (S.G.) iron D/F non-rising spindle resilient seated glandless sluice Valves with handwheel & without bypass arrangement. Valves in accordance with BS EN 5163 of PN-10/16 rated, with body and bonnet of ductile iron confirming to IS 1865 Gr. 500/7 or Gr. 400/15. Wedge nut of brass, shaft of stainless steel 1.4021/1.4104, stem seals min. 3 nos. of NBR, internal fasteners of stainless steel A2. Body and Bonnet coated inside & outside with electrostatically applied epoxy powder coated blue colour (suitable for drinking water) as per DIN 30677-2 & GSK guidelines with a coating thickness of min. 250 microns. Valves should be full bore & tight shut-off. Flange drillings as per IS 1538 raised face & pressure testing at manufactures works shall be done as per IS 14846.

Wash outs are required to drain the pipeline for repairs and maintenance. Location of wash out shall be at dippest point and near natural stream so as to dispose drained quantity. For wash out, sluice valve of rating PN1.6 shall be used in conjunction with flange adapter. Size of washout shall be 300 mm. Due to very small width available between pipeline and edge of ROW, the wash out need to be located very close to the pipeline. In view of above, BBM chamber need to accommodate both pipeline and wash out.

The exact location for each chamber shall be determined on site between the Employer's representative and Contractor. Unless indicated otherwise the manhole shall be of a uniform type and manufactured by the single manufacturer throughout the Works.

Access steps shall be of specially designed CI rungs in accordance with the Drawings and Specification. No improvised units shall be installed.

Where washouts have their outfalls to ditches, it will be necessary to install an outfall as indicated in tender Drawings. The Contractor shall design and get approval for the outfall to account for local variations in the size and layout of the ditch.

The Contractor shall review all the washout locations during the initial route survey and shall agree with the Employer's representative including the type of outfall to be used at each location.

3.6 Thrust Block and Anchor Blocks

The Contractor shall submit detailed design proposal on thrust blocks at bends, tees and dead ends and anchor blocks. The design pressures including uncontrolled surge pressures and available restrained lengths shall be clearly stated in the detailed design report by the Contractor. The Design Report shall be submitted by the Contractor with the remedial measures and detailed drawings for thrust blocks and anchor blocks at specific locations in order to obtain the approval from the Employer's representative.

3.7 Culvert, Small River and Nala Crossings

river / creek crossings are encountered.

i) Seena river width 150 m

The methodology for crossing is discussed in subsection 6C.8: other works

For other culvert, small river and nala crossings, the crossings shall be done by laying the pipeline at least 300 mm below the bed level. The length of the pipeline under full water course shall be encased in concrete encasing with minimum 1000 mm encasing extending beyond maximum width of water course. Detailed work specifications are given in Subsection 6C.8.

3.8 Internal and External Protection Lining (3 LPE)

3.8.1 3 layers polyethyelene coating

Providing & applying 3 layers polyethyelene coating of minimum 1000 micron composite coating and internal fusion bonded epoxy lining as per IS 3589 annex Cof 400 micron thickness for under ground laying MS Pipes, Similarly dual layer polyester coating of 400 micron externally and internal fusion bonded lining as per IS 3531 for above ground laying MS pipes. This includes coating and wrapping over the pipes handling , preparation of pipe surface, all labour material, including transportation of pipes from site of works to factory and back to site of works after coating as directed by Engineer in charge.

Cleaning

Prior to adbrasive blast cleaning, surfaces shall be inspected and, if required, cleaned according to remove oil, grease, or other foreign matter. Only approved solvents that do not leave a residue shall be used. Preheating to remove oil, grease, mill scale, water and ice may be used provided all pipe is preheated in a uniform manner to avoid distorting the pipe.

Abrasive Blast Cleaning

The exterior pipe surfaces shall be abrasive blast cleaned to achieve a near white metal surface. The interior pipe surfaces shall be abrasive blast cleaned to achieve a white metal surface. Abrasive blasting and coating shall only be performed when the metal temperature is more than 3°C above dew point.

Surface Inspection

The exterior and interior pipe surfaces shall be inspected for surface imperfections, such as slivers, scabs, burrs, weld spatter, and gouges, shall be removed by grinding.

Field repairs to damaged coating

Contractor shall be responsible for field repairs to damaged coating during transportation and handling. Methodology shall be on basis of the manufacturers recommendations subjected to approval of the Employer's representative.

3.8.2 Other Exterior Coating

Other coating system such as reinforced cement mortar coating (guiniting), liquid epoxy coating, and coal tar based coating and wrapping are not accepted.

3.8.3 Coating of Welded Joints

Coating as specified in standard specifications shall be adopted.

3.8.4 Protection for above ground pipeline

Protection as specified in standard specification shall be adopted.

3.9 Hydraulic Testing of Pipeline

After completing the installation of pipeline or a section of the line and welding of joints, a hydrostatic pressure test of the line shall be conducted before giving the coating to the exposed joints. The hydrostatic pressure equal to or higher than design pressure shall be maintained for 4 hours as per Clause 11.2 of the IS:5822. If a drop in pressure occurs the quality of water added in order to re-establish the test pressure, should be carefully measured. This should not exceed 0.1 litre per mm of pipe diameter per km of pipeline per day for each 30 m head of pressure applied.

Under the test pressure no leakage or sweating shall be visible at all section of pipes, fittings, valves, hydrant and welded joints. Any defective pipes, fittings, valves or hydrants discovered in consequences of this pressure test shall be removed and replaced by sound material and the test shall be repeated until satisfactory to the authority.

If the pressure measurements are not observed at the lowest section, an allowance should be made for the static head between the lowest point and the point of measurement to ensure that the pressure at the lowest

● point is as per required test pressure. Any defective joint or part shall be repaired and retested in the presence of the Employer's representative. The contractor shall make his own arrangements for water and all equipment and instruments. Water used for testing shall be free from contaminants for field testing. The pressure gauge used shall be tested and calibrated from laboratory approved by Engineer. The pipeline shall be tested in stretches of not exceeding 2 km in length. The hydraulic testing is mandatory.

SECTION 6C.4

DI PIPE

SUB-SECTION 6C.4: DI PIPELINE

4.1 Scope and Extent of Works

This sub-section covers particular requirements applicable to supply of pipe and pipe laying works, fittings, valves other appurtenances, internal-external protection of pipeline and testing.

The works for the transmission main shall include manufacturer, supply, transportation, excavation, laying, jointing, testing, backfilling and reinstatement of roads. The works shall also include all valves i.e. air valves, line valves, washouts, all related pipeline works, chambers and all works and items necessary for transmissions pipelines.

The total length of DI transmission mains is approximately 28.30 km as per particulars and conceptual design in the Table 5.1 below. The table also shows category of road on pipeline route.

Table 4.1: Details of transmission main

From	To	Nature of Main	Length (m)	Diameter of pipe	Category of Road on Pipeline
Tapping point on Raw water Gravity Mian	Pakni WTP	Raw Water Gravity Main	300	800 mm K-9	Crossing NH-52

A preliminary estimate of the length, diameter and the like of the pipelines is given in the price schedule. The actual pipe length shall be subject to be measured on site after the pipelines are installed, in accordance with the agreed pipeline route between the Contractor and the Employer's representative.

4.2 Variation in pipe diameter

The variation in diameter shall be one higher or one lower diameter as available in Maharashtra Jeevan Pradhikaran (MJP) CSR (DI Pipeline section) corresponding to diameter mentioned in Table 4.1

4.3 The Site

4.3.1 General Requirements

The Contractor shall carry out a detailed survey of the pipeline route and draw up plans in consultation with Employer's representative, indicating the working width available. Plans and L-Section shall be drawn at **1:1000 scale**. If the Contractor considers that at any location there is insufficient working width, then he shall indicate this on the plans, and produce a schedule of the locations with proposals for achieving the working width whilst taking into consideration the requirements of the regulating authority regarding movement of vehicular traffic etc.

The plans shall be submitted to the Employer's representative for approval. The plans shall be submitted well in advance of the date scheduled for commencement of pipe laying as specified in the Specifications and Employer's Requirements. The handing over of the site shall be generally made such that 200m length of pipeline is available for the Contractor for pipe laying at any time.

The Contractor shall provide road reinstatement depending on the particular type of road, should open trench pipe laying method be adopted for that particular road. National and State Highways and those maintained by the Public Works Department shall be permanently reinstated up to the top of the base course in accordance with the type of the road to be reinstated and as per the Standard Specification and Project Brief and Project Requirements. Depending on the requirements from the National highways, State highways and Public Works, the final reinstatement of the running surface shall be done directly by these authorities. In such case, a temporary wearing course shall then be laid down by the Contractor, or as otherwise in a way as directed by the Employer's representative. Under this scenario, final reinstatement of the road surface shall be done by the

authority. Roads under the authority of local panchayat or any other municipal authority shall be fully reinstated by the Contractor in accordance with the constructed road and Specification. The Contractor shall also be responsible for maintaining existing road at Ujani Jackwell and Zilla Parishad Road in the motorable condition by filling potholes and required metalling and asphaltting.

4.3.2 ROW and Constraints of Construction

Available RoW on all roads is generally 2000 mm which is just adequate to make trench and lay buried pipeline to required depth. Cover above the top of pipeline shall generally be as under:

Soil Cover	
Minimum	1000 mm

4.3.3 Shifting of Utilities and Crossings

If required for facilitating the work to be carried out, the Contractor shall be responsible for shifting utilities such as service lines, cables, gas pipes, water pipes and drainage pipes, overhead or buried, after obtaining permission from relevant utility authority. The role and involvement of the Employer at all these works will be to provide endorsement letters with the Contractor's letters to these authorities to make application for the aforesaid shifting of utilities by the utility authorities and the contractor. In case the Contractor could not get permissions from these authorities on time and the works are delayed, the Employer shall not make any compensation and all time and financial impacts shall be borne by the contractor. The Contractor shall assist these authorities to carry out their diversion work which shall include all other necessary work not within the scope of these authorities and its cost shall be deemed to be included in the price of the Contract.

4.3.4 Tree Cutting

The Contractor shall be responsible for felling or transplanting any trees as necessary after obtaining permission from the relevant authority.

4.3.5 Additional Working Area

The Contractor shall make his own arrangements and pay all expenses for any additional area that he may require outside 2000 mm wide available RoW, in order to complete the pipeline work. The Contractor shall obtain the consent of the Employer's representative of such arrangement prior to proceeding with the work.

4.4 Pipe Laying

The pipeline shall be generally buried except for bridge if any and rocky hillocks in alignment. Soil cover shall not be less than 1000 mm.

The trench width shall be equal to pipeline outside diameter +600 mm. The pipeline shall be laid in proper slope without any kink or dip in profile so as to facilitate air flow towards air valve for further release to atmosphere. The slope shall generally not be less than 1:500 for ascending section and 1:400 for descending section. Where such minimum slope cannot be achieved, the lesser slope shall be adopted with prior approval of Employer's representative. Spacing between air valves in section with lesser slope shall be less than general spacing detailed for air valve.

Bedding shall be as specified in standard specifications and tender drawings. Bedding material shall be as specified for each zone. Compaction of each layer shall be achieved, tested for proctor density and recorded duly signed by the Employer's representative and contractor's representative.

Above ground pipeline shall be restricted to minimum where below ground laying is either not economical or not feasible such as pipeline passing over bridge if any or rocky hillock. Contractor shall take proper care such as expansion joint as necessary between two ends and the pipeline shall be on ring girder as shown in tender drawings. Suitably designed thrust block shall be provided to restrain pipeline.

The contractor shall prepare working drawings on basis of topographical survey done by him for final pipeline route and exact locations of fittings and valve chambers which shall be agreed on site between the Contractor and the Employer's Representative.

4.5 Valves on Pipeline

The selection of the type of the valve i.e. butterfly valve as line valve, sluice valve as wash out and air valves, the detailed design, and the precise location of each valve shall be carried out as follows:

Valves shall be in accordance with the Specification. The Contractor shall use the uniform types and the single manufacturer for each type of valve, throughout the Works.

4.5.1 Air Valve

Suitable diameter of rating PN 1.6 / 16 bar, tamperproof air valve shall be provided. The location of air valve shall at every peak on pipe section and peak on hydraulic grade line, on upstream end of pipe section for crossing river, nallah and other minor crossings and on inlet and outlet shafts of tunnels. Spacing between two air valves shall be 500 m for all diameter pipeline. Above spacing is for pipeline section with minimum slope of 1:500 for ascending section and 1:400 mm for descending section. If flatter slope is unavoidable, number of air valves shall be increased. Air valves shall be fixed in position air valve shaft including providing and fixing G.I. Medium class or 6 mm thick M.S. pipe shaft 2.70 M. long over branch flange of air valve tee, providing PCC block of M-150 concrete 150 mm thick around the air valve tee including encasing of vertical shaft in PCC M-150 as shown in type design together with providing and making flanged joints wherever required and fixing of air valve over the shaft excluding cost of air valve and branch flanged air valves tee. etc. complete as per type design and as directed by Engineer-in-charge for following diameters of pipe lines.

4.5.2 Line Valve

The line valve shall generally be provided at 5 km interval so as to isolate pipeline and prevent unnecessary draining of pipeline during repairs and maintenance.

Diameter of line valves shall be 800 mm. Line valves shall be long body butterfly valve and of rating PN1.6. Flange adapter of adequate pressure rating shall be provided in combination with BFV to facilitate repairs, seal replacement and maintenance of BFV. The line valve shall be in R.C.C .chamber. The reducer and enlarger shall be eccentric type so as to allow air movement.

Manhole shall be provided at one end of BFV as approved by the Employer's representative and blank flange with dish shaped flange .

4.5.3 Wash Out

Wash outs are required to drain the pipeline for repairs and maintenance. Location of wash out shall be at dippest point and near natural stream so as to dispose drained quantity. For wash out, sluice valve of rating PN1.6 shall be used in conjunction with flange adapter. Suitable Size of washout valve shall be provided. Due to very small width available between pipeline and edge of ROW, the wash out need to be located very close to the pipeline. In view of above, RCC chamber need to accommodate both pipeline and wash out.

The exact location for each chamber shall be determined on site between the Employer's representative and Contractor. Unless indicated otherwise the manhole shall be of a uniform type and manufactured by the single manufacturer throughout the Works.

Access steps shall be of specially designed CI rungs in accordance with the Drawings and Specification. No improvised units shall be installed.

Where washouts have their outfalls to ditches, it will be necessary to install an outfall as indicated in tender Drawings. The Contractor shall design and get approval for the outfall to account for local variations in the size and layout of the ditch.

The Contractor shall review all the washout locations during the initial route survey and shall agree with the Employer's representative including the type of outfall to be used at each location.

4.6 Thrust Block and Anchor Blocks

The Contractor shall submit detailed design proposal on thrust blocks at bends, tees and dead ends and anchor blocks. The design pressures including uncontrolled surge pressures and available restrained lengths shall be clearly stated in the detailed design report by the Contractor. The Design Report shall be submitted by the Contractor with the remedial measures and detailed drawings for thrust blocks and anchor blocks at specific locations in order to obtain the approval from the Employer's representative.

4.7 Hydraulic Testing of Pipeline

The pipeline and valves should be tested hydraulically up to the required pressure as per IS satisfactorily and all the leakages if any should be repaired at the time of hydraulic testing. Contractor should make his own arrangements at his own cost for water for hydraulic testing of pipeline. He should not rely upon completion of any other sub-works for such testing.

SUB-SECTION 6C.5

SURGE CONTROL AND BREAK PRESSURE TANK

SUB-SECTION 6C.5: SURGE CONTROL AND BREAK PRESSURE TANK

5.1 General

Unsteady flow phenomenon takes place in three transmission Pipe systems as under:

- (i) Raw water pumping main from Jackwell to BPT – Length 28500 m

The pumping main encounter on power failure to pump- motor set transient pressures both negative and positive of objectionable magnitude causing water column separation and consequent high pressure when separated water column rejoin. Water hammer control device is necessary to restrict low pressure and high pressure to safe limits.

As regards BPT, unsteady phenomenon is experienced when pumps are restarted from No-flow condition in gravity main downstream of BPT .As seen from Hydraulic flow diagram, entire 81.50 km long gravity main from BPT to Soregaon WTP shall be full. On restarting the pumps very high acceleration head is imposed due to very long length causing WL rise initially in empty high level sections and further WL rise shall takes place in BPT which shall depend on cross sectional area of BPT.

The BPT needs to be designed considering this unsteady flow.

5.2 Surge Analysis and Water Hammer Control Devices

5.2.1 Surge Analysis

Surge analysis shall be carried out for sudden power failure condition using recognized software.

Design flow rate for surge analysis shall be as under:

- Raw Water Pumping main for $Q = 5256 \text{ m}^3/\text{hr}$ which is present Q Complete analysis with output of software shall be furnished.
If results

of analysis show low pressure below -3.0 m or water column separation, suitable water hammer control device shall be proposed for individual pumping main to meet following pressure limits

- Negative pressure over any pipe section of the pumping main not permissible
- Positive pressure shall not exceed 1.5 times normal working pressure

5.2.2 Acceptable Water Hammer Control Solution

Methods / solutions as under are acceptable to restrict water hammer pressure within acceptable limits stated above

Bladder vessel

5.4 Break Pressure Tank

5.4.1 Design Basis

Hydraulic analysis shall be based on guidelines given in paper 'Development of Guidelines for sizing of BPT' written by Dr. R.N. Ingle, Retired Professor Visvevaraya Regional College of Engineering, Nagpur and published in IWWA Journal. The hydraulic analysis shall include unsteady flow analysis in BPT during startup of pumps from no flow condition.

5.4.2 Design Data

$Q_{\text{design}} = 5256 \text{ m}^3/\text{h}$ (110 ML/d in 22 hrs)

- (i) LWL - based on steady state HGL @ C = 130 pipeline
No residual head
- (ii) TWL - based on steady state HGL @ C = 130 (pipeline) + 5.0 m; (Residual head)
- (iii) Overflow Level - based on max WL attained during unsteady flow + 1.0 m or TWL whichever is higher

5.4.3 Design Methodology for Numerical Analysis

Design methodology and equations stated below are based on Dr. Ingle's paper on BPT design

- (i) Start point is No – flow condition attained in entire downstream transmission system from BPT to WTPs
- (ii) From Hydraulic flow-diagram enclosed as tender drawing it is obvious that pipeline are nearly full under No-flow condition
- (iii) The computation shall be based on numerical analysis for unsteady flow on basis of following two equations which are based on Dr. Ingle's paper.

- Continuity of flow

$$Q_{\text{pump}} = Q_{\text{BPT}} + Q_{\text{pipe}}$$

.....Equation 1

Where

$$Q_{\text{BPT}} = Q_{\text{accumulated in BPT at any instance}}$$

$$Q_{\text{pipe}} = \text{Flowrate in pipeline at any instance}$$

- Unsteady HGL equation

$$Z_{\text{BPT}} = Z_{\text{end}} + H_f + H_a$$

.....Equation 2

Where

$$Z_{\text{BPT}} = \text{WL in BPT or transmission pipeline as applicable at any instance}$$

Z _{end}	=	TWL in Chene MBR
H _f	=	Friction loss for Q _{pipe} at any instance [The H _f shall be based on C=120]
H _a	=	Acceleration head at any instance caused due to increase / decrease in

- (iv) All duty pumps are assumed to start at starting point. Q_{pump} is assumed to remain constant
- (v) Computations using above equation are continued till maximum WL is attained in BPT for given BPT area
- (vi) Further computations are continued till Q_{pipe} becomes practically equal to design Q. HGL in BPT for the Q should be practically as steady state HGL which is check to ensure that numerical analysis is correctly done
- (vii) 'C' value for computation of friction shall be C = 130 being the worst design parameter and Minor losses @ 10% above friction loss
- (viii) Volume of BPT for given area shall be calculated on basis of maximum WL attained
- (ix) The analysis is done for 3-4 BPT areas to determine optimum and feasible BPT volume

5.4.4 Conceptual Design

Conceptual design based on C=130 for LWL and C = 130 for TWL + 5 m residual head envisages following hydraulic levels

Tank area - 91.0 m² (10.8 m diameter of circular BPT or 9.5 m X 9.5 m if square)
 LWL - 560.00 m RL
 TWL - 565.0 m RL Water Depth - 5.5 m

5.4.5 Contractors Option for Tank Construction

The contractor can opt for any of the following:

- Low level elevated RCC tank
- Ground level RCC shaft

5.4.6 RCC Tank /Shaft at BPT

If RCC tank or RCC shaft is proposed , provision as under shall be incorporated

- (i) Access staircase
- (ii) Overflow arrangement including drain pipe for disposal
- (iii) Tank drain arrangement including drain valve of 200 mm diameter.
- (iv) Lightening protection

5.4.8 Termination of inlet and outlet pipes

The inlet pipe shall be at the bottom of tank with flanged bellmouth. Outlet pipe may be bottom or side. Lip of the bellmouth shall be 200 mm above the bottom of the tank.

SUB-SECTION 6C.6

CROSSINGS

SUB-SECTION 6C.6: CROSSINGS

6.1 Railway Crossing

6.1.1 Location and Magnitude of Crossing

Railway track Crossing near Modnimb Railway Station, Mohol Railway Station and Bale Railway Station which will be done by pushing MS casing pipe under railway track and pipeline within MS casing pipe. Preparation of proposals, taking necessary permission from Railway department and execution of work is under this contract. The necessary charges of concerned Authority/Dept will be paid by SCDCL.

6.1.2 Methodology

a) Push Through Method

Pushing of MS pipes for railway crossing by Push Through Method in all types of strata by using hydraulic jack and drilling machine of required diameter of below MS casing pipes, lowering, laying, jointing of material, required welding machinery tripod, chain pully block crane, blower, compressor, loading and unloading the machinery into the trench etc. transportation and dewatering etc.

b) Conveyance / carrier pipe and concrete fill

Pipeline shall be laid in the casing pipe with suitable saddle at the bottom. Anti-corrosive paint shall be provided on outside. The inside of pipe will be coated with the primer and two coats of epoxy paint as per specification given hereunder on basis of Annex B of IS 3589. This work shall be done by the contractor under this contract and shall be supervised by Railway authority.

c) Pushing and receiving pit

Pushing and Receiving pits will be provided at two ends of crossing. Pushing pit size will be 3000mm x 3000mm x 3000 mm and Receiving pit size will be 3000mm x 3000mm x 3000mm approximately.

d) Inspection chamber and valve arrangement

Butterfly valve long body of PN 1.6 with flange adopter and inspection chamber will be provided outside railway boundary to facilitate the closure of flow of water supply whenever required.

After completion of work pushing and receiving pits will be filled. Valves chambers will be at both pushing and receiving pits. Vent pipe & sign board shall be provided.

6.2 Crossings of Water Courses

6.2.1 Minor Nala/ Stream Crossings

Pipeline shall be laid at least 300 mm below the bed level by doing open excavation which will be feasible and economical as these Nala and streams are not perennial. The pipe sections shall be encased in RCC in all such crossings section as shown in tender drawing. The encasing shall be extended at least 1000mm on both sides over maximum width of crossing. Concrete used for this shall be of M15 grade. Before placing concrete the pipes shall be supported at every 500 mm spacing with a padding of compressive material on a pre-cast concrete block. Concrete shall not be placed until the pipes have been jointed, inspected and tested. The concrete shall be placed to ensure full contact with the pipe barrel throughout its length. Necessary reinforcement steel shall be provided as per the approved design and site conditions. No concrete shall be placed around joints of a welded steel pipe until that length of pipe has passed a sectional hydraulic test.

6.2.2 Canal Crossing

The crossing of irrigation canals is to be executed as per the approved L-section, after obtaining necessary permission from the Irrigation Department or as directed by Employer's Representative. The Contractor has the full responsibility in case of damage to the canal embankment or lining. All costs for reinstatement of the canal to its original status shall be borne by the Contractor. The necessary charges of concerned Authority/Dept will be paid by SCDCL.

The pipe shall be laid at least 300 mm below the canal bed level. The entire length of pipeline under canal plus 10,000 mm on each side shall be encased. Concrete used for this shall be of M15 grade. Before placing concrete the pipes shall be supported at every 500 mm spacing with a padding of compressive material on a pre-cast concrete block. Concrete shall not be placed until the pipes have been jointed, inspected and tested. The concrete shall be placed to ensure full contact with the pipe barrel throughout its length. Necessary reinforcement steel shall be provided as per the approved design and site conditions. No concrete shall be placed around joints of a welded steel pipe until that length of pipe has passed a sectional hydraulic test.

The Contractor shall provide concrete lining of the canal section for a length of at least 15 m on each side of the crossing after the excavated portions of the canal embankment have been properly reconstructed with required compaction. Construction of the concrete lining must not result in any hump in the canal and must be graded to the requirements of the Irrigation Department.

6.2.3 River Crossings

There is one river crossing encountered throughout pipeline alignment

Seena River - 150 m

Pipeline should be 3 m below the bed level / scour level of river by open excavation in rocky bed. Pipe will be encased in RCC in river section. Open excavation is feasible and economical option

Preparation of proposals, taking necessary permission from concerned department and execution of work is under this contract. The necessary charges of concerned Authority/Dept will be paid by SCDCL.

The pipe sections shall be encased in RCC in all such crossings section as shown in tender drawing. The encasing shall be extended at least 10,000 mm on both sides over maximum width of crossing. Concrete used for this shall be of M15 grade. Before placing concrete the pipes shall be supported at every 500 mm spacing with a padding of compressive material on a pre-cast concrete block. Concrete shall not be placed until the pipes have been jointed, inspected and tested. The concrete shall be placed to

ensure full contact with the pipe barrel throughout its length. Necessary reinforcement steel shall be provided as per the approved design and site conditions. No concrete shall be placed around joints of a welded steel pipe until that length of pipe has passed a sectional hydraulic test.

6.3 NH and SH Crossing

Crossing on NH-65 at Pakni, Kegaon and on NH 52 at Soregaon which will be done by pushing MS casing pipe under National Highway and pipeline within MS casing pipe. Preparation of proposals, taking necessary permission from National Highway Authority and execution of work is under this contract. The necessary charges of concerned Authority/Dept will be paid by SCDCL.

Crossing of 8 No. en-route State Highway which will be done by pushing MS casing pipe under State Highway and pipeline within MS casing pipe. Preparation of proposals, taking necessary permission from State Highway Authority and execution of work is under this contract.

Pipeline shall be laid in the casing pipe with suitable saddle at the bottom. Interior and exterior of pipeline shall be coated with epoxy as per specification given hereunder. Space between pipeline and casing pipe shall be kept open. The inside of pipe will be coated with the primer and two coats of epoxy paint as per IS 3589. This work shall be done by the contractor.

6.4 MDR,ODR and Other Road Crossing

Crossing of number of en-route MDR,ODR and other road which will be done by excavating and laying 1800 mm Dia. RCC NP 3 encasing pipe and pipeline within RCC casing pipe and reinstating road surface. Preparation of proposals, taking necessary permission from concerned Authority and execution of work is under this contract. The necessary charges of concerned Authority/Dept will be paid by SCDCL.

Permission and approval of all concerned authorities, serve notices of intent to start the work as may be necessary, and observe all local Laws and Regulations. The Contractor shall submit details of his proposals, obtain approval from the Employer's Representative and local highway authority, and construct any required temporary diversion roads before starting the work.

The exterior of pipeline shall be coated with epoxy as per specification given hereunder.

6.5 Epoxy Coating System for Interior and Exterior of Pipeline under Crossing

The specification shall be applicable for interior of following pipeline under crossing:

- i. Railway crossing (Interior coating)
- iii. NH, SH and other Road crossings (Interior and Exterior)

6.5.1 Coating and Lining Systems

The coating and lining systems shall consist of two-part, chemically cured epoxy primer and two coatings of a different two-part, chemically cured epoxy topcoat.

6.5.1.1 Liquid-Epoxy Coatings

The coatings used shall be based on liquid, chemically cured epoxies. The curing agent may be an amine, amine-adduct, or polyamide; and the epoxy may be modified with the coal rat, phenolic, or other modifiers. Materials used in both the primer and finish coat(s) shall be products of one manufacturer.

6.5.1.2 Coating Thickness

Unless otherwise specified by the purchaser, the minimum dry film thickness DFT provided shall be at least 406 μm .

After curing but prior to burial, the coating system shall be a continuous film, free of thin spots and other imperfections as defined and shall pass electrical inspection.

6.5.1.3 Coating Application

The pipe coating shall be applied in accordance with the manufacturer's recommendations. Application by airless spray or centrifugal wheel equipment is preferred.

6.5.2 Pipe Preparation

6.5.2.1 Cleaning

Prior to abrasive blast cleaning, surfaces shall be inspected and, if required, cleaned according to remove oil, grease, or other foreign matter. Only approved solvents that do not leave a residue shall be used. Preheating to remove oil, grease, mill scale, water and ice may be used provided all pipe is preheated in a uniform manner to avoid distorting the pipe.

6.5.2.2 Abrasive Blast Cleaning

The exterior pipe surfaces shall be abrasive blast cleaned to achieve a near white metal surface. The interior pipe surfaces shall be abrasive blast cleaned to achieve a white metal surface. Abrasive blasting and coating shall only be performed when the metal temperature is more than 3°C above dew point.

6.5.2.3 Surface Inspection

The exterior and interior pipe surfaces shall be inspected for surface imperfections, such as slivers, scabs, burrs, weld spatter, and gouges, shall be removed by grinding.

6.5.2.4 Interior Cleaning

If abrasives or other loose foreign matter has entered the interior of the pipe, then clean, dry oil free compressed air shall be used to remove the loose foreign matter in a manner that does not adversely affect the cleaned surface. Alternatively, vacuum cleaning or other methods may be used in place of compressed air.

6.5.2.5 Application Temperature

The temperature of the mixed coating material and of the pipe at the time of application shall not be lower than 10°C. Preheating of the coating material, the use of in line heaters to heat the coating material; or heating of the pipe, fittings or specials may be used to facilitate the application. Heating shall conform to the recommendations of the coating manufacturer.

6.5.2.6 Application of Epoxy Coating System

If more than one coat is applied, the second coat shall be applied within the time limits, surface conditions, and temperature recommended by the manufacturer, if the period between coats is exceeded, then a repair procedure shall be obtained from the coating manufacturer and its recommendations followed.

6.5.3 Cure

After application, the coating system shall be tested for cure.

6.5.4 Electrical Inspection for Continuity

After curing, but prior to installation, the coating system applied to the pipe shall be tested for holidays according to the procedures and using the voltage settings. Any holidays indicated by the detector shall be marked with chalk or felt-tip marker to identify the area to be repaired.

6.5.5 Coating Repair

Accessible areas of pipe requiring coating repairs shall be cleaned to remove debris and damaged coating using surface grinders or other means acceptable to the purchaser. The adjacent coating shall be feathered by sanding, grinding, or other methods approved by the purchaser. Accumulated debris shall be removed by vacuum, blowing, or wiping with clean rags.

6.5.6 Welded Field Joints

6.5.6.1 Preparation

The weld joint shall be cleaned so as to be free from mud, oil, grease, welding flux, weld spatter, and other foreign contaminants. The cleaned metal surfaces of the weld joint shall then be abrasive blasted, vacuum blasted, or abraded using rotary abrading pads. The adjacent liquid epoxy coating shall be feathered by abrading the coating surface for a distance of 25 mm.

6.5.6.2 Electrical Inspection

After curing, the coating system applied to the welded joints shall be holiday tested. Any holidays indicated by the detector shall be marked with chalk or felt-tip marker to identify the area for repair.

6.5.6.3 Bedding and Trench Backfill

Where the trench traverses rocky ground containing hard objects that could penetrate the protective coating, a layer of screened earth, sand, or rounded river run gravel not less than 150 mm thick with a maximum particle size of 20 mm shall be placed in the bottom of the trench prior to installation of the coated article.

SUB-SECTION 6C.7

MECHANICAL AND

ELECTRICAL WORKS

DETAILED CONDITIONS FOR SUPPLY OF PUMPING MACHINERY

RAW WATER PUMPING MACHINERY

The scope of work includes designing, supplying, erecting & successful commissioning with test and trial of raw water pumping machinery with allied electrical and mechanical equipment with air vessel outside the pump house for water hammer control including safe transport, loading & unloading at site and watch & ward till erection.

The design of pumping machinery shall be based on pumping raw water with Six numbers of Vertical Turbine (VT) pumps, out of which Four numbers of pumps will be operating in parallel for conveying raw water through raw water rising main .Design and layout shall be based on following condition-

Design and drawing of pump house	Design and drawing of pump house shall be of vortex-free operation of Pumps. Minimum Submergence be ensured for cavitation free operation of pumps in all operating conditions
Floor and head room arrangement	The pump house shall be of double floor arrangement (i.e. separate floor for pumps and HT panel) . There shall be proper headroom for EOT Crane
RCC Platform for Installation of substation equipment and air vessel	RCC platform of required size is to be constructed one meter above highest flood level of Ujani Dam outside the pump house for installation of substation equipments and Bladder vessel. Design of platform shall be based on seismic zone of site considering scouring effect of river, live load of equipment to be installed and other associated loading condition of installed equipments.
Inlet arrangement to jackwell	Inlet pipe with rose pieces be provided with valve and head stock arrangement inside the pump house.
Approach road and bridge	RCC Concrete bridge and approach road of appropriate width be designed and constructed up to pump house and substation to facilitate transport ,unloading equipment up to pump house and substation.
Desilting arrangement	Desilting pump shall be provided for desilting the jackwell.

The Contractor is requested to get the levels confirmed for design of VT Pumps. The equipments shall be procured after approval from the Superintending Engineer (M). He shall submit the layout drawing of pumping machinery, sub-station and individual drawing of all equipments as per site condition for approval.

The installation of following equipments shall be done under the guidance & supervision of representative of Manufacturer.

- 1) V.T. Pumps
- 2) 3.3 kV VSS Motors
- 3) Transformers
- 4) 33 kV & 3.3 kV Panel.
- 5) Valve & Valve Actuators
- 6) Electronic Soft Starter
- 7) EOT Crane
- 8) EMF Flow meter
- 9) Bladder Vessel
- 10) Electrification
- 11) HT, LT power & Control Cable
- 12) Civil work for RCC Platform for 33 kV sub station

Test Certificate and Manuals

The successful tenderer shall submit the test certificate for various components after inspection. He shall also submit instruction manual in duplicate covering operation, maintenance and repairs of all equipments including wiring diagrams and charts in duplicate for periodical maintenance of equipment. Rectification of any defects during guarantee period of all executed items shall be carried out immediately, so that water supply should not be hampered.

SCOPE OF RAW WATER PUMPING MACHINERY WORK

- i) The scope of contract includes designing, providing, erecting, testing, commissioning of Vertical Turbine pumps and allied mechanical & electrical equipments as detailed below, rectification of defects during guarantee period of the pump & required civil works as per limit shown in layout and described in the tender documents.
- ii) The total work is of turnkey nature.
- iii) The job includes, loading, transportation, it's insurance, delivery at site, storing with due care, guarding, erection, allied civil works, performance test and trial and defect rectification during guarantee period.

Sr. No.	Item description	Qty	Unit
1	2	3	4
1	Item no. 1 Self Water Lubricated VT Pumpset:- Providing , erecting, commissioning and testing of water lubricated Vertical Turbine Pumpset capable of discharging 365 LPS against total head of 112 M. from all causes as per detailed specifications. (725HP)	6	Nos
2	Item no. 2 VSS Motor 540 kW- 3.3kV :- Providing, erecting and giving test and trial of Vertical Solid shaft Foot Mounted TEFC squirrel cage induction motor, conforming to IS 325 motor with 1500 RPM & having continuous rating suitable for operation at 3300 Volts +/-10%, 3 Phase, 50 Hz +/-3% with "F" class insulation temperature rise limited to class "B" insulation. Motor shall be fitted with suitable space heater and six nos.RTD as per detailed specification..	6	Nos
3	Item No-3- 3.3KV HT Indoor Panel- Providing, erecting, commissioning and testing of 3.3 KV HT Indoor cubicle HT Panel as per detailed specification.	1	No
4	Item No. 4- LT Panel :- Providing, erecting, commissioning and testing of LT panel with required switchgear, aluminium bus bar, wiring accessories, MS fabrication box. Labour etc. as per detailed specification..	1	Job
5	Item No-5-Temperature scanner Panel:- Providing erecting commissioning with test and trail of Temperature scanner panel as per detailed specification.	1	No
6	Item No-6- 3.3 kV APFC Panel:- Providing erecting commissioning with test and trail of 3.3 kV APFC Panel as per detailed specification.	2	Nos
7	Item No-7- 3.3 kV Load Break Switch for transformer Capacitor:- Providing erecting commissioning with test and trail of 3.3 kV Load Break Switch for transformer Capacitor as per detailed specification.	2	Nos
8	Item No. 8.a - 33 kV 1 x 3 x 95 sqmm Cable :- Supplying and erecting 33 kV XLPE Aluminium armoured cable of size 1 x 3 x 95 sqmm from MSEDCL supply point to 33 kV Metering Kiosk to Panel to Transformer as per detailed specification.	200	M
9	Item No. 8.b - 3.3 kV 2 x 3 x 240 sqmm Cable:- Supplying and erecting 3.3 kV XLPE Aluminium armoured cable of size 2 x 3 x 240 sqmm from Transformer to 3.3 Panel as per detailed specification.	200	M
10	Item No. 8.c - 3.3 kV 1 x 3 x 120 sqmm Cable :- Supplying and erecting 3.3 kV XLPE Aluminium armoured cable of size 1 x 3 x 120 sqmm from Panel to starter to motor as per detailed specification.	180	M
11	Item No. 8.d - 3.3 kV 1 x 3 x 120 sqmm Cable:- Supplying and erecting 3.3 kV XLPE Aluminium armoured cable of size 1 x 3 x 120 sqmm from Main 3.3 kV Panel to capacitor as per detailed specification.	180	M

Sr. No.	Item description	Qty	Unit
12	Item No. 8.e - 3.3 kV 1 x 3 x 150 sqmm Cable:- Supplying and erecting 3.3 kV XLPE Aluminium armoured cable of size 1 x 3 x 120 sqmm from Main 3.3 kV Panel to APFC capacitor Panel as per detailed specification.	50	M
13	Item No. 8.f - 1.1 kV 3.5 X 185 sqmm Cable :- Supplying and erecting 1.1 kV XLPE Aluminium armoured cable of size 1 x 3 x 185 sqmm from 100 kVA Transformer to main LT Main as per detailed specification.	200	M
14	Item No. 8-g- 1.1 kV 1 x 3 x 2.5 sqmm Copper Control Cable:- Supplying and erecting 1.1 kV 1 x 3 x 2.5 sqmm Copper Control Cable from VCB/C.T. T/F to transformer control panel / protection Board as per detailed specification.	200	M
15	Item No. 8-f- 1.1 kV 1 x 4 x 2.5 sqmm Copper Control Cable:- Supplying and erecting 1.1 kV 1 x 4 x 2.5 sqmm Copper Control Cable from VCB/C.T. T/F to transformer control panel / protection Board as per detailed specification.	200	M
16	Item No. 8-g- 1.1 kV 1 x 10 x 2.5 sqmm Copper Control Cable:- Supplying and erecting 1.1 kV 1 x 10 x 2.5 sqmm Copper Control Cable from VCB/C.T. T/F to transformer control panel / protection Board as per detailed specification.	200	M
17	Item No-9-a-Cable duct 2 tier-750W X 750 D - Providing and laying RCC (M-150) cable duct of size given below for laying electric cable including form work for centering M.S. bar reinforcement,PCC (M100), compacting,curing, plastering, as per detailed specification..	150	M
18	Item No-9-b- 200X20 mm X3 mm size Cable Tray- Providing and fixing G.I. perforated cable GI trays of 200X20 mm X3 mm thickness for laying of cables trays of 200X 20 X3 mm size fixing on provided angles as per detailed specification.	150	M
19	Item No. 10. a - 1000 mm dia- PN-1.6 DIDF Butterfly Valve :- Providing erecting jointing and Commissioning of 1000 mm dia- PN-1.6 rating DIDF Butterfly Valve with by pass arrangement with provided electric valve Actuator for non rising spindle type as per detailed specification.	1	No
20	Item No. 10. b - 500 mm dia- PN-1.6 DIDF Butterfly Valve :- Providing erecting jointing and Commissioning of 500 mm dia- PN-1.6 rating DIDF Butterfly Valve with bypass arrangement with provided electric valve Actuator for non rising spindle type as per detailed specification.	6	Nos
21	Item No. 10. c - 500 mm dia PN-1.6 DIDF Glandless Sluice Valve:- Providing erecting jointing and Commissioning of 500 mm dia PN-1.6 rating DIDF Glandless Sluice Valve with provided electric valve Actuator for non rising spindle type as per detailed specification.	6	Nos

Sr. No.	Item description	Qty	Unit
22	Item No. 11. a - 1000 mm dia PN 1.6 DIDF Reflux Valve:- Providing erecting jointing and Commissioning of 1000 mm dia PN 1.6 rating DIDF Reflux Valve with By-Pass arrangement rating as per detailed specification.	1	No
23	Item No. 11. a - 500 mm dia PN 1.6 DIDF Reflux Valve:- Providing erecting jointing and Commissioning of 500 mm dia PN 1.6 rating DIDF Reflux Valve with By-Pass arrangement rating as per detailed specification. 500 mm dia-PN-1.6 Rating	6	Nos
24	Item No. 12. a - Valve actuator for 1000 mm dia Valve :- Providing and Erecting Valve Actuator for 1000 mm dia PN 1.6 rating Sluice valve totally enclosed IP-67 Protection for non-rising spindle type as per detailed specification.	1	No
25	Item No. 12. b - Valve actuator for 500 mm dia Valve :- Providing and Erecting Valve Actuator for 500 mm dia PN 1.6 rating Sluice valve totally enclosed IP-67 Protection for non-rising spindle type as per detailed specification.	6	Nos
26	Item No.13.a - 1000 mm dia PN-1.6 rating Dismantling Joint:- Providing Erecting and commissioning of 1000 mm dia PN-1.6 rating MS Dismantling Joint as per detailed specification.	1	No
27	Item No.13.b - 500 mm dia PN-1.6 rating Dismantling Joint:- Providing Erecting and commissioning of 500 mm dia PN-1.6 rating MS Dismantling Joint as per detailed specification.	6	Nos
28	Item No. 14 - 200 mm Dia PN 1.6 rating DIDF Kinetic air Valve:- Providing erecting jointing and commissioning 200 mm Dia PN 1.6 rating DIDF Kinetic air Valve as per detailed specification.	3	Nos
29	Item No. 15- 150 mm dia Pressure gauge :- Providing erecting jointing 150 mm dia Glycerine filled Pressure gauge of required capacity complete with all required fitting as per detailed specification..	7	Nos
30	Item No. 16. a- MS Pipes & Specials:- Providing, erecting MS DF Pipes & specials for delivery of pump as per detailed specifications.	15000	kg
31	Item No. 16. b - MS flanges:- Providing, fabricating, erecting, M.S. Flanges sleep on type (all tables) of required size and thickness with both side machined as per detailed specifications.	1000	kg
32	Item No. 16. c-Structural steel work :- Providing erecting, hoisting structural steel work for various purpose required for pumping machinery installation as per detailed specifications.	4	MT

Sr. No.	Item description	Qty	Unit
33	Item No. 17. a - 1000 mm dia Flanged Joints:- Providing making flanged joints to 1000 mm dia MSDF pipes & specials as per detailed specifications.	4	Nos
34	Item No. 17. b - 500 mm dia Flanged Joints :- Providing making flanged joints to 500 mm dia MSDF pipes & specials as per detailed specifications.	12	Nos
35	Item No. 18 RCC Foundation:- Providing & casting R.C.C.foundation in 1:2:4 ratio (M 200) as per standardspecification.	6	cum
36	Item No. 19 - a 33 kV Switch Yard :- Providing, erecting 33 KV switchyard as per detailed specifications.	1	No
37	Item No-19 - b 33 kV HT Metering Kiosk:- Supplying, erecting, testing, commissioning of 33 KV H.T.metering cubical (Compact Type) approved by MSEDCL / Licensee epoxy coated 3 nos C.T having required ratio between 5/5A to 50/5A, VA10,Class0.5S, 33000/V3/330/V3 VA 50, class 0.5 epoxy terminal block suitable for provided trivector meter as per detailed specification.	2	Nos
38	Item No. 20 - Earthing Plate Type- Providing erecting galvanised cast iron earth plate type earthing with plate of size 60 x 60 x.6 cm including cost of all material,chamber labour as per detailed specification.	10	Nos
39	Item No. 21.a - 3.3 kV 240 sq.mm Indoor Termination Kit:- Supplying and erecting 3.3 kV 240 sq.mm Indoor Termination Kit for 3.3 kV XLPE cable as per detailed specification.	14	Nos
40	Item No. 21.b - 3.3 kV 150 sq.mm Indoor Termination Kit:- Supplying and erecting 3.3 kV150 sq.mm Indoor Termination Kit for 3.3 kV XLPE cable as per detailed specification.	20	Nos
41	Item No. 21.c - 3.3 kV 120 sq.mm Indoor Termination Kit:- Supplying and erecting 3.3 kV120 sq.mm Indoor Termination Kit for 3.3 kV XLPE cable as per detailed specification.	32	Nos
42	Item No. 21.d - 33 kV 95 sq.mm Indoor Termination Kit:- Supplying and erecting 3.3 kV150 sq.mm Indoor Termination Kit for 3.3 kV XLPE cable as per detailed specification.	14	Nos
43	Item No. 21.e - 33 kV 95 sq.mm Outdoor Termination Kit:- Supplying and erecting 3.3 kV 95 sq.mm Outdoor Termination Kit for 3.3 kV XLPE cable as per detailed specification.	2	Nos

Sr. No.	Item description	Qty	Unit
44	Item No. 22 - 33 / 3.3 kV, 3.0 MVA Transformer :- Providing, erecting and commissioning 33 / 3.3 kV, 3.0 MVA out door type copper wound energy efficient transformer as per IS 1180 : 2014 transformer continuously rated for 3 Ph, 50 Hz, at full load and temp. Rise not exceeding 45°C by thermometer in oil and 50°C as per detailed specification.	2	Nos
45	Item no-23- 33 / 0.433 kV, 160 kVA Transformer :- Providing, erecting and commissioning 33 / 0.433 kV 160 kVA out door type copper wound transformer continuously rated for 3 Ph, 50 Hz, at full load and temp. Rise not exceeding 45° C by thermometer in oil as per detailed specification..	2	Nos
46	Item No. 24.a - 3.3 kV HT Capacitor Panel :- Providing, erecting, commissioning of 3.3 kV HT Capacitor panel for 725 HP Motors in suitable kVAR as per departmental requirement along with associate Equipments as per detailed specification.	2540	KVAR
47	Item No. 24.b - 3.3 kV HT Capacitor Panel :- Providing, erecting, commissioning of 3.3 kV HT Capacitor panel for 3000 kVA Transformers in suitable kVAR as per departmental requirement along with associate Equipments as per detailed specification.	600	KVAR
48	Item No. 24.c - 0.433 kV LT Capacitor Bank :- Providing, erecting, commissioning of 0.433 kV LT Capacitor panel for 160 kVA Transformers in suitable kVAR as per departmental requirement along with associate Equipments as per detailed specification.	20	KVAR
49	Item No. 25. a - 10 MT Capacity EOT Crane :- Providing, erecting and commissioning of 10 MT single girder Electrically Operated Rectangular / Circular Overhead Travelling Crane with 10 m lift complete as per detailed specification..	1	No
50	Item No. 25. b - 50 X 50 mm Square Bar / Rail:- Providing, fixing 50 x 50 mm size square bar of EN 8 as rail for above EOT overhead crane as per detailed specification.	40	M
51	Item No-25. c - D.S.L. (Down Shop Lead) system:- Providing, fixing D.S.L. (Down Shop Lead) system for above EOT over head crane as per detailed specification.	30	M
52	Item No. 26. a - 1000 mm dia Electro Magnetic Flowmeter:- Providing erecting testing and commissioning with test and trial of 1000 mm dia Electro Magnetic Flowmeter as per detailed specification..	1	No

Sr. No.	Item description	Qty	Unit
53	Item No. 26.b 2.1 x 2.1 x 1.8 m Chamber for Flowmeter - Providing and constructing 2.1 x 2.1 x 1.8 m Chamber for Flowmeter with BB masonry with 15cm thick 1.3.6 proportion PCC bedding as per detailed specification.	1	No
54	Item No. 27 Indoor & Outdoor electrification:- Providing & making indoor & outdoor electrification as per detailed specification.	1	job
55	Item No. 28 Tools:- Providing & supplying tools as per list as per detailed specification..	1	job
56	Item No. 29 - 3.3 kV Electronic Soft Start Starter- Designing providing, erecting, commissioning , testing 3.3 kV Soft Starter as per detailed specification	6	Nos
57	Item No. 30 Automation System:- Designing, providing, erecting, commissioning & giving satisfactory test & trial of Automation system for automatic operation of pumping machinery as per detailed specification.	1	Job
58	Item No. 31 Bladder Vessel:- Designing providing erecting commissioning and giving satisfactory test and trail of Bladder Vessel and allied equipments as per detailed specification.	1	Job
59	Item No.32 - Civil work- Civil work for transformer sub station, meter room, transformer foundation, fencing etc complete	1	Job
60	Item No. 32 Test and Trail:- Giving satisfactory test and trial of pumping machinery and allied equipment for Five years period as per detailed specification.	1	Job

DETAILED SPECIFICATIONS OF PUMPING MACHINERY

The scope in this work includes providing approved make pumps & allied Mechanical & Electrical equipments as per requirement of the Department. The essential design features and detailed specifications of each and every item are mentioned below. A list of approved make is also attached separately. The contractor has to provide the machinery as per the approved make or as approved by Superintending Engineer (M), Thane. The decision of Superintending Engineer (M) in this matter will be final & bounded on the Contractor.

The make of product, design, GA drawing, MOC, CSD, inspection schedule of items mentioned in BOQ shall have to be submitted for approval & got approved from Superintending Engineer (M), Thane before actual procurement.

This work includes Providing new pumping machinery such as VT Pumps, 3.3 kV HT VSS motors, 33 kV indoor sub substation, 33 / 3.3 kV & 33/0.433 kV power

Transformers, 3.3 kV HT Motor & Capacitor panel, FCMA starters, power cables, Earthing grid, indoor & outdoor electrification, test & trial etc. complete. The required permission from Electrical Inspector & MSEDCL authorities shall have to be taken by the Contractor before installation & charging of system.

Third Party Inspection

The Contractor shall carry out third party inspection at Manufacturers works as per Third Party inspection Schedule attached separately & Departments requirement in the presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc. & the same are included in the respective item cost.

Important Note :- The Contractors are requested to visit the site & get accequiented with the scope of work in the tender. The defect liability period & Operation & Maintenance period for all pumping machinery is of 5 years & it will be counted after the initial trial Run of all pumping machinery period of 1 months. During this defect liability period, the Contractor has to carry out repair works which are occured due to manufacturing defects & the expences for the same shall also have to be borne by Contractor. The Contractor shall quote his offer considering the total scope of work & 5 years defect liability period as mentioned above.

Item No.1 Vertical Turbine Pump(Water Lubricated)

Essential Design Requirements

The Vertical Turbine Pump offered shall satisfy the following basic design features.

- It shall have a rising head characteristic.
- The impeller adjustment shall be such that, the impellers run free in any installed condition in spite of the extension of line shaft caused by hydraulic down thrust and weight of shafting and impellers.
- It shall be designed for non-overloading of prime mover.
- It shall be designed to run with closed sluice valve condition without overloading prime mover.

The pumps shall run smooth without noise & vibration. The magnitude of peak to peak vibration at slip will be limited to 100 microns at the bearing housing. Necessary NPSH curve shall be submitted and minimum submergence required

shall be stated. The system head curve and performance curve for all level conditions is to be enclosed.

The pump shall be suitable for satisfactory operation at the duty conditions, the head range stipulated with solo and parallel operation.

The pumps shall have following technical parameters and particulars.

- 1) No. of pumps to be installed - 6 Nos (4 working + 2 stand by)
- 2) Discharge of each pump 365 LPS
- 3) Duty head 112 m.
- 4) Working head range 74 m to 124 m
- 5) Shut off head Not less than 130 m
- 6) Pump efficiency at duty point Not less than 80 %
- 7) Speed 1470 RPM
- 9) Column pipe dia not less than 450 mm
- 10) Column pipe wall thickness Minimum 8 mm
- 11) Column pipe flange Minimum 20 mm thickness
- 12) Pump/Line shaft material Stainless steel –SS 410
- 13) Total column length 20 m. (Excluding bowl assembly)
- 14) Strainer Basket type, fabricated out of stainless steel bars
- 15) No of Stages of Bowl assembly not more than 4 stages.
- 16) Column assembly & other Stainless steel AISI 316 fasteners
- 17) M.S. Sole plate Minimum 40 mm
- 18) Base frame Fabricated with ISHB & ISMC.
- 19) Pump & Line shaft SS 410 Not less than 75 mm or nearest commercial size
- 20) Thrust bearing and Non Reverse ratchet arrangement: In discharge head
- 21) Temperature scanning arrangement in thrust bearing chamber

Material Construction	:	
Suction / Bowl assembly / Discharge Head	:	Cast Iron
Impeller / Bowl Bearing	:	CF8M
Line shaft bearing	:	Brass Lined cutless rubber.
Line Shaft coupling & Discharge head bush	:	S.S. 410
Line Shaft	:	SS 410
Pump Shaft	:	S.S. 410
Shaft Sleeve	:	S.S. 410
Fasteners	:	S.S.
Strainer	:	Basket type S.S.
Sole Plate	:	M.S.

Column Pipe : M.S. ERW flanged in 1.5 m length
with lifting arrangement (M.S. plate
welded to the bottom of the flange)

V.T. PUMP SETS (Water Lubricated)

The Vertical Turbine pump sets shall be (self water lubricated) suitable for following conditions and specifications.

The pump shall be as approved by the Superintending Engineer (M) and shall conform to IS: 1710 & shall satisfy test & trial as per IS:5120 with latest modifications from time to time. Pump efficiency shall not be less than 80% at duty point under all circumstances & shall be maintained for 5 years from date of commissioning of the pumps.

Constructional and design details of the set shall be as follows.

a) Impeller

Impellers shall be Stainless Steel CF8M statically and dynamically balanced. Balancing holes in impeller are not acceptable.

b) Wearing Rings

It shall be of Bronze conforming to IS: 318 and suitable Grade and shall be of renewable type. It shall be held in place against rotation by screw in or locking with pins press fitted locked with pins. The wearing rings shall be provided on both impeller and casing.

c) Pump Shaft

Pump shaft be of stainless Steel AISI 410 and diameter shall not be less than 75 mm or nearest commercial size

d) Line Shaft

Line Shaft with coupling shall be in 1.5 m length with each pump sets. Each shaft be of AISI 410. The diameter of shaft shall not be less than 75 mm or nearest commercial size. The coupling shall be forged stainless steel. Composite design of line shaft material and diameter and bearing centres shall ensure that the entire rotating assembly is brought from stand still to full speed without any vibration, whipping and shaft deflection and to ensure that first critical speed is not within 75 % to 125 % of full speed.

e) Column Pipe Assembly

Column pipe shall be of M.S. ERW Fabricated heavy duty flanged type. Thickness of column pipe shall not be less than 8 mm. Each length of column pipe shall be designed to accommodate guide bearing holders and in Standard length of 1.5 m with MS plate welded to the bottom of Top flange for support & to have ease while dismantling of pump. Matching distance piece pipe required shall be suitable for making the total column pipe length **20 m**. Spider shall be provided with nitrite rubber bushing.

e) Suction Bell Mouth

Entrance dia of Bell mouth shall be such that the suction velocity shall not exceed 1.5 m/sec. and shall be of cast iron. The shape and curvature of the bell mouth shall be designed for streamlined flow of bowl suction, the thickness of bell mouth shall not be less than 12 mm.

e) Strainer

Suction strainer shall be of flanged type heavy duty made from S. S AISI 410 plate of thickness not less than 10 mm. Total area of perforations shall not be less than 300% of entrance area of bell mouth. Stainless steel hardware shall be provided.

f) Bowl Assembly

The pump bowl / bowls shall be flanged type with machined matching of faces. The suction bell mouth, bowl assembly, column pipe and all Joints shall be of flange joints. The bowls shall be capable of withstanding a hydrostatic pressure equal to twice the duty-head or 1.5 times shutoff head whichever is greater.

g) Discharge Head

Discharge head shall be fully flanged type fabricated from M.S. It shall incorporate full diameter radial branch (same as that of column pipe) stuffing box with renewable bushing and taping for pressure gauge. It shall be of robust construction and shall be designed to support VSS motor & entire loading of pump assembly, water column etc. and shall with stand all static, dynamic, torsional loads hydraulic thrust imposed during operation from shutoff to stipulated operating conditions and thrust due to change in direction of flow without any vibration. The discharge head shall be capable of withstanding hydrostatic pressure equal to twice the duty head or 1.50 times shut off head whichever is greater. It shall be properly supported to eliminate vibration. An

Heavy duty GM air cock of 50 mm dia with same size of 'B' class G.I. pipes, bend shall be fixed to the discharge head. The G.I. B Class pipes shall be suspended vertically in the well with adequate length to release air.

h) Sole Plates

M.S. Sole Plate of minimum 40 mm or above thickness machined from both the sides shall be provided. The size of sole plate shall cover entire pump supporting girders (base frame). Suitable opening shall be provided at the center, considering diameter of bell mouth bowl assembly and strainer. The Sole Plate shall be fixed with nut bolts on 250 mm or as approved size ISHB & ISMC frame and shall be machined. The sole plate shall be kept on girders and blue matched to the extent of least 60 % of contact area. If necessary uneven surface shall be smoothed with polish paper / smooth file. The sole plate shall be perfectly leveled with straight edge and precision level. The sole plate shall have tapped holes to receive discharge head. The bottom and top of sole plate shall be blue matched to have at-least 60% contact area. Use of shims will not be permitted for pump leveling.

i) The pump shall be driven by vertical Solid shaft motor and shall be provided with non-reversible ratchet, check nut, flexible coupling etc. complete.

j) Special tools i.e. two pairs of erection clamps for the column and line shaft as recommended by manufacturer, adjusting nut spanner & impeller collate hammer shall be supplied with each pump set.

k) Pre Lubrication Tank & Other Accessories: - In order to lubricate line shaft bearing of the pump, lubrication arrangement comprising the following shall be provided.

l) Lubrication tanks 2 Nos. interconnected with each other common for all pumps fabricated from M.S. sheet metal of thickness not less than 5 mm and of capacity not less than 1 cum. The tank shall be cylindrical and shall be installed on pump mounting floor with concrete saddles or as directed during execution by Engineer-in-charge.

ii) Each lubrication tank shall be equipped with the following :

- a) W. L. side gauge
- b) Over-flow lead to sump
- c) Drain valve lead to sump

- d) "B" Class G.I. pipe connection with isolating valve and non-return valve to each pump column assembly for lubrication. The valve shall be located near the tank. The size of individual pipe and valve to pump shall be 40 mm diameter.
- e) Inlet connection with solenoid operated valve and suitable removable strainer by suitable tapping from common header.
- f) Float valve in the tank for control of overflow.
- g) Any other item necessarily required for proper functioning of water lubrication arrangement.

TESTING

Three random pumps as selected shall be subject to factory test in presence of Superintending Engineer (M) or his representatives or SMC Engineers and third party inspection agency approved by MJP and Contractor shall bear all expenses of testing.

FACTORY TEST

a) Hydrostatic Test

Following item 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 - Each.

Discharge Head. - Each.

Column Pipes At least 20% of total quantity

b) Performance Test

Performance test shall generally be carried out as per IS: 10981 of acceptance test for pumps Class - B at full speed & full load. It shall cover six points i.e.

- i) Duty point.
- ii) Two points above duty point.
- iii) Two points below duty point.
- iv) Shutoff head
- v) Power consumption at all above points.

The test at reduced speed will not be accepted.

c) Strip Inspection

Two pump sets out of six after completion of performance test and as selected by the Engineer or inspector at random shall be offered for strip-inspection and dimensional checking. The manufacturer / contractor shall submit all required dimensional drawings. Minimum points as under shall be checked. Original dimensions of impeller, neck ring etc.

- Condition of all components particularly bushes, bearing, and wearing rings to examine for undue rubbing, wear etc. and verification of dimensions after performance test.
- Dynamic balancing of (a) Impeller, (b) Flexible coupling, shall be carried out as per relevant IS.

Verification of clearance and tolerance between :

- a) Wearing rings
- b) Impeller shaft and bearings
- c) Impeller shaft and key
- d) Shaft and flexible coupling
- e) Key and keyway on shaft at (d)
- 5) Finish of water passage in impeller and diffuser.
- 6) Review of raw Material Test Certificate and quality control procedure.

Any deviation from tenders specifications & related IS shall be pointed out in inspection report.

Material test certificate to the various pump components shall be furnished.

FIELD PERFORMANCE TEST

Field test shall be witnessed by at least Two Engineers of MJP / SMC.

The test shall be carried out as per IS: 10981 Code of acceptance test of pump Class-B, in general and stated below in particular. The purpose of field test is not to ensure whether pump performance as regards 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) Verification of guarantee for H and Q specified in Clause 9.4.1 shall be based on following liberalized tolerances.

$XH_v + 0.006$

$XQ_v + 0.09$

- ii) As regards P-Q. Characteristics for acceptance. It shall be checked whether motor is not getting overloaded within specified head range.

- a) Volumetric

Volumetric measurement shall be taken on the basis of rise of level in clarifloculator. In addition, one Ultrasonic calibrated flow meter shall be arranged by the contractor at his cost

- b) The head shall be measured with calibrated pressure gauge of accuracy 1% or better. At least three pressure gauges shall be used dully calibrated from two different institutions with prior approval of the Engineer. The calibration shall be point to point

and not mere for percentage error. The gauge shall be fitted at suitable place on the discharge nozzle. It may be noted that the stipulation that pressure gauge shall be installed at least two times diameter away from discharge nozzle and delivery valve be placed at least four times diameter away from discharge nozzle cannot be simulated at site conditioned no allowance for this deficiency shall be considered. The decision of Engineer in-Charge shall be final.

c) The input power to motor shall be measured with 2 Nos. class 0.5 accuracy single phase watt meters with suitable CTs test lid and PTs provided in panel. The wattmeter, CTs and PTs shall be got calibrated from approved institutions. The calibration shall be for point to point and not mere for percentage error.

d) The speed shall be measured by at least two numbers, non contact tachometer with digital display and calibrated from two institutions, approved by the Engineer.

e) 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, 2 below and shut off). The guarantees for head and discharge shall be deemed to be fulfilled as per clause under 9.4.1 of IS : 10981.

f) The field performance test at site is absolutely essential as above (a) to(e).

Make: As per approved list of MJP.

Item No-2- 3.3kV VSS Motors

The motors shall be 4 pole Vertical Flange Mounted TEFC, energy efficient IE3type with IP 55 protection & conforming to IS 325 having continuous rating for operation at 3300 Volts +/-10%, 3 Phase, 50 Hz +/-3% & combined variation of +10%. The motors shall be Solid shaft suitable for operation of Raw water pumps mentioned above & shall be provided with "F" class insulation & temperature rise limited to class "B" insulation. Motor shall be fitted with suitable space heater – 2 Nos and 6 nos. of RTD as per detailed specification. The contractor shall have to provide winding data of motors at the time of third party inspection.

The torque-speed and current-speed characteristics of the motors shall be suitable to accelerate the driven equipment to full speed without exceeding the limit of starting current at six times full load current. The motor shall be marked with appropriate efficiency class on the name plate immediately after efficiency value.

The motors may also be marked with the standard mark for BIS certification.

The losses & efficiency of motors shall be according to IS 15999 (Part 2 / Sec 1).

DESIGN

The rated power of the motor shall be at least 10 % above the maximum power required over rated head range of pump. However, output rating shall not less than as per table given above.

The starting time and locked rotor withstand time under hot condition shall have suitably discrimination for proper selection of protection relay. The locked rotor withstand time under hot conditions and at 110 % rated voltage shall be more by at least three second than the starting time with driven equipment coupled and 85 % rated voltage.

The motor shall be suitable for restricted operation at following conditions.

Accelerating the driven equipment from stand still to full speed within duration of one minute or less at 85 % of rated voltage.

Operation on load at 75 % of rated voltage for 5 minutes.

Two starts in quick succession from cold condition.

One hot restart at maximum steady state temperature over ambient temperature of 48⁰ C Three starts per hour equally spaced over the duration after attaining thermal equilibrium. The Class of insulation of the motor shall be minimum 'F' class. However temperature rise of the motor when operating at extreme conditions of voltage and frequency variation shall not exceed 80⁰ C by thermometer and 90⁰ C by resistance over an ambient temperature of 45⁰ C at site.

CONSTRUCTION

The motor shall be flange mounted, vertical solid shaft, statically and dynamically balanced and critical speed shall not be in the range of 80 % to 120 % of the motor speed. The degree of enclosure protection shall be conforming to IP 55 or superior as specified in IS / IEC 60034-5. It shall have grease lubricated heavy duty anti-friction bearing.

The cable end box shall be phase segregated and with degree of protection conforming to IP55. The terminal box shall be suitable for termination of power cables as per size in cable schedule. The fault withstand capacity of the cable box shall not less than the fault level specified in Section-1. Required detachable gland plate shall be provided as per cable size.

The rotor bars shall be of copper. The bars shall not be insulated in the slot portion between the iron core laminations and the bars.

The motors shall be provided with class 'F' or better insulation. The winding shall be given vacuum impregnation treatment.

- i) The winding joints, end connections and terminals shall be braced to withstand short circuit current of 26.2 kA RMS (with 67 kA peak) for one second.
- ii) The motors bearings shall be so constructed that the loss of lubricating fluid is kept to minimum and the greasing shall be possible without any dismantling operation. The bearings shall prevent dirt and water from getting into the motor. Bearing lubricant shall not find access to motor windings. The bearings shall permit running of the motor in either direction of rotation. Lubricants shall be selected for prolonged storage and normal use of the motors in tropical climate and shall contain corrosion and oxidation inhibitors. The bearings shall be designed for L-10 rating of 40,000 hour.
- iii) Phase segregated terminal boxes shall be of weatherproof construction designed for outdoor service to eliminate entry of dust and water. Gaskets of neoprene or approved equivalent material shall be provided at cover joints and between boxes and motor frame. The terminal box shall be suitable for installation of soft starter & bottom entry of cables. The terminals and other general arrangement shall be as per the relevant IS standard. This shall be substantially designed for the current carrying capacity and shall ensure ample phase to phase and phase to ground clearance. Cable glands shall be nickel plated brass of suitable size. The connectors between motor leads & cable shall be tinned brass. The orientation of phase segregating terminal box shall be on the left side looking from the front side of the motor. Total two number phase segregating terminal boxes are to be provided to each motor.
- vi) Since the motor is to be used for VT pumps, utmost care shall be taken to keep vibrations and misalignments within satisfactory limits and conforming to BS 4675 Part – I, Class – III, Sub Class – B and should in no case exceed 2.8mm / sec. the TIR at shaft end shall be within 0.02 mm per meter. The surface finish of the motor shall be within 0.8 – micron root mean square. The rotor shall be dynamically balanced to VDI standard 2060 to Q-2.5 quality grade.
- vii) Motor external parts shall be finished and painted to produce a neat and durable surface, which will prevent rusting and corrosion. The equipment shall be thoroughly degreased, all rust, sharp edges and scales removed and treated with one coat of primer and finished with two coats of enamel paint.
- viii) The motors shall be provided with two earthing pads. These pads shall be of non corroding metal welded or brazed at two locations on opposite sides. The size of the pads shall be 75 x 10 mm with two holes drilled at 40 mm. Centers, tapped and provided with suitable bolts and washers. All the mechanical operations like bending, straightening, cutting etc. shall be carried out as per the site requirement.
- ix) Three Motor Stands shall be provided for keeping the Motor when removed for repair work etc.

ACCESSORIES

Following Accessories as under shall be provided with motor.

Shaft mounted cooling fan of cast iron/aluminum or mild steel and dynamic balanced.

Space heater, operating on 1 phase 240 V 50 Hz. Supply incorporating necessary interlocking to ensure that space heater OFF when motor is running and 'ON' when motor is idle with separate terminal box conforming to IP 54 protection on motor frames.

Resistance temperature detector for detecting temperature of winding with suitable scanner arrangement with terminal brought to separate terminal box. It shall be used for high temperature alarm and higher temperature trip and indication on scanner in VCP. The trip limit shall be set to 110 Degree.

Bearing temperature detector for bearing & wired to scanner in vacuum contactor panel.

Motor should be star connected with 3 line & 3 neutral terminals separately brought out to respective terminal boxes.

Motor should have separate phase segregated neutral terminal box suitable for connecting fully rated power cable to SOFT START STARTER.

An emergency stop push button station shall be provided and erected near motor with suitable IS MC stand post and box duly wired to main panel.

Third Party Inspection for 3.3 kV HT Motors

Three random motors as selected shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

The tested motors shall be used for performance test of pumps at manufacture's works.

The scope of testing is as under:

- i) Review of raw material test certificate and quality control procedure.
- ii) Routine test for all.
- iii) Type test for one number random motor including vibration and noise level.
- iv) The vibration level should be within permissible limit (IS:12075) and noise level shall be 80 db or less which the Certificate shall be submitted.

Item No-3- 3.3 kV Indoor HT Cubical Panel

The panel shall be got manufactured from HT Switchgear Panel Manufacturer only & shall have following components.

Sr. No.	Description	Qty	Units
1	3.3 kV, 1250 A draw out type Vacuum Circuit breaker for Incomer - 2 Nos Bus coupler -1 No	3.00	No.
2	3.3 kV,630 A draw out type Vacuum Circuit breaker 6 Nos for Motors + 2 Nos as spare	8.00	No.
3	3.3 KV 'Resincast PT 1 Ph. For incomer -2 x 3 = 6 no.	6.00	No.
4	3.3 kV Resincast CT 1 Ph. For Incomer -2 x 3 = 6 no. For Motor 8 x 3 -24 nos	30.00	No.
5	Motor Protection Relay For Motors and for spare VCB	8.00	No.
6	IDMT Relay numerical incomer – 2nos	2.00	No.
7	High speed trip relay For incomer - 2 nos&For Motors and spare - 8 Nos	10.00	No.
8	Anolog voltmeter 150 sq. mm with selector switch For incomer -2 nos	2.00	No.
9	Trip supervision relay incomer –2 , motor and spares- 8	10.00	No
10	Under Voltage relay incomer –2	2.00	No
11	Anolog Ammeter 150 sq. mm with selector switch For incomer -2 nosFor Motors & spare – 8 nos.	10.00	No.
13	LT/CT multifunction DLMS compliance energy meter of accuracy of class 0.5 ,3x240V,50 Hzwith optical & RS 232 port, backlit LCD,measures & Displays Trivector Energy, load survey, TOD,tamper detection & logging, power ON /OFF events,instaneous parameters of Rating -/5 Awith display in absence of power complete with zero adjustment &test certificate from manufacturer erected on provided M.S. box and connected to CTs, for incomer - 2 no,motor and spare - 8 no..	10.00	No.
14	Breaker control switch For incomer -2 nos For Bus coupler -1 no For Motors and spare - 8 Nos.	11.00	No.
15	TEST/RESET push buttons For incomer -2 x 2 = 4 nos For Bus coupler -1 x 2 = 2 nosFor Motors and spare -8 x 2 = 16 nos.	22.00	No.
15	Aluminium bus bar of suitable capacity	1.00	Job
16	Busbar insulators	1.00	LS
17	Complete wiring to panel with wiring for PLC command	1.00	LS
18	LED Lamps RY & othersFor incomer -2 x 4 = 8 nosFor Bus coupler - 1 x 4 = 4 nosFor Motors and spare - 8 x 4 = 32 nos.	44.00	No.

Sr. No.	Description	Qty	Units
19	LED Lamps B	2.00	No.
20	PVC Synthetic elastomer electrically insulating mat with class A insulation conforming to IS: 15652 – 2006 & CPRI tested having 2 mm thickness upto 3.3 15652 – 2006 & CPRI tested having 2 mm thickness upto 3.3 KV	20.00	Sqm
21	<u>12 V Battery 12 V / 100 AH tubular battery Total 120 Volts DC supply for HT Panel with 1 Hour back up</u>	10.00	Nos
22	Caution Board	11.00	No.
23	Panel fabrication 14 SWG with required vertical section	1.00	Job
24	Space heaters	11.00	No.
25	MS Channel Stand of 100x50 mm for complete panel	1.00	Job
26	3.3 KV surge Arrestor	2.00	No
27	Trolley for maintenance of VCB	4.00	Nos

The 3.3. kV Switch gears and control gear Panel shall be designed for :

- 1) Reception of power from **3000 kVA** power transformers.
- 2) Distribution of power to Motors.
- 3) Protection of the panel and meters from short circuit, earth fault, over current, under voltage, stalling and single phasing.
- 4) Indicators of voltage, current and operating conditions of breakers, relay motor.
- 5) Annunciation.
- 6) Auto Trip.
- 7) Interlocking.

The vacuum circuit breaker housed in metal clad dust moisture and vermin proof enclose surface, surge suppressor shall be provided. It shall be complete with control detection and annunciation instruments equipment's. The single line diagram arrangement of panel shall be submitted. The breaker shall be suitable for indoor application provided with automatic closing shutter. The breaker shall be of three pole operated through a common shaft.

All breakers shall have constructional features as under :

- 1) The contacts of suitable **proven material** and shape to break 25 kA current.
- 2) Air insulated copper bus bar designed for 100 MVA fault level and rated to carry Continue current.
- 3) 230 VAC supply for gang operated spring mechanism with state position, light switches and all other accessories suitable for any number of closing and opening

operating so long as power is available to the motor and at least on closing and opening operation in case of power failure.

- 4) Crane for manual charging of spring.
- 5) Required No. + NC contacts with minimum 2 No + 2 NC spare contacts.
- 6) Closing coil rated for 110 V DC and suitable for operation at 85% to 110% Voltage.
- 7) Trip coil rated for 110 V DC and suitable for operation on 70% to 110% voltage.
- 8) Operating mechanism housed in weatherproof enclosure at accessible height.
- 9) Mechanical on / off release, Operating counter, Secondary self aligned plug in contacts, Anti pumping features.

Rating : Minimum rating of Main & Motor VCB Panel shall be as under :

- 1) Rated voltage – 3.3 KV
- 2) Rated current – 1250, 630 Amp**
- 3) Symmetrical breaking current RMS 25 kA
- 4) Fault level – 150 MVA
- 5) Short time rating 25 kA for one second.
- 6) Peak making capacity – 36.73 kA
- 7) One minute power frequency with stand voltage – 10 kV

The incoming breaker shall incorporate following accessories Qty as mentioned in above table.

- 1) Epoxy resin cast CTs of suitable ratio / 5 / 5A with VA burden not exceeding 50 VACore I-class 0.5 for metering and Core-II class – 5 P 10 for protection.
- 1) Epoxy resin cast PT 3300 V / 110 V – 110 V / 100 VA burden two core with fare and test block one core shall be protection class and second are shall be class-0.5.
- 2) SCADA Computable type Numerical Non-directional TP IDMT relay having 2 over current element with 50% to 200% range and earth fault element with 70% - 80% range suitable for operation in 110 V.D.C. with range of 70% - 110% of rated voltage. A high set instantaneous element adjustable between 200% - 800% shall be incorporated.
- 4) Analog ammeter 0 to 500 Amp. with selector switch.
- 5) 0 to 4 KV analog voltmeter with selector switch.

- 6) LED indicating lamps for On and off, trip and trip circuit healthy circuit etc.
- 7) Cable termination from power cable and stands for center cable.
- 8) Single element high speed trip relay.
- 9) Trip circuit supervision relay.
- 10) TNC switch.
- 11) Digital multifunction Meter.
- 12) Panel space heaters with thermostat.
- 13) Push Buttons.

The Bus coupler shall incorporate following accessories with quantity as mentioned in above table.

- 1) LED indicating lamps for On and off, trip and trip circuit healthy circuit etc.
- 2) TNC switch.
- 3) Hooter.
- 4) Panel space heaters with thermostat.

Vacuum Circuit breaker Panel for Motor & Spare Panel shall consist following items with quantity as mentioned in above table.

1. Epoxy resin cast CTs of suitable ratio / 5 / 5A with VA burden not exceeding 50 VA Core I-class 0.5 for metering and Core-II class – 5 P 10 for protection.
- 2) Epoxy resin cast PT 3300 V / 110 V – 110 V / 100 VA burden two core with fare and test block one core shall be protection class and second are shall be class-0.5.
- 3) Static motor protection relay similar to Alstom make thermal instantaneous three phase over current, unbalance and single phasing, earth fault and separate built-in stalling protection.
- 4) 3.3 kV fuse protect draw out type VCB with 230 V A.C. motor spring charged closing mechanism with 30/110 V shunt trip closing coil, plug socket mech. operation counter.
- 5) Analog ammeter 0 to 500 Amp. with selector switch.
- 6) 0 to 4 KV analog voltmeter with selector switch.
- 7) LED indicating lamps for On and off, trip and trip circuit healthy circuit etc.
- 8) Cable termination from power cable and stands for center cable.
- 9) Single element high speed trip relay.
- 10) Trip circuit supervision relay.

- 11) TNC switch.
- 12) Digital multifunction Meter.
- 13) Panel space heaters with thermostat.
- 14) Push Buttons.
- 15) Power Cable termination and stands for center cable.
- 16) Surge suppressor to protect motor from over voltage.
- 17) Multifunctional Meter Class – 0.5
- 18) Operation counter for VCB and hour meter for motor.
- 19) Annunciator with hooter
- 20) Panel space heaters with thermostat.
- 21) No volt release arrangement for Motors.
- 22) Busbar chamber for incomer 1 & 2 for connection 3.3 kV LBS of capacitor Panel of Transformer.

A separate Battery charger Panel unit with 12 V maintenance free batteries -10 nos & 1 hour backup shall be provided for obtaining 110 VDC supply for control circuit for operation & protection of All VCB & VCP, Relay metering panel etc. & cost of this is included in the item.

Third Party Inspection for 3.3 kV HT Panel

The HT Panel shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Following tests to be performed

- Review of raw material test certificate and quality control procedure.
- HV test.
- IR test.
- Routine test.
- Checking phase and earth clearance of bus bars.
- Checking wiring diagram and contact circuit and operation of panels.

Item No-4- LT Panel

The Panel comprising of 415 V switch gears and control gear shall be design for.

- 1) Reception power from 160 kVA Distribution transformer.

2) Distribution power of sump compressor, compressor, motors for surge arrestor other auxiliary equipment and auxiliary installation.

The section specifies 415 V, LT Panel, 3 phase, 50 Hz switch board panel related equipment, control, metering, protection and indication. The general requirements of the system are described in the following clauses.

A dimensional drawing of the panel; showing position of switch gears, Ammeter, Voltmeter etc. shall be submitted before manufacturing, for approval.

CONSTRUCTION

The control panel shall comprise of fully compartmentalized modular type cubicles suitable for floor mounting. The panel board shall be divided into distinct vertical sections each comprising of:

- a) A completely metal enclosed bus bar compartment running horizontally.
- b) Individual feeder modules arranged in multi-tier formation.
- c) Enclosed vertical bus bars serving all motors in the vertical sections.

The switch board shall be completely factory wired, ready for connecting to the equipment. It shall be fabricated out of 14 SWG CRCA sheets in the front and top and 16 SWG CRCA sheets at the bottom and rear and 50 x 50 mm angles. The front and the rear sides shall be provided with hinged doors. Mechanical interlock shall be provided so that the front doors cannot be opened on 'ON' positions. Cable entry and exit to and from the panel board shall be from the bottom. The fabricated cubical shall form a totally enclosed, metal clad, dust and vermin proof enclosure. The indicating and operating switches shall not be mounted above 1.6 m from floor level.

• PANEL INTERNAL CABLING

Power cabling shall be of suitable size not less than 2.5 mm, 2 PVC insulated, multistoried copper conductors of 1100 V grade. All cable connections shall be made using proper crimping sockets. Suitable size flanged type glands shall be provided for outgoing cables.

Control cabling shall be done with PVC insulated multistrand copper conductors of size not less than 1.5 Sqmm of 600 V grade. The control wiring shall be concealed by taking through neatly arranged PVC cable trays and all cables shall be terminated in suitable compression type terminal blacks. The cable terminations shall be made in accordance with wiring diagrams, using identifying codes as

approved by the Engineer. All cable shall be arranged and marked in general compliance with IS:375.

- **EARTHING**

G.I. earthing flat, running the length of control panels shall be provided. Metal frame of control switchboard shall have two separate and distinct earth connections of adequate size.

- **PAINTING**

The panel shall undergo chemical de-rusting and shall be effectively phosphatised as per IS:6005 and primed. The panels shall be thoroughly rinsed with clean water after phosphatising, followed by final rinsing with dilute bicromate solutions and oven drying. The phosphate coating shall be sealed by the application of two coats of ready mixes, stoving type zinc chromate primer.

Two coats of finishing synthetic enamel paint shall be applied, each coat followed by stoving. The final finished thickness of paint film on steels shall not be less than 100 microns and shall not be more than 150 microns. The color for the finishing paints shall be approved by the Engineer. The finished painted appearance of panels shall present an aesthetically pleasing appearance free dust and un-even surface.

Engraved PVC labels shall be provided on all incoming and out going compartments. The exact legend to be provided shall be as approved by the Engineer.

The switch gear shall be as specified below

Particular	Qty	Unit
400 Amp MCCB TPN with overload protection	2	Nos
400 Amp Change over switch	1	No
Outgoing 63 Amp MCCB FP C Series	5	No
32 Amp MCB FP for lighting C series	12	No
32 Amp MCB DP for lighting C series	5	No
Volt meter Analog with selector switch	1	No
Ammeter Analog 0 – 400 Amp	1	No
CTs	3	No
PVC Synthetic elastomer electrically insulating mat 3.3 kV grade	2	Sqm
Danger board-	2	No
Panel wiring for PLC command	1	No

Particular	Qty	Unit
Bus bar alluminium	1	Job
LED RY & others Lamp ON,OFF,TRIPetc	25	No
LED B	1	No
Reverse forward starters for Valve Actuators in addition to the integral starters provided in Actuator	7	Nos

- **MISCELLANEOUS**

Engraved PVC labels shall be provided on all incoming and out going compartments. The exact legend to be provided shall be as approved by the Engineer.

MOULDED CASE CIRCUIT BREAKER

The final steady state operation temperature of the contacts when carrying rated current under continuous operation shall not exceed the limit specified in relevant IS. The contacts shall be of silver alloy of high arc resistance and long electrical life quality. The operating mechanism shall be quick make quick break and trip free. The housing shall be made of heat resistant insulating material. Mechanical ON-OFF indication shall be provided. The MCCB shall incorporate shunt release device. The overload protection shall have the setting range to meet the load requirement. All release should operate on common trip bar. The auxiliary contact block should be provided to facilitate visual ON-OFF indication. The MCCB shall be supplied with all standard accessories for functional requirement as per duty conditions, as per relevant standard.

The current density for auxiliary bus to connect out going switches or other switches shall be minimum 1 Amp per square mm or nearest commercial size

BUS BAR

Bus bar shall be of electrolytic Aluminum to suit 400 Amp current rating and of withstanding the electro mechanical force due to short circuit. The neutral bus bars shall not be smaller than half cross section of main bus bars. The bus bars shall be housed in separate bus bar chamber and supported on unbreakable, non-hygroscopic supports, rigidly held to the framework. The bus bar shall have separate special screwed cover with ventilating louvers. The continuous rating of the bus bars shall not be less than 400 Amp. The temperature rise of the bus bars shall not exceed 55⁰C over an ambient temperature of 40⁰C. The bus bars shall be PVC insulated with colour code for phase identifications. The bus bars shall be easily accessible for inspection. The power distribution bus bars or cables shall be bolted clamp type. The parallel bus bar shall not be used for main bus bars or distribution whichever is on higher side for Aluminum bus and 2 Amp/Sq.mm for copper bus.

MCB

The Miniature Circuit Breakers shall be provided for isolation purpose and have the rating to suit the load continuous on it. The ON-OFF position shall be clearly marked on the panel. The mechanical interlocking shall be provided so that the door opens only on off position of switch

H.R.C. FUSES

H.R.C. cartridge fuses shall be of link type for power and control, non deteriorating has adequate fault capacity, indication to show health and tripped conditions. Fuses shall conform to IS:2208.

INDICATING LAMPS

The indicating lamps of 22 mm dia shall be of filament bulbs type of 230 volts rating with series resistance for different voltages. The oil and dust proof, unbreakable suitably colored poly-carbonate lenses shall be used to improve appearance and illumination.

SELECTOR SWITCH

The selector switch shall be with three positions, unit designed for heavy duty application and handle of robust design. The required position shall be engraved on the front plate.

AMMETER, VOLTMETER

The meters shall meet following general requirements.

- i) Accuracy _ Class 1 as per IS;1248
- ii) Case _ Steel
- iii) Cover _ Metal
- iv) Window_Plastic
- v) Scale _ Flat
- vi) Voltmeter – 0-500 V _ 1 No. with S/S
- vii) Ammeter - 0-100-300 _ 2 Nos. with suppressed scale with S/S and suitable CTs.

FORWARD REVERSE DOL STARTER:

Forward reverse type DOL Starter shall be provided for operation of valve actuators .The starter shall be associated with interlocking arrangement of pump starters including control wiring required for satisfactory operation of valves. These starters shall be provided in addition to the integral starters normally provided with actuators.

.RUBBER MATTING

PVC Synthetic elastomer electrically insulating mat with class A insulation conforming to IS: 15652 – 2006 & CPRI tested having 2 mm thickness upto 3.3 15652 – 2006 & CPRI tested having 2 mm thickness upto 3.3 KV

Third Party Inspection for 3.3 kV HT Motors

The motors shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative, SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Following Tests to be performed

- Review of raw material test certificate and quality control procedure.
- HV test
- IR test
- Routine test
- Checking phase and earth clearance of bus bars.
- Checking wiring diagram and contact circuit and operation of panels.

Item No-5- TEMPERETURE SCANER PANEL

Description	Qty	Units
10 Point Temperature Scanner	6.00	No.
Complete wiring to Scanner Panel with wiring for PLC command	1.00	Job
14 SWG MS Fabrication powder coated	1.00	Job
Iron work ISMC 75x 40 mm	1.00	Job
PVC Synthetic elastomer electrically insulating mat with specs as mentioned above	1.00	Sqm
Caution board	1.00	No.
Space Heaters	2.00	No.

Third Party Inspection for Temperature Scanner Panel

The motors shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Following Tests to be performed for Temperature Scanner Panel

- Review of raw material test certificate and quality control procedure.
- HV test
- IR test
- Routine test
- Checking phase and earth clearance of bus bars.
- Checking wiring diagram and contact circuit and operation of panels.

Item No. 6- 3.3 kV APFC Panel

The 3.3 kV APFC panel for capacitors shall have draw out type vacuum circuit breaker and vacuum contactors. **It shall be got manufactured from HT Switchgear Panel Manufacturer only.** The VCB & VC panel shall be housed in metal clad dust moisture and vermin proof enclosure surface, surge suppressor shall be provided. The vacuum contactor panel shall be complete with control detection and annunciation instruments equipment's. The single line diagram arrangement of 3.3 kV VCB & VC panel shall be generally as shown in accompanying. APFC panel shall have following equipment's:

Sr. No.	Description	Qty	Units
1	3.3 kV, 1250 A draw out type Vacuum Circuit breaker for main	1.00	No.
2	3.3 kV, 630 A draw out type Vacuum Contactor Panel outgoing for capacitor	4.00	Nos.
3	3.3 kV Resin cast CT 1 Ph. For main - 3 Nos for outgoing - 12.00	16.00	Nos.
4	3.3 kV Resin cast PT 1 Ph. For main	3.00	No
5	IDMT numerical Relay For main - 1 Nos for outgoing - 4.00	5.00	Nos.
6	High speed trip relay For main - 1 Nos for outgoing - 4.00	5.00	Nos.
7	Trip supervision relay For main - 1 Nos for outgoing - 4.00	5.00	Nos
8	Analog Voltmeter 150 sq. mm with selector switch	1.00	No
9	Analog Ammeter 150 sq. mm with selector switch	5.00	Nos.
10	LT/CT multifunction DLMS compliance energy meter of accuracy of class 0.5, 3x240V, 50 Hz with optical & RS 232 port, backlit LCD, measures & Displays Trivector Energy, load survey, TOD, tamper detection & logging, power ON /OFF events, instantaneous parameters of Rating -/5 A with display in absence of power complete with zero adjustment & test certificate from manufacturer erected on provided CRCA sheet box and connected to CTs, for main - 1 no, outgoing - 4 no..	5.00	Nos.
11	Breaker control switch For main - 1 nos, outgoing - 4 Nos.	5.00	Nos.
12	TEST/RESET push buttons For main - 1 x 2 = 2 nos, For outgoing - 4 x 2 = 8 nos.	1000	Nos.
13	Aluminium bus bar of suitable capacity	1.00	Job
14	Busbar insulators	1.00	LS
15	LED Lamps RY & others	1.00	Job.

Sr. No.	Description	Qty	Units
16	LED Lamps B	1.00	No.
17	APFC Relay	1.00	No.
18	Complete wiring to panel with wiring for PLC command	1.00	LS
19	PVC Synthetic elastomer electrically insulating mat specs as above 3.3 kv grade	5.00	Sqm
20	Caution Board	5.00	Nos.
21	Panel fabrication 14 SWG with required vertical section	1.00	Job
22	Space heaters	5.00	Nos.
23	MS Channel Stand of 100x50 mm for complete panel	1.00	Job
24	Trolley for maintenance of VCB & VCP Each 1.00 No.	2.00	No

- 1) Epoxy resin cast CTs of suitable ratio / 5 / 5A with VA burden not exceeding 50 VACore I-class 0.5 for metering and Core-II class – 5 P 10 for protection.
- 2) Epoxy resin cast PT 3300 V / 110 V – 110 V / 100 VA burden two core with fare and test block one core shall be protection class and second are shall be class-0.5.
- 3) SCADA Computable type Numerical Non-directional TP IDMT relay having 2 over current element with 50% to 200% range and earth fault element with 70% - 80% range suitable for operation in 110 V.D.C. with range of 70% - 110% of rated voltage. A high set instantaneous element adjustable between 200% - 800% shall be incorporated.
- 4) APFC Relay- Static power factor controller relay with minimum 8 capacitor stages with micro-processor based capacitor switching with display of power factor
- 5) Analog ammeter suitable capacity with selector switch.
- 6) 0 to 4 KV analog voltmeter with selector switch.
- 7) LED indicating lamps for On and off, trip and trip circuit healthy circuit etc.
- 8) Cable termination from power cable and stands for center cable.
- 9) Single element high speed trip relay.
- 10) Trip circuit supervision relay.
- 11) TNC switch.
- 12) Digital multifunction Meter.
- 13) Panel space heaters with thermostat.
- 14) Push Buttons.

Constructional features :

Vacuum Contactor Panel shall be built in single tier construction with provision of HRC fuse of suitable capacity. Vertical section of the panel shall contain CT, PT, Bus bar etc. Isolator shall on load type. Mechanical interlock shall be provided. The operation coil of vacuum circuit breaker shall be rated for 110 V DC, suppressor shall be provided.

Construction details for APFC Panel

The panel shall be fabricated from CRCA Sheet 2.5 mm in the front and bottom and 2.00 mm in the rear and other sides. Hinged doors shall be provided at the front and rear with car type handles. **Mechanical interlock** shall be provided to prevent opening of front door in ON position to trip the supply in the event of opening of the door. Suitable stopper shall be provided to restrict opening of the door and scratching of paint with adjusting panel structure. Cable entries and exists shall be from bottom. The indicating and operating devices shall be preferably at uniform levels and shall not be above 1600 mm front floor level.

The Panel frame work shall have minimum ISMC-100 base channel.

Bus Bar :

Bus bar shall be aluminum rectangular section rated to carry 630 Amp.

Indications : Indications as under shall be provided on front of the panel.

1)	Incoming Breaker	Closed open tripped	Red Green
2)	Each Relay	Energized-de-energized	Red Green.
3)	Each Motor	Running-Stopped	Red Green
4)	Space Heater	ON	Red
5)	Each Motor	OFF	Green.

Earthing-

Ground bus of section not less than 50 x 6 mm G.I. flat Extending throughout length of panel shall be bolted to the frame work.

Positive earthing arrangement shall be provided each cubicle to ensure the cubicle rate is earthed in all position of rank.

Painting :The Panel shall be painted as under -

Prime Coat One Coat of Red Oxide.

Intermediate Coat Enamel paint of shade approved by the Engineer.

Final Coat As above

Labels and Payer's Mark: It shall be provided as Per I.E. Rule.

Third Party Inspection for APFC Panel

The APFC panel shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

The Factory testing shall be as under :

- 1) Review of material test certificate and quality control procedure.
- 2) Routine Test.
- 3) Checking components.
- 4) Checking wiring diagram and control circuit.
- 5) H.V. Tests on power and control circuits.
- 6) Insulation Resistance Test.
- 7) Simulation test to check functioning & control, interlocking and annunciation.
- 8) Power Frequency Test.
- 9) Fault stimulation test.
- 10) Review of type Test certificate of Contactors.

Remaining specifications shall be as per Item No.3 – 3.3 kV HT panel.

Note- 110 VDC supply for APFC panel shall be taken from provided 110 V DC battery charger of 3.3 kV panel.

Item No.7- 3.3 kV ON Load Break Switch for HT Capacitor

Extendable type ON load break switch with fuses of 630 Amp rating and with IP 55 protection class, on provided MS channels/ trench/ foundation in an approved manner.

As per IS 9920 / 9921

Recommended Standards:

ON Load Break Switch should normally comply with the following parameters:

Material:

- Steel Sheet
- Electrolytic Aluminium Bus bar of 400A

- Arc Chutes
- Epoxy Resin Cast Type Insulators
- H.T. Fuses of adequate capacity
- Shunt Trip Coil
- Manual trip push button
- Auxiliary contacts
- Earth switch
- Earth Bus bar copper (25x3)

Method of Construction:

Load break switch should be erected on provided MS channels/ trench/ foundation as per approved drawing by site in charge. Manufacturer's certificate for type test should be obtained. Routine Type test should be carried out at site .An earth switch having separate operating handle should be interlocked with main switch should be checked .An operating handle with correct sequence device having ON and OFF position and arrangement for pad locking provided should be checked.

The HT Capacitors for Transformers details as mentioned separately shall be housed in this panel.

Third Party Inspection for 3.3 kV onload break switch

The **Onload break switch** shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Item No 8-a- Power Cables

3.3 kV power cable shall be aluminum conductor cross link armoured cable (XLPE) and of 3.3 kV rating. The cables shall be of size to carry full load current at 0.90 PF continuously or to withstand short circuit current of 13.10 kA for 0.1 second duration whichever is greater but shall not less than the size specified in subsequent clause. Power cable used in 415 V systems shall be 1.1 KV grade 3.5 core/3 core.

Payment for cable shall be on basis of per running meter of 1/3/3.5 core. The cost of all accessories i.e. lug's gland, fixtures for laying cable tray cable trances.

Third Party Inspection for 3.3 kV power cables

The cables shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

The scope of testing for power cables is as under :

- a) Review of raw materials test certificate and quality control procedure,
- b) Routine test,
- c) Insulation Resistance test.

Item No. 8 bD.C control cables.

Supplying and erecting Laying of following copper control cable 1 x 3 x 2.5 sq.mm from VCB/C.T. T/F to transformer control panel/ protection Board. All control cable shall be supplied by the Contractor.

1100 V grade cable of adequate member core of suitable size copper conductor, PVC sheeted armoured shall be provided as required approved by the Engineer and MSEDCL. All above cables for purpose of tendering are designed as control cables and include all required cables not specifically stipulated. No of cores in the cable as under shall be spare.

- Up to 6 core Nil
- 7 to 10 Core 1 Nos.
- 11 to 20 core 2 Nos.
- Above 20 core 3 Nos.

Cable schedule :

The cable lengths stated in the schedule are estimated quantity. However for contract works quantity of the cables actually required shall be supplied at the tendered rate.

Cabling Methods :

Cables shall be laid trenches in ground, ducts, while passing through wall and trays in and outside the pump house, and in RCC duct / RCC trench with clearance not less than 600 mm below the common header. Every cable shall be neatly run vertically, horizontally or parallel to adjacent walls, beams or columns, At both ends for termination, the cable shall be approached from a common direction and are individually terminated in all orderly and symmetrical fashion.

The cables shall be terminated in mechanical glands which shall be suitable to provide adequate support by locking on the armour and additional earth continuity suitable compression type copper cable lugs shall be used for cable termination.

The point of entry, exit of the cables from the building shall be sealed from outside with an approved asbestos compound by about 40 mm thick bituminous compound on a

weak mortar. Care shall be taken not to Head Workstage sheathing of cable due to hot bituminous compound while sealing.

Cable root markers of approved design shall be installed at the following positions :

Entry and exist points of underground duct/trench.

Exists from the building.

At every 5 M distance of straight run.

Any other position necessary to trace route.

A metallic plastic tag bearing cable reference no. indicated in cable schedule at every 4 M. run on part thereof and both ends shall be provided for case of identification and route tracing. The schedule shall be prepared by the contractor and submitted for approval. The cable routing and laying shall be such that sharp bends and kinks are avoided. The radius at bends for PVC insulated cables shall not be less than 15 D where d is overall diameter of the cable. Laying and termination of 3.3 KV grade cable shall be as per manufactures instructions. Such instructions shall be furnished to the Engineer-in-Charge. Loops / extra lengths shall be provided in length shall be adequate for two straight through joints as and when such need arises.

Item No-9-a- Cable Duct :

The depth of the trench shall be at least 800 mm measured from finished ground level. Before laying bottom of the trench shall be cleared of broken stones, loose pieces, etc. and the bottom shall be finished firm and smooth contour. First 75 mm sand layer shall be placed to form bedding for cable shall be gently cooled rested on bedding to avoid any tension during backfilling and subsequent settlement. After laying of cables a further 75 mm well tamped shall be provided to cover cables which shall further be covered by pre cast concrete tiles of adequate width to overlap the cables by at least 50 mm each on both sides. The trench then shall be backfilled and finished to ground level with top soil. The trenches inside transformer substation shall be of size 0.6 x 0.6 M constructed in RCC and filled by Sand. Separate trenches shall be provided for LT and HT cables.

Item No-9-b-Cable Trays:

The cable trays shall be used for indoor installation of cables and outdoors vertical runs on the buildings. The trays shall be of mild steel prefabricated and perforated. The sheets shall be of thickness not less than 2.0 mm shall be complete with approved type fixing and shall be not dipped galvanized. Bends and tees shall also be

prefabricated with inside radius not less than 300 mm or above in case of large cables and galvanized. All cuts on sides shall be treated with cold galvanized process. Support brackets shall be provided at maximum of 1200 mm centers.

Cables shall be fixed on the trays at an interval of 1500 mm with suitable designed cable clamps. The cable / trays shall be supported at each 250 mm span. Particular care shall be exercised in laying cable on vertically rising trays by providing adequate cables fixing at short intervals to ensure that cable is not under any strain, load is properly transmitted to clamp and cable is securely fixed. Separate cable tray shall be used for power and control cables and also the cables operating on different voltages.

Item No-10-A-D.I.D.F. Butterfly Valve

The Butterfly valve shall be generally conforming to IS - 13095 / 1991, synthetic rubber faced ring secured on disc by retaining ring with stainless steel screw stub shaft of stainless steel riding in Teflon, Ring format, Ductile iron housing with EPDM liner and multiple shaft bearing. The liner is also used to seal the flange. There is thus no contact between the medium and the valve housing. The valve has a swing-through disc (angle of rotation 360°). The position of the valve disc is indicated by a notch on the front of the shaft. Butterfly valve, actuator, manual adjuster and mounting kit are packed separately. The butterfly valves are supplied without counter-flanges. For use as motorized or manual control or shut-off valves in heating, ventilation and air conditioning systems. All fasteners shall be of SS.

The valve shall be subjected to test at manufacturer's work with valve actuators for seat and body at pressure stipulated as below.

- 1) Body 16 Kg/cm² for 10 min.
- 2) Seat 24 Kg/cm² for 5 min.

Third Party Inspection for Butterfly Valve

The valve shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Tests to be performed

1. Review of raw material test certificate and quality control procedure.
2. Body and seat test
3. Test with operation of actuator and reduction gearbox fully assembled with valve opening and closing with synchronizing.
4. Checking wear travel.

Item No-10-B-D.I.D.F. Sluice Valve (Glandless)

The Sluice valves shall be D.I.D.F. Glandless type confirming to I.S.14846 on Pump delivery without bypass arrangement suitable for working pressure as mentioned below with standard non rising spindle, handwheel, cap etc. Valves shall be in accordance with Manufacturers Standardization Society, flanged, bolted bonnet, OS&Y, Ductile Iron body, with body and bonnet conforming to ASTM A 395 Ductile Iron. Packing and gaskets to be non-asbestos.

It shall be provided in the delivery pipe of each pump. It shall be double flange, water works pattern, inside screw, non-rising spindle type and shall be fitted with double faced gunmetal taper wedge made in one piece and having two machined facing rings securely fixed into machine recesses in the wedge. Thrust bearing shall be located in suitable housing above stuffing box and shall be oil/grease lubricated. Construction shall be such that ingress of water into bearing housing is totally prevented. The guides and the lugs shall be provided to guide the wedge through its full travel and the lugs and guides shall be lined with bronze. The bronze liners provided on guides and lugs shall be secured by counter sunk screws or rivets of non ferrous metals. The clearances (radial and lugs axial) between the lugs and guides shall not exceed 2.5 mm. All above accessories shall be provided by the valve .manufacturer only. The extension spindle shall be S.S. and similar to valve spindle dia. The valve shall be provided with thrust bearing.

The Valve shall be suitable for Actuator operation.

Necessary CC support shall be provided underneath the valves and shall be paid under relevant item in Schedule ‘B’.

Material of Construction

Body, cover, door face disc.Bonnet	D.I. ASTM A395 Gr. 60-40-18 or D.I., DIN 1693 Gr. GGG 40
Hand Wheel	C.I. / FAB STEEL (Attach with Actuator)
Stem	S.S. 410
Body Seat Ring, Spindle Nut , Wedge Face Ring , Guide Channel & LUG. SHOE	L.T. Bronze IS 318 Gr. LTB-2
Bonnet Gasket	Rubber , IS 638 Type – B
Stem Packing	NBR / EPDM (Rubber ‘ O ‘ Ring)
Bolts & Nuts	Carbon Steel IS – 1367 CL-4.6 & 4

The valve shall be subjected to test at manufactures work with valve actuators for seat and body at pressure stipulated as below.

- | | |
|---------|-----------------------------------|
| 1) Body | 24 Kg/cm ² for 10 min. |
| 2) Seat | 16 Kg/cm ² for 5 min |

Third Party Inspection for Valves

Three number of random valves as selected shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Tests to be performed for Sluice Valves

1. Review of raw material test certificate and quality control procedure.
2. Body and seat test
3. Test with operation of actuator and reduction gearbox fully assembled with valve opening and closing with synchronizing.
4. Checking wear travel.

Item No-11 A - D. I. D.F. Reflux Valve

The valve shall be 1000 mm dia generally conforming to relevant international standard with bypass arrangement. It shall be provided in the delivery pipe of each pump. The valve shall have free acting, quick opening, non-slam closure, and low head loss characteristics. The entire assembly shall be suitable for working pressure of 16 Kg/ Sq cm and body test pressure of 24 Kg / Sq cm or as approved. Construction materials shall be as per relevant standard. However, rubber faces shall not be offered. It shall be multidoor generally conforming to relevant standard and shall be installed on rising main at location as directed by Engineer In Charge. Alternatively DIDF 1000 mm dia valve with sliding disk generally as per construction of zero velocity valve can be accepted if manufacturer and contractor jointly give guarantee for one years. Necessary CC support shall be provided underneath the valves and shall be paid under relevant item in Schedule 'B'.

MATERIALS OF CONSTRUCTION

Body, cover, door face disc.	D.I. ASTM A395 Gr. 60-40-18 or D.I., DIN 1693 Gr. GGG 40
Hinges	Cast Steel confirming to IS:1030.
Hinge pins, door pins & door suspension pins.	Stainless Steel confirming to IS :6603.
Bering bushes, body Hinges and door faces.	Gun metal conforming to grade 2 of IS : 318 LTB.
Bolts & Nuts	Carbon Steel IS – 1367 CL-4.6 & 4

The valve shall be subjected to test at manufactures work with valve actuators for seat and body at pressure stipulated as below.

- 1) Body 24 Kg/cm² for 10 min.
- 2) Seat 16 Kg/cm² for 5 min

Third Party Inspection for Reflux Valve

The valves shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Tests to be performed for Reflux Valve

1. Review of raw material test certificate and quality control procedure.
2. Body and seat test

Item No-11 B - D. I. D.F. Reflux Valve

Thereflux valve shall be 500 mm dia generally conforming to relevant international standard with bypass arrangement. It shall be provided in the delivery pipe of each pump. The valve shall have free acting, quick opening, non-slam closure, and low head loss characteristics. The entire assembly shall be suitable for working pressure of 16 Kg/ Sq cm and body test pressure of 24 Kg / Sq cm or as approved. Construction materials shall be as per relevant standard. However, rubber faces shall not be offered. It shall be multidoor generally conforming to relevant standard and shall be installed on rising main at location as directed by Engineer In Charge. Alternatively DIDF 500 mm dia valve with sliding disk generally as per construction of zero velocity valve can be accepted if manufacturer and contractor jointly give guarantee for one years. Necessary CC support shall be provided underneath the valves and shall be paid under relevant item in Schedule 'B'.

MATERIALS OF CONSTRUCTION

Body, cover, door face disc.	D.I. ASTM A395 Gr. 60-40-18 or D.I., DIN 1693 Gr. GGG 40
Hinges	Cast Steel confirming to IS:1030.
Hinge pins, door pins & door suspension pins.	Stainless Steel confirming to IS :6603.
Bering bushes, body Hinges and door faces.	Gun metal conforming to grade 2 of IS : 318 LTB.
Bolts & Nuts	Carbon Steel IS – 1367 CL-4.6 & 4

The valve shall be subjected to test at manufactures work with valve actuators for seat and body at pressure stipulated as below.

- 1) Body 24 Kg/cm² for 10 min.
- 2) Seat 16 Kg/cm² for 5 min

Third Party Inspection for reflux valve

Three number of random valves as selected shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Tests to be performed for Reflux Valve

1. Review of raw material test certificate and quality control procedure.
2. Body and seat test

12- Smart Type Valve Actuators

- Design, manufacture, testing & supply of non-intrusive type intelligent / smart electrical actuator for Valve operation
- For Quarter Turn valves with operating torque requirement of up to 900 Nm (including safety margin) the Actuator should be with direct drive quarter turn output. For higher torque requirements, combination of Multiturn Actuators with Quarter Turn Gearboxes is also acceptable. Quarter Turn Gearbox housing material of construction should be Ductile Iron with enclosure of IP68 rating. Secondary Gear Box, if required, shall be of same make as that of Actuator.
- Double Sealing in Terminal compartments to be provided. The motor and all other internal electrical elements of the actuator shall be protected from ingress of moisture and dust even when the terminal cover is removed for site cabling.
- Electric Motor : Suitable AC/DC motor to be provided to accept power supply of 3 Phase 440 V +/- 10% variation AC at 50 Hz frequency with +/- 4% variation. Class `F` insulation with temp rise limited to class `B`. Intermittent Duty Rating S-2 15 minutes.
- Position and Torque measurement shall be through two completely independent sensors & mechanisms. Failure of either device will therefore be independent of the other.
- Position Measurement : Position Sensors: Absolute encoder type/ Magnetic pulse type as per OEM's standard with or without battery backup.

- Torque Measurement : Measurement of torque shall be from direct measurement of force at the output of the actuator.
- Display Window : A continuous (0-100%) backlit illuminated indication for valve position to be provided. Alarms like Torque Trip/Phase Lost/Valve Jammed should appear on the display window of the Actuator. Indication lamp/LED for valve position to be provided showing OPEN and CLOSE position.
- Protection Facilities : Auto Phase Correction, Jammed Valve Protection, Anti Hammer Protection, Instantaneous Reversal Protection, Motor Thermal Protection to be provided.
- Configuration Tool : Configuration / setting tool shall be provided at least 2 nos. per location as standard supply without additional cost. In case the configuration and setting can be done from local push buttons on the actuator itself, separate external Configuration/ Setting tool not to be supplied.
- Datalogger : Integral data logger to record and store the following operational data to be provided in Actuator:
 - Opening last /average torque against position
 - Closing last /average torque against position
 - Opening motor starts against position
 - Closing motor starts against position
 - Total open/closed operations
 - Maximum recorded opening and closing torque values
 - Event recorder logging operational conditions (valve, control and actuator)

The data logger shall record relevant time and date information for stored data.

Data logger data is to be accessed via non-intrusive IrDA communication.

The above mentioned operational data should be available and accessible independent of 2 wire bus communication system

- Electronically latched contacts shall be provided to take care of power supply interruptions which can be selected to indicate any position of the valve, Provision shall be made for the selection of a normally closed or open contact form. Contacts shall maintain and update position indication during hand-wheel operation when all external power to the actuator is isolated.
- Communication Capability: The Actuator should be suitable for future upgradation for any one of the control facilities, if required in future, viz Modbus, Profibus, Foundation Fieldbus, DeviceNet, Pakscan.

The design calculation of torque and HP of actuator motor shall be got approved from Engineer-in-charge.

Third Party Inspection for Valve Actuators

Three number of valves Actuators as selected shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Tests to be performed for Actuators

- Review of raw material test certificate and quality control procedure.
- High Voltage test.
- Insulation resistance test.
- Routine and operation test.
- Checking of wiring diagram & circuit.
- Operation test with limit switch.
- Valve actuation will be tested along with relevant sluice valve.

Item No-13-Dismantling Joints

The M.S. dismantling joint shall be provided in between the pump discharge head and non-return valve in delivery line of each pump with suitable flanged reducer for easy assembling and dismantling to the pipe work. The shell thickness shall be 12 mm and flange thickness shall be 28 mm. The dismantling joint shall withstand test pressure of 24 kg/Sq.cm. or twice the shut off head whichever is greater. The design shall generally confirm to typical drawing of dismantling joint shown in the drawing. The tendered may offer other technically equal arrangement. The arrangement shall however, fully ensure that. When assembled and under dynamic load the bolts together shall withstand pull equal to 1.5 times the duty head and no torque or pull is exerted on the pump foundation arrangement.

During assembling or dismantling the sliding flanges can be slid adequately to enable to detach the discharge head and piping from each other.

The seal ring joint shall be designed to withstand test pressure of 20 g/Sq.cm. without any leakage. The sliding flange should slide at least 20mm.

Each dismantling joint shall be supplied with 3 No's .of spare (Seal rings.)

Item No-14- Double Orific Kinetic Air Valves

The Kinetic type air valve shall be of **200 mm dia** Double orifice type & shall be provided on common manifold as per direction of Engineer-in-Charge. The air valve shall be suitable for working pressure of 20 Kg/Sq.cm and isolating sluice valve designed for working pressure of 20 Kg/Sqcm. The air valve shall be mounted on common header hole with MS pipe of size 200 mm and at least height of 1000 mm.

MATERIALS OF CONSTRUCTION ;

Float chamber, cowl & cover.	Grey cast Iron conforming to Grade FG200 of IS : 210
Small orifice float.	Seasoned timber ball covered with soft rubber.
Large orifice float.	Seasoned timber ball covered with hard vulcanite.
Orifice guides and mechanism.	12 % chromium steel conforming to IS : 1370 or Stainless Steel to BS : 970-1045-15.
Sealing ring.	Molded rubber of suitable quality.

Third Party Inspection for Kinetic Air Valve

The Kinetic Air Valves shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Tests to be performed for Kinetic Air Valve

- a) Review of raw material test certificate and quality control procedure.
- b) Body and seat test.
- c) Operation test for functioning of small orifice and large orifice.

Item No-15- Pressure Gauges

The pressure gauge shall be 150 mm size IS 3626 : 1987 having range of 0 to 17.5kg /cm² range, Glycerin filled type of required capacity complete with syphon tube isolated cock. Pressure gauge shall be installed as directed with tapping on rising main. Isolating brass cock, G.I. Pipe etc. shall be supplied and erected on pump manifold or near to pump. The meter scale shall be either in Kg/cm² or in meter of water or with both. The pressure gauge shall be located at a height of 2.5 feet from floor level to ease easy reading for the operator. The pressure gauges shall have range from 0-25 Kg/ Sq.cm. & should be of approved make only.

Location of Pressure gauge.

- 1 No (One for each pump)

- 1 No (One on rising main manifold)

Item No-16-a and b- MSDF Pipes & Specials

The MSDF pipes and specials shall be fabricated to transmit flow without disturbing streamlined condition to gradually and smoothly changes the direction or velocity as the case may be and to offer neat aesthetic appearance. The M.S. pipes and specials to be provided by the contractor under this item includes on delivery pipe of **500 mm**, dished ends and specials on **1000 mm dia** manifold @ Raw water pumping station.

MATERIAL AND FABRICATION

The pipes, specials and flanges shall be manufactured from mild steel plates generally conforming to IS: 226 Thickness of plates shall not be less than those stated below or nearest commercial thickness.

- i) M.S. pipes and specials 10 mm thick
- ii) Dished end 20.mm thick
- iii) Flange Thickness 16 mm

MODE OF MEASUREMENT AND PAYMENT

The pipes and specials provided by the contractor such as pipes, specials flanges dished end and blank flanges are payable on Kg. - rate basis for complete work. For calculation the weight for payment on rate per kg basis following parameters will be applicable.

- i) Wt. of pipe and special shall be based on finished/fabricated component, Wastage will not be considered for payment.
- ii) Thickness shall be average thickness of pipes supplied.
- iii) No deduction for bolt holes in flanges will be made.
- iii) Nut bolts and washers will not be considered for weight calculation.
- iv) Specific weight of M.S. pipes and specials shall be as 7850 kg./Cum.
- v) Cost of epoxy painting of M.S. pipes specials and valves are deemed to have been included in rate for Kg. basis and shall not be considered separately for payment.
- vi) Positive tolerance in the thickness of pipe is acceptable. The thickness shall be measured by ultrasonic gauge and it shall be measured by agency in presence of department Engineer at site with their instrument.
- vii) Cost of breaking of pump house wall for pipeline work and making and finishing to original after completion of work is included in this item. Contractor should provide

branch tees for air valve, pressure relief valve etc. erected on manifold as per drawing and as per directions of Engineer-in-charge.

- **PAINTING**

- For all M.S. pipes supplied by the contractor and manifold pipe the external surfaces of the pipe work and valves shall be painted with one coat of epoxy primer and two coats of epoxy paint approved by the Engineer. Painting shall be carried after completion of erection work.

- **TESTING**

- The contractor shall test the pipe work for hydrostatic pressure as per instructions of Engineer-in-charge.

Item No-16-b-MS Flanges

Providing, fabricating, erecting M.S. flanges 20 mm thick. The flanges shall be machined on both sides. The flanges shall be welded to the M.S. pipes used for connecting the pumps and other accessories. The payment will be made on weight basis.

Item No-16-c-Structural Steel Work

Structural steel work in rolled stanchions fixed with connecting plates or angle cleats as in main and cross beams, hip and jack rafters, purlins connecting to truss members and like as per detailed designs and drawings or as directed by Engineer-in-charge including cutting, fabricating, hoisting, erecting, fixing in position, making riveted / bolted / welded connections and one coat of anticorrosive paint and over it two coats of oil painting, as directed by incharge.

Item No-17- Flanged Joints

The delivery of pump shall be connected to the rising main by making flanged joints of 500 mm dia. & 1000 m. The flanges shall be jointed with fasteners of adequate strength and quality. The bolt diameters shall conform to IS: 1538. The joint ring between flanges shall be of 3 mm thick rubber of adequate hardness for forming watertight joints and suitable to withstand hydrostatic pressure of 20 kg/Sq.cm. This item includes the cost of good quality rubber packing & nut bolts with washer. All flanged joints shall be hydraulically tested on full load of pump.

Item No-18- RCC Concrete Foundation

The work includes excavation in all types of strata, reinforcement casting of RCC works as required with curing etc. complete. Payment shall be made on the basis of finished concrete work. Excavation disposal of excavated stuff refilling form work and curing etc.

shall not be paid separately and deemed to be included in cost of RCC/PCC work. The thrust block for foundation NRV/SV using M-200 concrete shall be provided. All foundations shall be made finished with proper edges and surfaces.

The support for valves and pipes, platform for valve operation, shall be cast in M-200 concrete. The dimensions and spacing of block shall be submitted for prior approval. Suitably designed and adequate numbers of concrete supports for pipe work and all sluice valves and non-return valves shall be provided. Minimum design criteria as under shall be adopted.

- a) The free end of common delivery line shall be suitably anchored to withstand and relieve pipe work and fasteners from stresses due to thrust. The thrust block to common manifold free end / bend should be designed and got approved from the Deptt. Proper RCC chairs blocks should be provided to common manifold.
- b) There should be separate foundation blocks for all valves.

Item No-19 a - 33 kV Indoor Type Compact Substation with Panel

The 33 kV Indoor Type Compact Substation with Cubicle Panel shall comprises following equipments

Sr. No.	Description	Qty	Unit
1	33 kV 630 A draw out type Vacuum Circuit Breaker	3	No.
2	<u>33 KV 630 A draw out type Vacuum type Load Break Switch</u>	2	No.
3	33 KV Resin cast PT 1 Ph.	3	No.
4	33 KV Resin cast CT 1 Ph.	9	No.
5	33 KV surge Arrestor	3	No.
6	LED RY And others	18	No.
7	Push button TEST ACCEPT RESET	9	No.
8	Complete wiring with PLC Command	1	Job
9	Caution Board	5	no
11	Space heaters with thermostat	5	no
12	Fabrication in 2 mm thick powder coated MS sheet	1	Job
13	MS Stand for panel 100x50 mm ISMC	1	Job
14	Trolley for maintenance of VCB	1	No
15	110 V battery charger panel as per details mentioned in 3.3 kV Panel	1	No

The contractor shall prepare substation layout and get it approved by the electrical inspector before starting the work and permanent charging permission before commissioning. The required fees for the above shall be borne by the contractor.

33 kV Switch Gear and Control Panel H.T. Panel.

The 33 kV panel shall be got manufactured from HT switch gear Panel Manufacturer only. The VCB Panel shall be comprising of 33 kV Switch gears and control gear designed for

- Reception of power from Cubical Meter / 33 kV Structure.
- Distribution of power to 33 kV / 3.3 kV Transformers - 2.00 Nos and 33 kV/ 0.415kV station Transformer 2.00 Nos
- Protection of the panel and meters from short circuit, earth fault, over current,
- Under voltage, stalling and single phasing.
- Indicators of voltage, current and operating conditions of breakers, relay ..
- Annunciation.
- Auto Trip.
- Interlocking.

Components :

- 630 Amp draw out type VCB 25 kA horizontal for reception of power from Cubical meter.
- 630 Amp draw out type VCB 25 kA horizontal outgoing for 33 kV/ 3.3 kV Transformers.
- **On**Load break switch with HRC fuse outgoing for 33kV/ 0.415 kV
- Air insulated aluminum bus bar designed for 100 MVA fault level and rated to carry 800 Amp. Continue current.

The breaker shall be suitable for outdoor application and draw out type provided with automatic closing shutter. The breaker shall be three pole operated through a common shaft. The breaker shall have constructional features as under :

- The contact of suitable **proven material** and shape to break 25 kA current.
- 230 VAC for with gang operated spring state position, light switches and all other accessories suitable for any number of closing and opening operating so

long as power is available to the motor and at least on closing and opening operation increase of power failure.

- Crane for manual charging of spring.
- Required NO. + NC contacts with minimum 2 NO + 2 NC spare contacts.
- Closing coil rated for 110 V DC and suitable for operation at 85% to 110% Voltage.
- Trip coil rated for 110 V DC and suitable for operation on 70% to 110% voltage.
- Operating mechanism housed in weatherproof enclosure at accessible height.
- Mechanical on / off release.
- Operating counter.
- Secondary self aligned plug in contacts.
- Anti pumping features.

Rating : Minimum rating of breaker shall be as under :

- Rated voltage – 33 kV
- Rated current – 630 Amp.
- Symmetrical breaking current RMS 25 kA
- Fault level – 150 MVA
- Short time rating 25 kA for one second.
- Peak making capacity – 36.73 kA
- One minute power frequency with stand voltage – 25 KV

The incoming breaker shall incorporate following accessories each.

- CTs Epoxy resin cast of ratio Suitable A / 5/5A with VA burden not exceeding 50 VA
- Core 1 - class –0.5 for protection and for metering.
- Core 1 - class – 5 P. 10 for protection and for Protection
- 3 phases PT 33 kV/ $\sqrt{3}$ / 110 V / $\sqrt{3}$, 100 VA burden fixed type two core with fare and test block one core shall be protection class and second are shall be class-0.5 for metering.
- Analog ammeter with selector switch.

- 0 to 40 KV Analog voltmeter with selector switch.
- TNC Switch for Vacuum Circuit breaker

The Outgoing breakers shall incorporate following accessories each.

- CTs Epoxy resin cast of suitable A / 5/5A with VA burden not exceeding 50 VA
- Core 1 - class –0.5 for protection and for metering.
- Core 1 - class – 5 P. 10 for protection and for Protection
- Analog ammeter 0 to 150 Amp. with selector switch.
- Indicating lamps for On and off, trip and trip circle healthy circuit.
- Cable termination form power cable and stands for center cable.
- Rectifier arrangement – Obtaining 110 VDC supply from PT for current voltage.
- TNC Switch for Vacuum Circuit breaker
- Annunciator with hooter
- 25 KA load break switch with HRC fuse outgoing for 33KV/ 0.415 KV.

Constructional features :

Vacuum circuit breaker panel shall be powder coated & built in single tier construction with provision of HRC fuse of suitable capacity. Vertical section of the panel shall contain CT, PT, Bus bar etc. Mechanical interlock shall be provided. The operation coil of vacuum circuit breaker shall be rated for 110 V DC. Suppressor shall be provided.

Panel Construction :The panel shall house 33 KV VCB –3 Nos for VCB incoming and 2 Nos of Load break switch with HRC fuses for Outgoings in totally enclose steel metal clad. Rectifier arrangement for obtaining 110 V.D.C. supply for control by connecting to P.T. shall be provided. Labels and Payer's Mark :It shall be provided as Per I.E. Rule.

The panel shall be fabricated from CRCA Sheet 2.00 mm in the front and bottom and 2.00 mm. in the rear and other sides Hinged doors shall be provided at the front and rear with car type handles. Mechanical interlock shall be provided to prevent operating of front door in ON position at alternatively arrangement shall be provided to prevent operating of front door in ON position at alternatively arrangement shall be provided to trip the supply in the event of opening of the door. Suitable stoppage shall

be provided to restrict opening of the door and scratching of paint with adjusting panel structure. Cable entries and exists shall be from bottom. The indicating and operating devices shall be preferably at uniform levels and shall not be above 1600 mm front floor level. The Panel frame work shall have minimum ISMC-100 base channel. Bus bar shall be aluminum rectangular section rated to carry 800 Amp.

- **Indications as under shall be provided on front of the panel.**

•	Incoming Breaker	Closed open tripped	Red Green
•	Each Relay	Energized- de-energized	Red Green.
•	Each V.C.B	Running-Stopped	Red Green
•	Space Heater	ON	Red
•	Each Motor	OFF	Green.

Earthing-

Ground bus of section not less than 50 x 6 mm G.I. flat Extending throughout length of panel shall be bolted to the frame work. Positive earthing arrangement shall be provided each cubicle to ensure the cubicle rate is earthed in all position of rank.

33 kV Sub Station Relay Metering Panel

The Relay metering panel shall have Protection relays provided to open the circuits in the event of fault the relays shall conform to specifications in subsequent sub clauses. The relays, instruments and indications specified below shall be housed in common relay and metering panel located in the pump house. The CTs and PTs installed on pole structure shall be connected for protection and metering. Rectifier unit to obtain 110 V (D.C.) for the control circuit shall be provided.

PROTECTION RELAYS

A separate protection relay for each VCB for over current, short circuit and earth fault protection shall be provided. The relay shall be triple pole, 5A rating having, two over current elements with 50% to 200 range and one earth fault element with 20% to 80% with inverse definite minimum time lag characterize and instantaneous high set relay for 200% to 800% All relays shall be in one standard case and mounted flush on panel. The relay shall be suitable for protection on 110 VDC with range of 70% - 110% of rated Voltage. The relays shall be provided with plug setting on coil and time reset tripping time. The relay shall conform to IS: 323 in general and IS: 3231 in particular. The relays shall be of rectangular shape with tight dust covers removable from the

front. It shall have external reset positive action indicator. The auxiliary relays shall be series or shunt connected and shall be non draw out type. The main relay shall be draw out type. It shall not trip the circuit when deenergized. Facilities as under shall be provided.

i) Test facilities with loose test plug

ii) Provision for easy isolation of trip circuits of each relay for testing and maintenance.

PANEL

The panel shall house the protection relays all vital controls, indication, fault annunciation and vermin proof with degree of protection not less than IP 54. The panel shall be fabricated from steel sheet of 2 mm thickness reinforced with steel section and shall be floor mounted on base channel of ISMC of 75 mm at least 150 mm above floor. The panel shall be equal to height of 3.3 kV panel. Panel with proper finish of spray painted. The relays controls and meters etc. mounted flush on the front side of the panel. Doors shall be provided at the rear. The panel shall incorporate following components.

IDMT Relay Numerical for VCB	3.00	No.
Differential protection Relay for H.T. Transformer	2.00	No
High speed trip relay for VCB and Transformer	5.00	No.
Auxiliary Relay for 2000 kVA Transformer for Alarm & Trip	4.00	No.
Trip supervision relay for For Incomer and Transformer.	3.00	Nos.
Analog voltmeter 150 sq. mm with Voltmeter Selector switch	3.00	No.
Analog Ammeter 150 sq. mm with Ammeter Selector switch	3.00	No.
Digital phase sequence meter 100 sq. mm	1.00	No.
Digital oil temp. indicator 100 sq. mm	2.00	No.
Digital winding temp. indicator 100 sq. mm	2.00	No.
Breaker control Switch	3.00	No.
LED Lamps RY & others	6.00	No.
LED Lamps B	3.00	No.
Push Buttons	6.00	No.
12 Window Annunciator	2.00	No.
10 point indication Window	3.00	No.
Hooter	3.00	No.
Complete wiring to the relay metering with PLC wiring	1.00	Job
Caution Board	3.00	No.
Step down Transformer with rectifier arrangement of 110 V D.C.	3.00	No.

Space Heaters	3.00	No.
Fabrication Work	1.00	job
Iron work ISMC 100 x 50 mm and Angle work 50 x50x 6 mm for battery & battery charger bracket & HT Panel.	1.00	Job
PVC Synthetic elastomer electrically insulating mat as above	11.00	Sq m
LT/CT multifunction DLMS compliance energy meter of accuracy of class 0.5 ,3x240V,50 Hzwith optical & RS 232 port, backlit LCD,measures & Displays Trivector Energy, load survey, TOD,tamper detection & logging, power ON /OFF events,instantaneous parameters of Rating -/5 Awith display in absence of power complete with zero adjustment & est certificate from manufacturer and connected to CTs	3.00	Nos.
Digital type Frequency meter	1.00	No

A separate Battery charger Panel unit with 12 V maintenance free batteries -10 nos shall be provided for obtaining 110 VDC supply for control circuit for operation & protection of All VCB, Relay metering panel etc. & cost of this is included in the item.

The details for construction of Relay metering panel shall be as per the details given for 3.3 kV HT panel as in above items.

Third Party Inspection for 33 kV VCB Panel

The 33 kV VCB Panel & Relay Metering Panel shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Testing of VCB panel shall be as under

- 1) Review of material test certificate and quality control procedure.
- 2) Checking components.
- 3) Checking wiring diagram and control circuit.
- 4) Routine Test.
- 5) Insulation Resistance Test.
- 6) Complete panel after assembling.
- 7) H.V. Tests on power and control circuits.
- 8) Simulation test to check functioning control, interlocking and annunciation.
- 9) Power Frequency Test.
- 10) Fault stimulation test

11) Review of types Test certificate of breakers.

Testing of Relay Metering panel shall be as under

- 1) Review of material test certificate and quality control procedure.
- 2) Routine Test.
- 3) Checking components.
- 4) Checking wiring diagram and control circuit.
- 5) H.V. Tests on power and control circuits.
- 6) Insulation Resistance Test.
- 7) Simulation test to check functioning o control, interlocking and annunciation.
- 8) Power Frequency Test.
- 9) Fault stimulation test.

Additional works for 33 kV Sub Station

Following additional works shall be provided alongwith 33 kV Sub Station.

Fire Extinguisher-Qty -4.00 Nos

DCP type of 9 kg capacity fire extinguisher cartridge type, with .G.M. capacity 150 gm CO2 gas cartridge powder brackets conforming to IS 2171-1985

Fire Bucket –Qty - 8.00 Nos

GI fire buckets with round bottom duly painted having atleast 9 lit capacity and filled with dry sand and kept on provided stand etc complete.

MS Stand–Qty - 2.00 Nos

Floor mounted stand for keeping 4 Nos of fire buckets 1500 mm in length and 900 mm in height made out of 30 x 30 x 4 mm angle iron welded with 4 hooks.

Stone metal spreading- Qty - 280.00 Cum.

Stone metal 25 mmsize for 100 mm depth above the ground level.

Fencing- Qty - 63.00 Nos.

The fencing frame 2.45 m (height) x 1.2 m (width) size shall be fabricated from angle of size 50 x 50 x 6 mm and covered with G.I. welded 50 mm Sq. Mesh made out of 10 SWG G.I. hard drawn wire duly painted with two coats of red lead and two coats of silver paint/aluminum paint for minimum 40 x 20 . The vertical angles of the frames, shall be extended 0.5 m on both sides and duly erected in CC foundation block. Adjacent frame shall be fixed by means of nuts and bolts to vertical angles on both

sides. Anti-climbing spikes shall be provided. Four fence gate of overall size 3.0 level as directed by Engineer-in-Charge without any extra cost. It shall be fabricated from G.I. pipe 25 dia and shall be in two halves, each half of 1.50 m x 1.85 M with anti-climbing devices and frames are to be covered with similar welded mesh. The gates (minimum 2 Nos.) shall be supported on hinges fixed on 2 Nos ISMC 100 channels. The channels shall be 3 m long and vertically erected in CC foundation 400 x 400 x 600 mm deep in the ground. Suitable padlock and keys shall be provided with Godrej Navtal lock of 7 levers. Also walkway of 1 m wide on three side of switch yard compound shall be provided. The entire area shall be levelled and covered with 100 mm layer of 20 to 25mm stone metal. Instruction chart As required as per IE rules. The contractor will have to refill sub-station area upto required

Double leaf hinged door –Qty 04.00 Nos

Each **1500mm in width x 1850 mm in height** using Bclass ,GI pipe with angle iron supports, chain link wiremesh (jali) complete supported on channel iron, erected in foundation, and painted

Hand gloves – 2 Pair

Duly tested rubber hand gloves as per IS :340715 suitable for working on 33 kVsupply.

Item No-19-b- HT Metering Kiosk-

33 KV H.T.metering cubical (Compact Type) approved by MSEDCL/Licensee fabricated with 2mm.(14 SWG) CRCA sheets with supporting angle and channel, painted with powder coating / epoxy paint of required shade copper bus bar size 25x6 mm electronic security lock and heavy duty mechanical lock, with counter meter for measuring no of times the opening of doors, top side cover (C.T.P.T COVER) interlock with meter doors, epoxy coated 3 nos C.T having required ratio between 5/5A to 50/5A, VA10,Class0.5S, 33000/V3/330/V3 VA 50, class 0.5 epoxy terminal block suitable for provided trivector meter, and provision for incoming and outgoing cables etc complete duly tested by Licensee with necessary Test Certificates and erected on provided plinth/ C.C foundation

Item No.20 - Plate Type Earthing for substation, Motors & Panel&Copper Earthing For Metering Cubicle

The earthing arrangement for sub-station switch yard and indoor equipment shall be designed in conformity with the I.E. rules 1956 and IS: 3043 and Rules/ Regulation/

Instructions of statutory authorities, as applicable for the class of work under the contract. The arrangement specifications and quantity/size stipulated hereunder are minimum requirements. It shall however, be the responsibility of the contractor to design and provide the earthing arrangement as stated above without any extra cost. Required excavation for above system by Mechanical Means should be done by concern contractor without any extra cost.

EARTH ELECTRODE AND EARTH PITS

All earth electrodes shall be of Galvanised cast iron earth plate size 60 x 60 x 0.6 cms with funnel with a wire mesh for watering and brick masonry block C.I. cover complete with all materials, testing & recording the results as per specification No. EA-EP .The electrodes shall not be situated at a distance less than 1.5 m from There shall be separate and independent earthing system for 33 kV, 3.3 kV and 415 V system and isolated from each other. Separate ring bus shall be formed for each system to which individual earth electrodes. Earth leads from equipment shall be connected separately to the ring bus. Two earth leads from each equipment shall be connected to ring bus independently. A disconnection link shall be provided at each pit for disconnection and measuring earth electrode resistance.

Each earth pit shall have funnel arrangement for watering, minimum requirements of each pits/ electrodes are as under.

1. For HT motors – 6 Nos
2. HT,LT panel , Capacitor panel – 4 Nos Total 10 Nos.& other as requirements

Each earth electrode shall have disconnecting link to disconnect and measure resistance of earth electrode. RCC chamber shall be provided with C.I. cover to each earth pit. RCC chamber's top shall be flushing to metal spreading level in switch yard. A ring bus shall be formed in a pole yard and transformer yard to which individual earth electrode shall be connected. Earth leads from equipment, structure etc. shall be connected separately to the ring bus. Both ring buses shall be interconnected with two parallel earth leads at two opposite points on each ring bus.

EXTENT OF EARTH CONNECTIONS

Earth connections shall be given to metal frame work of A. B. switches, operating handles, lightning handles, lightning arrestors, insulators, transformer neutral and body cable box and glands, VCB body and frame work, pole structure and fencing. Each unit shall have two separate and distinct earth connections of adequate size.

EARTH LEADS

Minimum size of earth leads for earthing of equipment shall be as under.

Lightening arrestor, A.B. switches steel structure 50 x 6 mm Transformer body, cable box, gland Galvanized fencing flat,Transformer neutral 3.3 kv system. The earth leads run on the structure shall be severely bolted or clamped. Neutral earth leads shall run on separate support without touching body of the transformer. The run and arrangement of earth lead shall be neat and in parallel and at right angles formation with reference to general layout of switch yard and equipment. The bend in flat shall be gradual to prevent mechanical Head Worksage and 90o multiple bends if required in earth leads shall be located below ground level. Inter connections of the earth continuity conductor and main/branch earth shall be bolted ensuring reliable, permanent and good electrical connection and further brazed. Earth leads shall be protected against mechanical Head Worksage and corrosion particularly at the point of connection.

EARTHING FOR 3.3 KV AND 415V SYSTEMS

The earthing shall be generally as specified above and as detailed

- a) Minimum 32 earth pits for 3.3 KV and 33 kV system.
- b) Minimum 3 Nos. earth pits for equipments and panel of 415V system.
- c) There shall be separate and independent earthing system for 33 kV, 3.3 kV and 415V system and isolated from each other.
- d) Earth electrodes for 3.3KV, 33kV and 415V system shall be 50 mm diameter G.I. and of 3m long.
- e) Separate ring bus shall be formed for each system to which individual earth electrode of the system shall be connected. Earth leads from equipment shall be connected separately to the ring bus.
- f) Two earth leads from each equipment shall be connected to ring bus independently.
- g) A disconnecting link shall be provided at each pit for disconnection and measuring earth electrode resistance.
- h) Water tap connection with necessary G.I. pipe & isolating valves (Brass) shall be provided for watering earthing pit. The water connection shall be tapped from rising main with suitable arrangement of isolation.

TESTING

The contractor shall arrange for taking the actual earth tests for all electrodes as per I.E. Rules & relevant BIS code. These tests shall be taken in presence of Engineer-in-charge & test results shall be submitted in five copies for record. The Tenderer shall submit the details earthing system layout drawing for HT & L.T. earthing system from Competent Authority before starting / Execute the work.

Item No-21-Indoor & Outdoor Termination Kit

3.3 kV and 33 kV cables indoor & Outdoor termination kit shall be provided & fixed to pole structure, VCB, Vacuum contractor, motor as per Termination method as recommended by the manufacturer with cable termination heat shrink type Kit/Compound etc. Any structural work required for its proper mounting connections including lugs and glands shall be done. The 33 kV cable shall be laid in suitable vertical G.I.Pipe with clamp while jointing to DP structure. Indoor, Outdoor type termination kit for 3.3 kV / 33 kV XLPE Screened 3 core cable shall be provided.

Item No-22- 33 / 3.3 kV Power Transformers

The transformers shall be **33 / 3.3 kV, 3000 kVA** capacity rating, **energy Efficient** as per IS: 2026, copper wound, oil immersed, naturally cooled & Suitable for outdoor installation. It shall be designed, manufactured, supplied to fulfil requirements of the specifications and to render satisfactory trouble free operation. Transformers shall be suitable for parallel operation. The load and no load losses shall be limited as per IS and norms issued by MSEDCL whichever are lower. The short time overload rating shall be conforming to relevant IS **with SCADA Computable.**

The unit shall be mounted on provided RCC platform as per I.E. Rule and approved from Electrical Inspector.

CONSTRUCTION OF TRANSFORMERTANK

The tank shall be fabricated from high grade steel sheet of thickness 6 mm for Tank side & 10 mm for Tank Top & Bottom. The construction shall be such to prevent collection of water in any part of the tank. It shall be mounted on skids. It shall have adequate number of lifting lugs so located that, adequate, working clearance is available while lifting between slings and any fitting or necessary on the transformer. It shall also have 4 Nos. of jacking pads for lifting with jacks **& arrangement for Pad locking. 4 Nos antitheft SS fasteners with breaking nut for top cover shall be provided. All fasteners shall be of Stainless Steel. Detachable gland plate shall be provided to both cable end boxes as per cable size & departmental requirement.**

WINDING

The winding shall be of electrolyte grade copper conductors conform to group Dy.-11 The star point shall be brought out tank and suitably terminated with separate base

terminal with weather proof porcelain bushing for solid neutral earthing. The insulating paper and other insulating material shall be suitable for high oil temperature without any effect on physical and chemically properties. The winding shall be treated for shrinking before assembling in the core. The winding shall be designed to eliminate hot spot and braced to withstand dynamic stresses due to fault without any Head Worksages.

The core shall be constructed from cold rolled grain oriented steel laminations insulated from each other by means of suitable heat resistant oil proof coating. The arrangement shall afford lifting of the cores and winding body from the tank without disturbing the cable base or HT bushing.

RADIATORS

Radiators shall be either tubular or plate type. Each radiator shall be provided with air releasing plug, isolating valve and drain valve. The radiators shall withstand the pressure tests specified for the tanks to which these are fitted. Radiator earthing shall be as per IS: 3043-1982.

CONSERVATOR

The conservator shall be complete, with fill cap drain plug and dehydrating breather. The design of breather shall prevent contact between external atmospheres and dehydrating agent conservator shall be provided with magnetic oil level gauge with low level alarm contacts on one face and plain prismatic level on the other face. The porcelain bushing shall be solid type with continuous metallic stud or metallic tube. Buckholz relay shall be provided to detect internal fault in transformer, The relay shall comprise of alarm, trip elements and should be wired to relay and control panels. The transformer should be provided with suitably designed 'Neutral ground resistance with restricted earth fault unit plinth mounted. Outdoor type with proper connection to transformer neutral with G.I.Strip and proper earthing. The transformer shall be painted with two coats of red oxide and two coats chemical epoxy paints of approved shade.

TRANSFORMER CORES

The cores shall be constructed from high grade cold rolled grain oriented silicon steel laminations. The operating flux density shall be of the order of 16.5 x 17 Kilo lines/ Sq cm. The design shall provide tank mounted core and the use of core bolts shall be totally avoided for securing the core to the tank. Suitable arrangement shall be provided for lifting the core and winding for inspection.

CABLE END BOX

H.V. side connection of transformer should be through 33 kV, 3 core 95 Sq.mm XLPE aluminum cable & L.V. side connection through 3.3 kV XLPE 3 x 240 Sq.mm multi cable, & Porcelain bushing with neutral- 4 Nos. An air insulated cable end box with disconnecting chamber shall be provided to HV & LV sides & it shall be suitable to accommodate number of cable terminations and consistent with number of cable runs on HV & LV side of transformer and associated breaker with **SS fasteners**. The cable boxes shall be suitable to withstand fault current of 26.2 KA (LV) 13.12 KA (HV side) for 1 Sec. The cable boxes shall be fully weather proof conforming to IP-55 protection and equipped with canopy for ingress of rain water through joints. An inspection cover shall be provided on cable boxes and disconnecting chamber for access to terminals.

INSULATING OIL

The transformer shall be supplied with new, filtered and tested transformer oil duly filled. The insulating oil shall conform the IS:335. Approximately 10% excess oil shall also be supplied to account for loss.

ON LOAD TAP CHANGER

The high voltage winding shall be provided with ON LOAD tap changer with 16 position steps tapings from **+ 10% and -10%** in step of 1.25%. The tap changer shall be automatic with voltage regulator control, on load tap switch. The tap position indicator shall be provided and shall give positive and unambiguous tap position. The radiators shall be either plate type or of tubular construction complete with bronze collared air release plug, isolating valves and drain plugs. The RTCC panel shall be erected in VCB room.

RATINGS

The design rating of the power transformer shall be as under.

i)	Capacity	3000 kVA.
ii)	Overload rating	As per IS :1180 / 2026 as applicable
iii)	Max. HV voltage	36 KV
iv)	Transformer ratio at no load	33 KV: 3.3 KV
v)	Tappings	(+) 10% to (-)10% in steps of 1.25 %
vi)	Vector Group	Dy-11
vii)	Primary connection	Delta

- | | | |
|-------|--|--|
| viii) | Secondary connection | Star |
| ix) | Impedance | 6 % |
| x) | Temperature rise limits
oil (measured by thermometer) | 50 0 C ambient |
| xi) | Winding (Measured by
resistance method) | 50^C above ambient |
| xii) | 1 minute power frequency
with stand voltage for
windings and bushings.(KV-RMS) | For HV side- 70 KV
For LV side- 10 KV |

Noise level

Tap changing method ON LOAD tap changer with
automatic voltage regulator.

- | | | |
|-----|---------------------------------------|---|
| xv) | 1.2 M.S. impulse withstand
Voltage | For HV side – 170 KV
For LV side – 40 KV |
|-----|---------------------------------------|---|

Fittings as under shall be provided with each power transformer.

**ON LOAD tap changer (as per IS 8468 – 1977) with automatic voltage regulator
& RTCC panel**

Conservator with all accessories

Magnetic level gauge with alarm contact.

Explosion vent with diaphragm.

Air release vent.

Buckholz rely with alarm and trip contact.

Inspection cover on tank cover.

Oil samples valve.

Oil drain valve.

Filtering connection

Two ground terminals on tank]

Lifting lugs for transformer

Pulling eyes.

Lifting lugs or eyes for cores and winding

Bi-directional rollers.

Dial type temperature indicator and winding temp. indicator with alarm and trip contacts.

Resistance type oil and winding temperature indicator with alarm and trip contacts (For indication on scanner panel)

Winding diagram and rating plate.

Weather proof control cabinet/Marshalling box for all control cables/wiring.

Cable end box on HV side and LV side suitable to accommodate cable size stated in cable schedule.

a) Cooling arrangement with detachable radiator

b) Thermometer pocket.

c) Remote control tap changing arrangement.

d) Interlocking facility for electrically operated on load tap changer with manually operated system with lever (only one system work at a time)

e) Dehydrating breather with silica gel.

f) First filling of good tested transformer oil to full capacity.

Third Party Inspection for Transformers

The Transformers shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Tests to be performed for Transformer.

a) Review of raw material test certificates and quality control procedure.

b) Load & no load losses.

c) Routine test for all.

d) Temperature rise test for one random transformer.

e) Type test including impulse test for one random transformer.

Item No-23- 33/0.433 kV Station Transformers

The transformers shall be **33 / 0.433 kV, 160 kVA** capacity rating, **energy Efficient type Level-II** as per IS 1180 / 2014 (Part 1), copper wound, oil immersed, naturally cooled & suitable for outdoor installation. It shall be designed, manufactured, supplied to fulfil requirements of the specifications and to render satisfactory trouble free operation. Transformers shall be suitable for parallel operation. The load and no load losses shall be limited as per IS and norms issued by MSEDCL whichever are lower. The short time overload rating shall be conform to relevant IS **with SCADA Computable**.

TANKS

Transformer tank shall be manufactured from high grade steel plates suitably reinforced by providing stiffeners of structural steel. Tank shall be provided with lifting lugs, so located that safe clearance is obtained between sling attached to the lifting lug and transformer fittings without use of spreader. Main tank drain valve shall be provided with flanged connection at the bottommost location of the tank to ensure complete drainage of the transformer oil. One filter valve, at the top and one drain valve at the bottom of the tank shall be provided. The tanks shall be constructed as to prevent collection of water at any location. The bottom and cover thickness of plate shall not be less than 6 mm and that of side shall not be less than 5 mm. All gasketed joints on the tanks such as main tank cover, bushings, mounting and other bolted attachments shall have high quality neoprene gaskets and so designed that the gasket will not be exposed to the weather. If necessary, suitable stops shall be provided to prevent crushing of the gasket due to over tightening. **Tank lifting hook & cover lifting hook – 2 Nos each.**

TRANSFORMER CORES

The cores shall be constructed from high grade cold rolled grain oriented silicon steel laminations. The operating flux density shall be of the order of 16.5 x 17 Kilo lines/ Sq cm. The design shall provide tank mounted core and the use of core bolts shall be totally avoided for securing the core to the tank. Suitable arrangement shall be provided for lifting the core and winding for inspection.

WINDINGS

The transformer windings shall be made using electrolytic grade copper conductors. The insulation of transformer windings and connections shall be of insulating paper. The material used for winding insulation shall not shrink, disintegrate, carbonize or become brittle under the action of hot oil. While copper conductors are being covered with paper, care shall be taken to avoid Head Worksage to the paper layers due to sharp edges etc.. Completed windings shall be subjected to shrinkage treatment before assembly on the core.

Tappings shall be provided at such on the windings so as to preserve, as far as possible, the electromagnetic balance of the transformer at all voltage ratios. Joints carrying shall be riveted and soldered or riveted and brazed. No joint shall be made in the disc of the windings. The windings shall be suitable for withstanding the short circuit current in the even of fault without Head Work sage. Adequate insulation shall be provided between the windings and core / tanks wherever the specified minimum clearance in oil is difficult to obtain.

RADIATORS

Radiators shall be either tubular or plate type. Each radiator shall be provided with air releasing plug, isolating valve and drain valve. The radiators shall withstand the pressure tests specified for the tanks to which these are fitted. Radiator earthing shall be as per IS:3043-1982.

CONSERVATORS

Conservators shall be fitted with filling hole with cap and drain plug. Each feed pipe from the conservators shall be connected to the highest point of any part of the transformers and associated equipment to which it may run. A dehydrating breather shall be fitted to the conservators. The breather shall be designed to ensure that external atmosphere is not in contact with the dehydrating agent. The transformers shall be supplied with first filling of dehydrating agent. Conservators shall be provided with magnetic oil level gauge on one face and prismatic oil level gauge on other face and which shall be clearly visible from ground level.

BUSHINGS

The bushings shall be of solid porcelain or oil filled porcelain type. The bushings shall have continuous metal stud or tube from end to end making intimate contact with either solid or liquid dielectric at all points throughout the length. Porcelain used for insulator shall be of best electrical quality, sound, free from defects and thoroughly vitrified so that glaze shall be smooth and of uniform brown shade and shall completely cover the exposed parts of the insulators. The protected creepage distance shall be at least 50% of the total creepage distance.

TAP CHANGERS

The tap changers shall be off circuit type electrically and mechanically rugged and arranged to provide for convenient tap changing. Tap position indicators shall be positive and there shall not be any ambiguity resulting into incomplete tap changer position with respect to the mechanical tap position indication . The operating handle of tap exchanger shall be brought out of the tank at the side at an accessible height from ground level. Tap changer operating switch mounted on the top of the

transformer tanks will not be acceptable. Provision of padlocking the tap changers without interfering with visual tap position indicator shall be provided. The tap changers shall be provided with a micro switch arrangement to issue trip command to the breaker disconnecting the transformer from source of power in the event of an inadvertent attempt to change the taps when transformer is on load.

TEMPERATURE INDICATORS

Transformers shall be provided with oil temperature indicators which shall register the temperature of the top oil in the transformer tank. Indicators shall be housed in the marshalling box of the transformer. The connection between the temperature sensing element and the temperature indicator located in the marshalling box shall have adequate mechanical protection.

CABLE ENDBOXES

Transformers shall be provided with air insulated type cable end boxes with disconnecting chamber with **SS fasteners**. Cable end boxes shall be suitable for accommodating the termination / glands of appropriate size & suitable for withstanding the short circuit current of the corresponding system for one second duration. The minimum phase to phase and phase to earth clearances in the cable boxes shall be as under.

For 433 Volts

Phase to phase 50 mm

Phase to earth 25 mm

The cable end boxes shall be fully weather proof in construction, with provision of suitable gaskets on the joints of covers. Suitable canopy shall be provided on the boxes to prevent entry of rain water through the joints. Necessary inspection covers shall be provided on the cable boxes and disconnecting chambers so as to access to the bushing connections.

INSULATING OIL

The transformer shall be supplied with new, filtered and tested transformer oil duly filled. The insulating oil shall conform the IS:335. Approximately 10% excess oil shall also be supplied to account for loss.

TRANSFORMER FITTINGS

The fittings to be provided on the transformer shall include the following among others and shall be as per IS:3639-1966.

- a) Off-load manual tap changing switch extremely operated specified and positioned on side of transformer accessible from the ground level.
- b) Conservator with drain plug, filling plug as specified

- c) Explosion vent with diaphragm
- d) Air relief vents
- e) Inspection cover on the tank covers for all transformers
- f) Following valves shall be provided.
 - i) Oil sampling valve One No.
 - ii) Oil drain valve One No.
 - iii) Filtering Valve One No.
- g) Grounding terminals, two for the transformer tank for clamping to grounding grid connections.
- h) Lifting lugs or eyes for the cover top part of tanks cores and soils and for the complete transformers.
- i) Pulling eyes for pulling the transformer parallel to and at right angle to the axis of bushing.
- j) Diagram and rating plate of transformer
- k) Bidirectional Rollers
- l) Thermometer pockets with dial type thermometer for top oil temperature indication. The thermometer shall be clearly visible from ground level as specified and
- m) Weather proof control cabinet
- e) Dehydrating breather with silica gel.
- f) First filling of good tested transformer oil to full capacity.

All fasteners shall be of SS.

RATING

Capacity required _ **160. kVA.**

Quantity As per BOQ

Number of phases 3 Three

Frequency _ 50 Hz.

Number of windings _ Two

Type of cooling _ ON

Max. system voltage _ 33 kV

Transformer ratio _ 33 kV/433 Volts

Specification _ **IS : 1180:2014Part -1**

Method of connection

Primary _ Delta

Secondary _ Star

Vector group _ Dy.11

Impedance at rated kVA _ 4%

And corrected to 75°C for

Neutral Earthing The neutral of the secondary winding brought out through an appropriate connection to earthing system

Tapping Off circuit taps from -12.5% To +2.5% on the primary side in steps of 2.5%

Installation Outdoor

Tolerance in impedance + 10%

Temperature Max. temperature for oil (measured by thermometer shall not exceed 45°C and of windings (measured by Resistance method) shall not exceed 50°C

Terminal details

Cable end box on HV side and LV side suitable to accommodate cable size stated in cable schedule. outdoor type suitable for three and half core of required size PVC armored cable with brass compression cable ending gland with suitable disconnecting chamber (marshalling box)

Noise level Less than 80 db

Earthing Grounding terminal with clamps suitable for connecting to the grounding grid to be provided for transformer body earthing.

Third Party Inspection for Transformers

The Transformers shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative, SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Tests to be performed for Transformers

- a) Review of raw material test certificates and quality control procedure.
- b) Load & no load losses.
- c) Routine test for all.

Item No-24- HT Capacitor Bank for Motors, APFC Panel & Transformer.

All motors shall be provided with capacitors for improving power factors to 0.99 lagging as normal duty condition. However, KVAR selected shall not exceed the magnetizing KVAR of the motor, even if corrected P.F. is less than 0, the lagging calculations shall be suitable for operation at rated voltage and shall be connected in respective power circuit of the motor. The capacitor bank shall be complete with structure, connection each wise, discharge resistors etc. The capacitors shall be low loss metalized polypropylene and craft paper insulated foiled type impregnated with

chlorinated biphenyl or mineral oil. The capacitor rating shall be subject to prior approval on furnishing letter from motor manufactures stating magnetizing KVAR and uncorrected PF at rated power required by the pump. The capacitors shall be tested up o 4.2 KV. The capacitor rating shall be subject to prior approval on furnishing letters from motor manufacturer stating magnetizing KVAR and uncorrected PF at rated power required by motor.

Separate cubicle shall be provided for mounting capacitor banks with separate HRC fuses each bank. Total 8 Nos. capacitor banks (For Motors – 6 Nos &are to be provided and connected to power circuits of 3.3 kV motor control switchgear panel through suitably rated HRC fuses and Vacuum contactor Panel as specified under above item. 3.3 kV Bus connector of each capacitor shall be totally enclosed type and provided with suitable rating CT and pedestal mounting ammeter with SS to measure Amp. rating of each capacitor individually.

Third Party Inspection for APFC Panel & Capacitors

The APFC Panel &Capacitorsshall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

Tests to be performed for APFC Panel

- a) Review of raw material test certificate and quality control procedure.
- b) Routine test.
- c) High voltage test.
- d) Insulation resistance test.

Tests to be performed for HT Capacitors

- a) Review of raw material test certificate and quality control procedure.
- b) Routine test.
- c) High voltage test.
- d) Insulation resistance test.

Item No-25-a-Electric Operated Travelling Crane.

EOT Crane 10 Tonne working Capacity& 1.50 MT tested capacity Electric Operated Circular or Rectangular Travelling Crane (double Girder) type with 15 m span & with 12 m lift complete with wire rope hoist, class II duty.with all accessories shall be provided of approved make by MJP.

Functional requirement of the crane are as under:

To lift complete weight of the pump or motor from any point in the pump house the operation shall be electrical, lift of hoist rope should be 12 mtr. Minimum.

The travel longitudinally along entire length of 30 mtr of the pump house including loading / unloading bay. Operation shall be electrical.

To travel across entire 15 m nominal pump by span Operation shall be electrical.

The sub-work includes

ISMB and ISMC of adequate sections not less than ISMB 350 and ISMC 200 if square bar is used as track covering entire longitudinal travel and mounted on RCC corbel with necessary anchoring etc.

50 mm x 50 mm square bars or 30 pounds/yard rail sections.

Bridge girder mounted on track wheel and end carriages.

Motorized mechanisms (Hoist speed limit of 4 mtr. / minute)

Electric wire rope hoist suitable for 12 mtr, lift.

Trolley and hoist

Push button operated pendant with control cable to operate crane from floor level of pump house.

Control gear and switch gear including earthing.

Mercury/Sodium vapour lamps on crane girder or end carriages to illuminate area particularly while pump erection / dismantling.

Micro speed of crane say 0.40 mtr/Min. shall be provided in hoist.

Key operated pendent main switch for additional protection shall be provided.

Make of the motor shall be MJP approved make or may be different than approved make but suitable for crane duty.

Material of hook shall be forged steel / EN-9.

Minimum capacities of crane ISMB square bars/rail section are stated above. It shall be the responsibility of the tenderer to design and provide higher capacities if the heaviest load of the equipment to be handled need so without any extra cost.

The crane shall generally conform to IS: 3177 and IS: 807.

BRIDGE, RAILS AND SUPPORTING RSJS

The bridge girder shall be designed to carry 12.50 ton load at any position during travel. The wheels of end carriage shall be machined and shall have flanged on both sides. The end carriage shall be driven by common shaft extending full span for longitudinal travel power to end carriage shall be through reduction gear box.

The rail shall be either square bars not less than 50 mm x 50 mm or equivalent rail section. The rail/square bars shall be secured on supporting ISMBs with all required fasteners' and end stops to prevent over travel.

The ISMB sections shall be secured on the provided MS plate on RCC corbels.

TRAVELLING TROLLEY AND HOIST

The travelling trolley shall have single flanged 4 wheels and shall be mounted on bridge girder. Suitable sops shall be provided to prevent over travel of trolley. The hoist shall be mounted below travelling trolley. The joist shall incorporate swivel hook with ball and roller bearing.

REDUCTION GEAR BOX

The reduction gear boxes shall be of robust construction and for arduous duty. They shall be fully enclose with oil level markings for minimum and maximum levels. The bearing shall be ball and roller type and taper roller bearings shall be provided where thrust loads are to be sustained.

BRAKES AND CLUTCHES

Automatic electro-mechanical brake system shall be provided for hoisting motion. The hoisting motion shall have limit switches to stop motion automatically at upper and lower limits. Electro-magnetic clutches or similar safety device shall be provided on all power transmission system to disengage the motor in case of over loading and obstruction.

MOTOR

The electric motors shall be totally enclosed fan cooled with enclosure conforming to IP-55 or superior. They shall be squirrel cage induction 230 V/415 V A.C. supply with class-F insulation. The motor shall preferably be foot mounted and shall be designed for S.5 duty as per IS: 325.

SWITCH GEARS, CONTROL GEAR AND ELECTRICAL WORKS

A panel fabricated from mild steel sheet of 2.0 mm thickness and down shop leads shall be provided to meet the functional requirement of the crane. The essential features shall be as under:

Reception and distribution of power for Electric motorized operation.

Control gears for start and stop the motors with reversing contactor.

Operation of hoisting motion including reversing motion by means of suspended mobile pendant set for operation from pump floor level at RL 16 m

Limit switch for automatic stop of hoisting motion.

Earthing arrangement

L.T.cable as required

Holder and bulb fixture should be provided on trolley, so as to travel with trolley for required illumination at work site.

EOT crane shall have optional alarm arrangement while travelling from one place to another and during lifting and lowering of loads.

Material of Construction

- Material of construction for components shall be stipulated below or superior.
- Structural steel conforming to IS 808.
- End carriage steel to IS:2061

- Track and trolley wheel carbon steel casting IS:1030
- Hooks steel to IS: 1875/Forged steel.
- **DSL arrangement**
- For the above crane along longitudinal travel 3 phase neutral slip ring type colour code bus bar with current collector box. Electrically operated single girder, rectangular overhead travelling crane with 8 mtr. lift with wire rope hoist class-II duty, all three motions electrically operated by suitable rating motor IP-54 control panel and down pendant control block.

Testing

The EOT Crane shall be offered for factory test in presence of Superintending Engineer (Mech.) or his representative or SMC Engineer and third party inspection agency approved by MJP and shall bear all expenses including testing fee etc.

The scope of third party inspection of EOT crane by the agency approved by MJP is as under.

- a) Review of raw material test certificate and quality control procedure.
- b) Operation test
- c) Deflection test.

Item No-26 a - Fullbore Battery operated Electromagnetic Flowmeter

The full bore Electro Magnetic Flow Meter shall be designed, manufactured and calibrated according to internationally accepted ISO standard having by directional flow measurement and totalisation facility and total measurement accuracy as $\pm 5\%$. It shall be **1000 mm dia** to be installed on existing raw water rising main near pumping station. The location of flow meter shall be finalized in consultation with SMC Engineers. Meter shall be installed on Straight pipe length of 5 D or more on upstream side and 2D more on downstream side of meter is necessary. (D is diameter of flow meter) The flow meters shall be installed so as to have a laminar flow with pipe running full. The manufacturer of flowmeter should have ISO 9001 certification. The Magnetic flow meter shall be microprocessor based with integral and or remote electronic as applicable. The flow meter should perform without any disturbances by

line pressure (variation in line pressure) The lining material shall be hard rubber suitable for safe drinking water. The remote mounting transmitter installed up to 150 m. long should not require signal booster between sensor and transmitter. The flow sensor length shall be strictly according to length specified by ISO- 13359. The meter shall be suitable for input battery power. The transmitter shall have one scalable output and one current 4-20 mA isolated output. The display unit shall be with 2 line LCD display for indication of actual flow rate, forward and reverse flow direction and total flow. The protection category for sensor shall be IP-68 the transmitter shall be IP-67. The converter come transmitter should be fully programmable. The programming shall be user friendly, self prompting menu driven. The totalizer valve shall be protected by EEPROM during the power out stage and utilize an over flow counter. The display shall be capable of indicating error message such as Empty pipe condition, error condition, low flow, cutoff, A lamination chart stating type of error shall be displayed adjustment to the display unit. The transmitter shall have one built in totalizer such as forward and reverse direction and total flow. The flow sensor will be mounted in the field of water in sensor. The sensor should have fully welded/ bolted construction and epoxy painted. The meter body shall be flanged type. The meter must have a full perfect grounding arrangement In addition to above requirement the detailed specifications are tabulated as below.

Component :-

Sensor :-

Sensor body should be with epoxy painted and flow measuring to tube shall be off SS-304 having IP-68 protection with flanged of carbon steel up to PN-3 rating. Sensor coil housing shall be epoxy painted / powder coated, carbon steel / cast aluminum with IP68 The transmitter housing shall be cast aluminum with IP-67

Transmitter :-

The transmitter shall have one scalable pulse output, one current (4 mA- 20 mA HART / MODBUS or Similar protocol) isolated output- 1.00 No. The current out put shall be galvanically / optical isolated. It shall be fitted with switched mode power supply capability of 85- 250 V AC and 45-55 Hz to cope with power transients without Head Worksage.

Cable :-

Coaxial signal and power cable of 25 M each in length per flow meter shall be provided. Sensor / transmitter cable shall be of suitable size and shall with stand the entire transmitting load as per manufacturing standard practice. Minimum 50 mm GI

pipe of length 25 m shall be used for laying the cable with suitable digging and concealing the duct.

UPS :-

UPS working on 230 V AC, 50 Hz. Power supply suitable for 12 hours continuous operation- for each flow meter -1 No. On line UPS with VRLA (valve regulated lead acid) maintenance free battery and in built battery charger with life of 3 years (Three years)

Data storage capacity with built-in or separate for date, time actual flow rate, totaliser and error messages if any with storage capacity of 120 days at 60 minutes interval data logging –1 No. This device shall be placed in appropriate cabin box having protection of IP-68 class.

24 Pin, 180 column **Dot matrix printer of EPSON**, WIPRO or Hewlett packard make with printer interface unit for printing of stored data as per Item No. D-2-1.00 No.

Suitable surge suppressor (arrestor) for protection from lightening on incoming signal cable and power supply cable of meter-1.00 Set.

Suitable over voltage protection unit for protection of instrument from higher voltage.

Working conditions and Specifications:-

Water Temp: 10 Deg. to 50 Deg.

Water quality: Raw water, turbid in nature or potable chlorinated water.

Operating pressure: 0-30 Kg/Sq cm.

Pipe line MOC: CI, DI, MS with / without mortar lined, non- metallic pipes, HS & PSC.

Pipe condition: Pipe shall be running full.

Full- Bore Bi- directional Electromagnetic flow meter shall be designed, manufactured and calibrated to international standards with accuracy of + 0.50 % of reading.

The manufacturer should have ISO-9001 accreditation and fully traceable calibration methods to either of the two primary standard means of testing mass(ISO-4185) or volume (ISO-8316)

The meter shall be wet calibrated at the place of manufacturing with 3-point calibration at sufficient flow meter rates. The in house testing facility shall be duly accredited in accordance to ISO-17025. The calibration shall also be carried out at CW PRS / FCRI / DEMI

The sensor shall have standard length as per ISO-13350.

The sensor shall have built in stainless steel grounding electrode and and empty pipe detection. Any ground probes, rings, flanges or straps will be strictly not acceptable. The sensor and transmitter shall be capable of working in tropical environment.

The flow meter shall be suitable for both submergence as well as burial installation and shall with stand all necessary natural shocks.

The transmitter and sensor shall not have any EMI interference in the actual flow meter reading.

The liner material shall be either certified hard rubber (HR) with drinking water approval or polyurethane (PU) and Teflon.

The meter body shall be flanged or with custom connector as per the requirement. Water designs will not acceptable.

The housing of flow meter shall be Die Cast Aluminum/ Painted steel with suitable anti corrosives paint.

The Transmitter wall mounted type with a 2 line display for the indication of Actual Flow Rate and Totalized value. The material enclosure shall be sufficient to guarantee 5-yearsoperatio life.

The Transmitter shall be capable of fully programmed with push button/ using HART communicator. It shall have a set up menu so that relevant parameter may be user – set from self-prompting driven menu. The repeatability shall be 0.1 % or reading or better, minimum + 0.5 mm /s. The flow meter shall be provided with remote display suitable without and signal booster / amplifier for distance up to 150 m for online MIMIC.

Manufacturer's Guarantee, Certificate and Training. :-

The flow meter shall be supplied with manufacturer's test certificate as per International standards given above, calibration certificate 36 months comprehensive guarantee for the trouble free performance and giving adequate training for handling Dispatch documentary from flow meter manufacturer with serial No. Model etc. of each flow meter is essential without which flow meter will not be accepted and payment will not be made.

Field Testing :-

The flow meter shall be tested at site after installation and satisfactory Commissioning. The testing shall be carried out in presence of Engineer-in-Charge. The accuracy of the flow meter shall be compared by installing calibrated portable flow meter (with

validity of calibration with 6 month) and also by volumetric measurement wherever possible. The necessary charge for all the testing and inspection shall be borne by the contractor. The contractor shall have to make all necessary arrangement for field testing with required equipments, tools and tackles without any extra cost.

Erection work

The contractor shall dismantle or cut the pipe line i.e. rising main at site of work and as directed by MJP Engineers and shall be fix the meter in engineering manner with required sundry materials etc. complete The flow meter is connected to the both end with concentric F taper of required size as per IISCO catalogue specifications. The work shall carried out as per instructions of Engineer - in – charge. The layout drawing of fixing water meter and flanged specials shall be got approved before manufacturing from the Engineer -in - charge.

The offered water meters are to be manufactured in accordance with ISO: Standards and. Certificate of compliance from designated Labs for is to be submitted along with the bid, if the certificate is in regional language, a translated copy in English language shall be submitted along with the bid. Bidder shall submit the web site details of the lab where the certificate can be traced by online retrieval process. In case the lab does not publish this details on their web site, bidder shall furnish the original copy of the certificate to the evaluation committee for verification, original certificate, will be returned back after due verification. Attested / Notarized copies of certificates will not be treated as original copies. Falling to compliance the bid may be treated non-responsive or would be liable to be rejection.

The offered system shall have the facility to record the reverse flow and the same shall be reflected in the software system.

The Flow Meters will be then run with reverse flow and bidder will take remote readings for reverse flow and show the quantum of reverse flow on the computer screen/ Hand - held Unit. Even after reverse flow, the dial reading of meter and remote reading shall match. Bidder will download the readings on P.C. and list out the recorded readings.

After the testing the meters will be left under submerged condition for 48 hours after which the same test will be repeated to verify that the performance is not affected.

The literature, Leaflets, certificates and all other relevant documents giving the details on meters and list/ details of meters supplied during last two years should also be furnished along with tender. If any certificate / supply orders are in language other than English the English translated version of the same will have to be submitted.

Flow Meter Transmitter Panel

This job includes providing, fixing of flow meter transmitter to internal walls of building in a suitably designed panel cabinet with proper locking arrangement with heavy duty Godrej lock and triplicate key with glass window on frame door for seeing the readings of flow transmitter and data logger without opening the panel cabinet. It should house complete ancillaries and including the provision for connection of electrical power supply from near by apparatus. The panel cabinet shall be pre wired and with suitable gland entries.

Item No-26-b- Chamber for Flowmeter 2.1 x 2.1 x 1.8

Chamber with precast RCC covers ,constructing B.B. masonry valve chamber with 15 cm thick 1:3:6 mm proportion PCC bedding including excavation BB masonry in cm 1:5 proportion pre cast RCC frame and cover etc. comp as directed Engineer-in-charge. Size 1.5 x 1.5 internal size and depth upto 1.5 meter with precast RCC slab cover.

Item No-27- Internal & External Electrification

The item includes electrification to the pump house internally & externally.

Sr.	Descripton of Item	Qty	Unit
1	GI Pole 80mm dia -6M- supplyng and erecting isi mark G.I pipe pole B class grade 80 mm dia. 6 mtr long with pole cap,base plate in provided foundation as per specificationoint	8	Nos
2	St Light Bracket- supplyng and erecting street light bracket made from 40 mm.dia B class G.I.pipe ,0.6m. In length along with pole cap of 300 mm length and duly welded with provided leads as per specification	16	Nos
3	LED Fitting- Supplying and erecting LED street light fitting suitable for above 70W- 75 lamp, including lamp, with PF > 0.95 class IP 65 and above Housing of pressure die cast alluminium alloy and heat sink extruded alluminium complete per specification No FG-ODF/	16	Nos

4	MH Fitting -supplyng and erecting street light fitting suitable for 70 W metal halide lamp complete with accessories on provided bracket as per specificationc	8	Nos
5	MH Lamp 70Watt -Supplying and erecting Metal halide lamp double ended 230 v,70 W	8	Nos
6	Armoured cable -Supplying and erecting approved make 1x2x2.5 sq.mm copper armoured cable	200	mtr
7	Terminal Box -Supplying and erecting water tight terminal box of 1.6 mm.(16 gauge) CRCA sheet of size 200x150x150 mmcomplete on pole as per specification	8	Nos
8	MCB-32 Amp -Supplying and erecting and marking DP MCB 6 amp-32 amp B series, for lighting in provided distribution board as per specificationbody,	8	Nos
9	DP MCB 63 Amp -Supplying and erecting and marking DP MCB 40 amp-63 amp B series, for lighting in provided distribution board as per specificationbody,	3	Nos
10	Mains -Supplying and erecting mains with 2x1.5 sq.mm FR. Copper pvc insulated wire laid in provided conduit/trunking/insidepole/bus bars or any other places as per specifications	200	mtr
11	Earthing -providing earthing with galvanised cast iron earth plate size 60x60x0.6 cm complete with all materials,.	2	Nos
12	Point wiring -point wiring for light/fan/bell in 20mm rigid PVC conduit with 1.0 sq mm FRLS grade copper wire with flush type switch and required accessories etc	30	points
13	Plug wiring -wiring for plug on board with swith socket with copper wiring and earthing	10	Nos
15	Socket -Supplying and erecting ISI mark flush type shock proof plug socket 6 pin 6 amp and 16 amp with swith 16 amp combined unit erected on filled poly proplyne ISI marked (IS.14772-2000)board or double wooden block/3 mm thick hylm sheet/4 mm thick ply wood pasted with 1.5 mm thick sun mica etc complete	5	Nos
16	Copper wire -supplyng and erecting annealed bare copper wire of high purity of different sizes used for earthing on wall with necwssary copper clamps fixed on wall/cable/conduit with screws	3	Kgs
17	Ceiling Fan -supplying and erecting regular/ standard model ceilling fan of 1400 mm sweep complete erected in position	2	Nos
18	Pedestal Fan -Supplying, pedastal type air circulator 600 mm sweep oscilating type sutable to work on 230 volts,50 cycles 1440 RPM with speed regulator,over head protection unit totally enclosed flame proof motor with additional 3 core wire 5 mtr length and hand shield type 3 pin 6 amp plug top complete with moisture proof treatment and E class insulation and marking of approved make	8	Nos

19	Supplying, installing, testing & commissioning of 1400 VA Digital pure sine wave inverter based on IGBT technology single phase 230V,50 Hz complete as per specification no.AP-INV (Without batteries)	1	Nos
20	Supplying and erecting 12 V/150AH TUBULAR Battery with battery terminal wire, duly charged complete with 36 months warranty complete	2	Nos
21	Supplying and erecting Exhaust fan heavy duty 230 V , A.C. 50 cycles 450 mm, 1440 RPM complete erected in position	6	Nos

Point wiring

Point wiring for light/bell & independent plug with ISI mark 2-1 sqmm. 1100 V grade PVC insulated, Fire Retardant grade copper wire in 20 mm dia. ERW H.G. steel conduit of 16 gauge with ISI mark duly painted with 2 coats of good quality approved shade enamel paint erected on wall/ceiling with 3mm. x 20mm .M.S spacers & G.I saddles screwed & with 12 SWG G.I / 1.50 Sqmm. Bare copper wire clamped to conduit with 22 gauge 10 mm. width copper earth clips at every one meter length & at ends joints with ISI mark piano type 6 Amp. Switch/bell push erected on Filled polypropylene ISI marked board or polished double wooden or 3 mm. Thick hylam sheet hylam sheet / 4 mm. Plywood pasted 'sunmica with hickness not less than 1.50 mm. with S.M. Screws & ISI mark ceiling rose batten / slanting holder on PVC block / junction box of ISI mark erected with S.M. screws.

LED Flood Light Fitting

Supplying and erecting ISI mark LED flood light luminaries suitable for use with 70 watt with LED lamp. The luminair comprising and having made of die cast aluminium of low copper contact to offer high resistance to corrosion and to accommodate the optical system consisting of Aluminum electro chemically brightened and anodized. glass retaining frame made of die cast Alluminium is provided to hold glass cover in osition and is hinge able to main housing and this facilitated to replace the lamp easily complete with control gear box suitable for 70 watt LED lamp

Metal Hallied Lamp fitting-

supplyng and erecting street light fitting suitable for 70 W metal halide lamp complete with accessories on provided bracket as per specification

Metal Hallied lamp 70Watt

Supplying and erecting Metal halide lamp double ended 230 v,70 W.

MCB

Supplying, erecting & marking miniature circuit breaker of single pole breakers 6 A to 32 A in provided distribution boards with required wiring connections and lugs etc for distribution of circuits as shown in diagram

Street light bracket

Supplying & erecting street light bracket for erection of side entry W.P. LED. fitting / M.V. fitting / Sodium Vapour fitting made from 40 mm. dia. 'B' Class G.I. Pipe, along with necessary nipples, reducers etc. if required 1.20 m. in length welded to pole cap 4 mm. thick, 30 cms. in length of suitable dia. On top of the pole with 15 cms. welded corner support of suitable size of MS sheet 3 mm. thick complete erected with 6 mm. dia. set screws duly painted with one coat of aluminum paint complete. erected with provided leads.

Plug Socket

Plug socket 6 amp & 16 amp (6 pin) with 16 amp

G.I. Pole

Supplying & erecting ISI mark G.I. pipe pole 'B' grade 75 / 80 mm. dia. 6 mtr. long complete with 75 mm. Deep pole cap and MS. / C.I. base plate of size 30 x 30 x 0.60 cms. welded at the bottom and duly painted with two coats of red oxide paint and one coat of bituminous paint for the 1 / 6 thick. length to be embedded in ground and muffing (Square/round) and two coats of silver paint for the remaining portion and complete erected in provided C.C. foundation & muffing (Square/round) with welded earthing stud.

LED Street light fitting

Supplying & erecting street light 150 Watts LED lamp fitting with lamp having deep drawn one piece aluminium body nickel chrome plated reflector with clear acrylic cover and necessary control gear & ignitor etc. with necessary wiring complete with accessories such as copper wound choke, condenser etc. Marking serial number and date of erection.

Street light bracket

Supplying & erecting street light bracket for erection of side entry LED fitting / M.V. fitting / Sodium Vapour fitting made from 40 mm. dia. 'B' Class G.I. Pipe, along with necessary nipples, reducers etc. if required 1.20 m. in length welded to pole cap 4 mm. thick, 30 cms. in length of suitable dia. On top of the pole with 15 cms. welded corner support of suitable size of MS sheet 3 mm. thick complete erected with 6 mm. dia. set screws duly painted with one coat of aluminum paint complete. erected with provided leads.

Terminal box

Providing and erecting street light terminal box of 16 swg. CRCA sheet 200 x 150 x 150 mm to erect suitable kitkat, etc. complete on provided G.I. pole.

Cable, 1.5 Sq.mm

Supplying & erecting 2 core 2.5 Sqmm. PVC armoured Aluminium conductor cable 1100 volt. Grade with ISI mark twin core solid / stranded aluminium conductor with 6 mm. thick 25 mm. width M.S. spacer with G.I. earth wire 6 Sqmm. complete erected on wall / on pole with 25 x 3 mm. M.S. clamps or in provided trench in an approved manner.

DP MCB

Supplying and erecting and marking DP MCB 6 amp-32 amp B series, for lighting in provided distribution board as per specification body.

Bare copper wire

Supplying and erecting annealed bare copper wire of high purity of different sizes used for earthing on wall with necessary copper clamps fixed on wall/cable/conduit with screws.

Pedestal fan

Supplying, pedestal type air circulator 600 mm sweep oscillating type suitable to work on 230 volts, 50 cycles 1440 RPM with speed regulator, over head protection unit complete

Exhaust fan

Supplying and erecting Exhaust fan heavy duty 230 V , A.C. 50 cycles 450 mm, 1440 RPM complete erected in position

Note :- All fittings shall be of Energy Efficient only.

Item No-28- Tools & Fire Fighting Equipments

The contractor has to supply following meters/instruments/Tools./safety equipment/Spares/Water Cooler and Furniture of standard specification

Sr.	Description of items	Qty	Unit
1	D.E. Fix spanner set 12 piece 6-32mm	1	set
2	Ring spanner set 12 piece 6-32mm	1	set
3	Ball pen Hammer 800 gm	1	no
4	200mm cutting plier	2	nos
5	Adjustable wrench 250-30 mm	2	nos
6	Pipe wrench 450-60 mm	1	no
7	Pipe wrench 600 - 60 mm	1	no
8	Screw driver 6x300 mm	2	nos
9	Screw driver 8 x 200 mm	2	nos
10	Screw driver 5-200 mm	2	no

11	Screw driver 5 x 300 mm	2	no
12	Screw driver with tester 3.6 x 60 mm	2	nos
13	Hack saw frame 300 mm size with blade	2	nos
14	M.S. Tool box	2	nos
15	Chain pipe wrench IS 54123 -- 210 - 4"	3	nos
16	Chain pipe wrench IS 54123 -- 210 - 6" Each	4	nos
17	Hydraulic flip flop crimping tool suitable for 6 to 500 sq mm size cable lugs (Usha- Ismail or similar make)	1	nos
18	Insulation tester (Megger)-2000 mega ohms	1	no
19	Earth Tester- 4 terminals of range 0-10-100-1000-10000 Ohms	1	No
20	Tong tester	1	no
21	Engineer's precision steel level of size 300 mm	1	nos
22	Tubular box spanner set 8 pieces	2	nos
23	Vibration meter digital	3	No
24	Supplying and erecting ultra violet storage type water purifier with softener for safe drinking water consisting of UV germicidal tube of 8W capacity choke made of copper wire and two indicator lamps with output of purified water 8 Ltr/min with activated carbon filter and softener operating on 230 V single phase A.C. supply.	2	No
25	Laser tachometer Digital non contact type	3	No
26	Digital Temperature sense Gun Type	2	No
27	Digital Thickness gauge meter	2	Nos
28	LED Chargeable Search Light	3	No

Item No-29-Test & Trial

The contractor shall carry out operation and maintenance of pumps and the relevant works involved in the scope of this item for Five Years.

The intention of carrying out operation & maintenance through contractor is to operate the pumps as per the requirement, impart training to the staff in a systematic manner, so that the starting and stopping of pumps is done methodically, the records are maintained, checks, routine maintenance which shall be as under.

1. Operation of all pump, motor, valve and supply water as per the requirement of department.
2. To maintain all records i.e. logbook, for operation and maintenance.
3. To monitor all parameters such as pressure temperature, substation equipments and for all other systems specified in the tender.

4. To carry out routine checks water level, operation of equipments noise, vibrations and shall maintain all corresponding records.
5. Carrying out preventive maintenance during above period such as lubrication, greasing, gland cooling abnormal heating of panel, motor, etc checking of loose connections decolourisation of cables, and keep the installation neat and clean dust free.
6. The pump house shall be clean as far possible from leakage water i.e. checking and keeping the drainage arrangement clean and clear removing waste etc.
7. To give training to the operators or to the agency envisaged by the department for smooth O & M.
8. The contractor shall provide log books and all records as directed by the department and shall hand over to the department and safety precautions for emergency situations such as power failure, tripping restarting, abnormal leakages in pump house short circuits sparking fire etc. The contractor shall engage the following staff. (Two shifts per day)
 - a) Operator-cum-Electrician having valid PWD electrical license 1 NO/ shift
 - b) Helpers – 1 No per shift

The contractor shall make suitable arrangement to provide reliever for operator/helper to avail weekly off, without hampering water supply Contact No. of employees engaged with operation and maintenance shall be informed to office Engineer-in-Charge prior to start O & M work.

He shall carry out following duties.

1. **Operate the pump set.**
2. Operate the pumps as & when required to meet the water demand & as per instruction of engineer in charge. **Keep the log book of activities:-**
All activities regarding pumping machinery should be kept regularly i.e. starting time, stop time, voltages, currents, daily P.F. transformer temperature etc. should be maintained.
3. **Carry out preventive maintenance.**
Contractor shall arrange for preventive maintenance of pump, motor, starter, and transformer, all types of valves to avoid the breakdown proper maintenance procedure should be carried and the necessary record should be kept. as required. The tools supplied under the contract shall be allowed to be used for O & M and shall be handed over in good working condition.
Normally the pump is to be operated to required quantity in 24 Hrs. a day.

The contractor shall carry out daily operation of the pumpset to meet the daily requirement of the water as per instruction of Engineer in charge for 2 shifts a day

4. **House keeping, watching & guarding:-**

The contractor shall provide for watching & guarding of premises. He is responsible for any loss of material from our premises.

5. **Rectification of defects:-**

The defects noticed during operation of pumps shall be attended & keep the pumps in smooth working condition immediately. The defects remained unrectified shall be brought to the notice of engineer in charge.

Item No-30-3.3 KV F.C.M.A. Soft Starter for HT Motors

Designing, providing, erecting, commissioning with test & trial soft starter working on flux compensated magnetic amplifier (FCMA) principle suitable to operate 3.3 KV H.T.V.S.S. Motor of 540 KW.

- 1) The High Voltage Soft starter for HT motor will be based on Flux Compensated Magnetic Amplifier principle and shall be installed on the Neutral side of each HT Motor.
- 2) The Flux Compensated Magnetic Amplifier (FCMA) Soft Starter shall be suitable for operation on specified Voltage at 3 ph.,50 Hz. A.C. Supply and suitable for connection to the phase segregated Neutral Terminal Box of the HT motor for Neutral Soft Starter & between DOL Starter and Motor for line Side Soft Starter.
- 3) The rating of soft starter shall be 1 % more than motor rated power and shall be capable of operating satisfactorily with the motor over the entire operating range. The soft starter rating offered shall not be less than the rated KW of the motor.
- 4) The soft starter shall reduce the starting current of the motor at least to 80 % of the direct on line starting current of the motor. The soft starter shall have a facility to further reduce the current upto 50 % of the direct on line starting current if the motor & load torque speed curves permit so. The soft starter shall control the starting torque in such a manner so as to effect smooth starting of the HT motor drive. The Soft Starter shall be provided with suitable rated ammeter to indicate the motor current during starting.
- 5) The Flux Compensated Magnetic Amplifier (FCMA) shall work on the principal of unsaturated core in the working zone and shall not lead to generation of

- harmonics. The L.T. control circuit shall be suitable to operate on 230 V A.C. 50 c/s electric supply.
- 6) The Soft Starter shall be so rated as to allow at least two consecutive starts from cold or four hot start per hour.
 - 7) The Soft Starter shall be designed for supply voltage variation of + 6% and frequency variation of + 3%.
 - 8) The required LT control cable from panel to soft starter is included in cost of item.
 - 9) The windings of the soft starters shall be with insulation class H Max. Temperature of winding shall be limited to that of Class –B.
 - 10) The FCMA Soft Starter shall be housed in a sheet steel enclosure of thickness not less than 14 gauge and painted with corrosion resistive paint such as Epoxy or Polyurethane. The degree of protection shall be IP-41.
 - 11) FCMA The Soft Starter unit shall have anti condensation heater, complete with switch and thermostat. The heater shall have interlocking in such a way that is is switched 'OFF' when motor is in run mode.
 - 12) FCMA The Soft Starter shall not contain any active electronic components.
 - 13) FCMA The Soft Starter shall have a built in facility for run mode bypass so that the incoming voltage to the motor is equal to the supply voltage.
 - 14) The FCMA unit should be Air Natural Cooled.
 - 15) The FCMA Soft Starter shall be dust and vermin proof and suitable for indoor mounting.
 - 16) A suitable by pass arrangement to operate the motor in case of any difficulty with the starter shall be kept.

Selection criteria for H.T. Soft Starter

The H.T. Soft Starter will be selected from the manufacturer satisfying following requirement.

The manufacturer should have designed manufactured tested and supplied "Flux compensated Magnetic Amplifier " H.T. Soft Starters for 3.3 KV motors Item No.2. The Soft Starters of similar or higher rating working on FCMA principle should be satisfactorily operating at different installations including installations at recognized government (state/ central) semi government organizations or public bodies. The tender should submit the certificate of satisfactory operation of the soft starter for at least three years or more.

Also the certificate of suitability of soft starter with motors by any of the reputed motor manufacturer should be submitted. The operational references of H.T. Soft Starter for pump application would be preferred.

Guarantee of Performance :

The equipment should be almost maintenance free and should not produce any harmonics. The tenders should give guarantee of performance of at least 1 year from the date of issue of final certificate from the Engineer-in-charge.

Data Required from Pump / Motor manufacturer.

1. GD of the Work.
2. GD of the Pump.
1. Torque speed characteristics of pump.
2. Torque speed characteristics of motor.
3. Current time characteristics.

Test to be carried out for FCMA Starters

- i) Review of raw materials test certificates & quality control procedure.
- ii) Physical inspection for dimensional check.
- iii) Control circuit operation check.
- iv) Insulation resistance test before & after high voltage test.
- v) High voltage test.
- vi) Temperature rise test for by pass device at rated motor current for 1 hour.
- vii) Fault simulation for testing protection relays except short circuit & earth fault.

SITE TEST.

- i) Insulation resistance check.
- ii) Control circuit test.
- iii) Test to demonstrate achievement of starting current as per specifications.

Item No-31- Automisation System

Multifunction Energy Meter. :- Capture detailed electrical parameters available for power analysis. Detailed measurement of Voltage, Current, Power Factor, Frequency, Demand, Consumption data for each phase minimum 1 record per 15 minute. Measured parameters RMS Voltage per phase (V1,V2,V3), RMS Voltage (V12,V23,V31) , RMS Current per phase (I1,I2,I3), Total kW , Total kVA, Frequency, Neutral Current , Power Factor per phase. Energy parameters:- Total kWh Import , Total kWh , Total kWh Net, kWh Import per phase.

Remote communication :- GPRS/3G/2G for remote web communication as per Indian telecom standards. communication shall be established between Controller and Web based Software via GPRS/3G as well as SMS. It should send all meter & sensor data through GPRS communication to server.

Security system :- In case of communication failure between hardware and software the hardware should send an alert in terms of SMS. Only authorized person shall be able to make changes to the settings in the controller. The system should be password protected and allow access to settings to authorized person only. Control panel shall have security lock

Software :-The application software should be controllable through a web browser via Internet. This centralized application to provide access to users/ Managers to browse thru the history reports, and current Dashboards for the Efficiency of the pump stations. Web Based software Solution Provider's proposed solution should be based on industry standard. The software should be purely web based and does not need any client installation. The system should very reliable data collection mechanisms from the field and have provision to support large number of meters on the field .

Reporting :- Online display of Graphical Charts for various Process Parameters. Select individual sensor/equipment for Remote Monitoring. Define Reports on the basis of Quality of Power supply like Voltage imbalance, Current imbalance, Voltage fluctuations etc. System should generate reports for following parameters :- RMS Voltage per phase (V1,V2,V3), RMS Voltage (V12,V23,V31), RMS Current per phase (I1,I2,I3), Total kW , Total kVA , Frequency, Neutral Current, Total kWh Import , KWH /ML report , totalised flow , KWH / Running hour report.

Dash board for analysis whole day data on a single screen :- Pump status ON /OFF , Running hour report with chart & graph , Minimum & Maximum voltage on a same day , Minimum & Maximum KVA on a same day, Minimum & Maximum KWH on a same day.

Sensor Integration :-

Flow Meter sensor data acquisition :- Acquire data continuously from upto 4 Flow meters as per site requirements. Directly capture Flow Rate & Totalized flow values from existing Flow meters. Shall support Electro-Magnetic & Ultrasonic flow meters. All data of flow rate & cumulative flow should be displayed in form of graphs & charts.

Level Sensor data acquisition :- Acquire data continuously from upto 4 Level meters as per site requirements. Directly capture Level panel values from existing level

sensors. All data of Level should be displayed in form of graphs & charts. Provision for additional sensors like pressure, Temperature, pH, Turbidity, Vibration etc.

Pressure Transmitter :- Designing, Supplying, Installing, commissioning & testing of pressure transmitter CE mark with following technical parameters at Raw Water Pump House and Interfacing with PLC

Medium- Water

Pressure - 0-20 kg/cm²

Output 4-20 mA

Power supply - 24V DC ext.

Display - Large LCD

Accuracy - +/- 0.5 % of full scale or better

Temp.- suitable for Amb. temp

Enclosure- IP 65 weatherproof

Mounting - In Line

Item No-32- Blader Vessal

DESIGN, MANUFACTURE, SUPPLY, ERECTION, COMMISSIONING & TESTING AT SITE AND SUPPLY OF BLADDER TYPE AIR VESSELS

Scope:

The work described by this section of specifications consists of furnishing all equipment, materials, and labor to provide and install and test the bladder-type pressure tanks for raw water surge control (surge tank) and specified in the Quotation. Manufacturer should have manufactured & supplied similar capacity or higher capacity of bladder type vessels in last 2 years either in India or anywhere in other European countries.

Manufacturer should have in-house bladder manufacturing & Testing facility.

Methodology of 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 pumping 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 cavitations conditions. The case with cavitations 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 5 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.
8. The assumptions used for modeling non return valves (NRVs) (closure time and mode of closure) must be validated using non-dimensional dynamic characteristic data supplied by manufacturer or with the data published in literature for similar type of NRVs.

9. Maximum positive surge pressures on the pipeline should not exceed **25 %** **than** the maximum working pressure. The sustained (lasting for more than 10 seconds) negative pressures on the pipeline should not be less than -2m and all other negative pressure occurrences must be no less than -5m. 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.

SURGE PROTECTION SYSTEM SHOULD COMPRISE OF BLADDER VESSEL AND ANY OR ALL OF THE FOLLOWING EQUIPMENTS DEPENDING ON THE RECOMMENDATION OF SURGE ANALYSIS TO PREVENT THE POSITIVE AND NEGATIVE SURGES IN THE PIPELINE. IN LINE SURGE PROTECTION EQUIPMENTS WILL NOT BE ACCEPTABLE.

The surge tank shall be vertical, Bladder type vessel suitable for use of with water. The tank, supports & anchor bolts shall be designed & with stand confirm to Indian / international standards.

SURGE TANK

The surge tank shall be vertical, bladder type vessel suitable for use with Water.

TANK SIZING

SURGE TANK DESIGN AND MATERIALS

1. Materials for the tank, design, and shop fabrication and inspection shall comply with pressure equipment standards (IS/ASME/BS 5500/CODAP)
2. Minimum design pressure shall be as stated in this section of the Specifications, Perform hydrostatic testing in shop. Test pressure shall be 150% of the design pressure of the tank.

3. Provide a ½ inch threaded connection at the top of the tank to contain a gas charging valve and pressure gauge. Tank shell will be constructed of deep drawn carbon steel double welded domes and side shells with double welded seams. Tank shall be equipped with a heavy duty butyl rubber bladder. The Precharge pressure will be located between the bladder.

Bladder tank shall be equipped with a Hydro control Level Gauge Equipment with Output 4/20 MA.

BLADDER MANUFACTURING

SERVICE CONDITIONS

Surge tank hydraulic performance conditions and design data shall be as shown below.

Tank Configuration	Vertical
Minimum Capacity	15 m³
Minimum Design Pressure	16 Kg/cm²
Minimum Test Pressure	25 Kg/cm²
Bladder Material	Butyl Rubber inverted with Coating
Precharge Pressure Setting	As per Surge Analysis Report.
Outlet Flange Size	300 mm Tee at Tank Bottom
Vessel Connection Size	400 mm
Minimum Manhole Size	As per Manufacturing Standard
Outlet Pressure Rating as per ANSI B 16.5	Class suitable for 16Kg/cm² Design Pressure.

TANK INSTALLATION

The surge tank shall be installed in accordance with the manufacturer's/Suppliers suggested procedures. All supports, piping, valves, and related appurtenances shall be provided and installed by the Contractor at no additional cost to the Owner.

PAINTING AND COATING

All painting and coating shall be completed at the factory. Field painting and coating will not be accepted. The tank interior shall be painted with anti-corrosion epoxy paint

with a uniform layer thickness of no less than 100 microns, The tank exterior shall be painted with 3 coat zinc based epoxy to a minimum thickness of 110 microns.

MATERIAL SPECIFICATIONS FOR BLADDER TYPE SURGE VESSEL

SHELL : SA 516 Gr 70/EQUIVALANT

ELLIPTIC CAP : SA 516 Gr 70/EQUIVALANT

BLADDER : BUTYL

COATING INSIDE : SAND BLASTING SA 2.5
1 COAT FOOD EPOXY THICKNESS 100 MICRON

COATING OUTSIDE : SAND BLASTING SA 2.5 ZINC EPOXY DRESSING
LACQUER RAL 2002 TOTAL THICKNESS 110
MICRONS.

LIFTING PAD : SA 516 Gr 70/ EQUIVALANT

OUTLET : CARBON STEEL S/ENS or EQUIVALANT

DESIGN TEMP. : 60°C

POSITION : VERTICAL

LOAD CELL : HYDROCONTROL LEVEL GAUGE EQUIPMENT WITH
OUTPUT 4/20 MA.

- The proposed models are Three Stage Surge Suppression Air Valve.
- The models have a simple and robust construction offering high reliability and trouble free operations.
- **AIR INTAKE :**

The models offer very high air intake capacity because of nominal orifice size for ex. 6" valve has a large orifice of 6". Also, better aerodynamic design reduces the obstruction of air flow through the valve.

➤ **SEALING :**

The models are equipped with a two stage sealing, a soft EPDM seal and stainless steel 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 stainless steel seat. This ensures low minimum sealing pressure of 2 meters and long life maintenance and leakage free operation.

➤ **FLOAT DESIGN :**

Floats are made of polycarbonate, and are tested for 100 bar bursting pressure for all pressure ratings of the valves. The float design offers long term maintenance free operation and resistance against drowning effect of float against orifice. The float design and the air valve body design offers better protection against pre-mature closing of the valve. The spherical hollow design of the float offers less resistance which leads to high flow capacities and also avoids accumulation of debris.

➤ **AIR DISCHARGE AND SURGE SUPPRESSION :**

The non-slam disc used in the HFNS model is the highlight of the model. The concept and design of the disc has been developed by ARI after extensive research and several experiments conducted through various authorities worldwide (some of them have been listed above). Whenever a non-slam air valve is used as a measure of surge protection, the input data/parameters (which have to be accurate and authentic) required for transient simulation plays a vital role. The following parameters are emphasized by ARI 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 (NON-SLAM ORIFICE) :**

ARI has developed standard non-slam orifice sizes for each size after extensive research and numerous experimentations. Customization for specific requirement as per the hydraulic analysis is offered by ARI.

3. **SWITCHING PRESSURE :**

This denotes differential pressure required to switch from large orifice to non-slam orifice during air release. **ARI offers non-slam disc operating from a differential pressure less than 2.75 KPA (27.5cm) of water column.** This feature gives a better advantage and offers an edge to the valves for sensitive applications.

- Reliability of the above models can be attributed to the long and maintenance free operation of the valve with less moving parts, little frictional resistance and less resistance along the passage.

MATERIAL OF CONSTRUCTION

THREE STAGE SURGE SUPPRESSION AIR VALVE.

- Body & Cover : Ductile Iron ASTM A 536
- Float : Polycarbonate
- Nozzle Seat : Bronze ASTM B-62, B271
- Screen Cover : Ductile Iron ASTM A 536
- Screen : SS 304
- Ring : SS 316

AUTOMATIC VALVE :-

- Body : Reinforced Nylon

- Rolling Seal : E.P.D.M. Rubber
- Clamping Stem : Reinforced Nylon
- Float : Foamed Polypropylene
- Nut & Bolt : SS 304
- O-Ring : BUNA-N
- Automatic Orifice Area : 12 mm² (Highest area leads to removal of entrapped air at Maximum efficiency)
- Fluid Handled : Pure Water
- Flange Drilling : ANSI 150 or as per requirement.
- **Pressure Rating : 16 Kg/cm²**

Note :- The Contractor shall submit the surge analysis for the system & get it approved from IIT Bombay & shall provide water hammer device as per their recommendation.

Item No-33 – Civil Work

The Contractor shall provide RCC elevated Platform for 33 kV sub station & VCB Panel room & MSEDCL meter room as per size mentioned in obligatory conditions. The drawing & design shall be got approved from competent authority.

SUB-SECTION 6C : 8

**OPERATION AND MAINTENANANCE
OF WATER SUPPLY SYSTEM**

SUB-SECTION 6C : 8 OPERATION AND MAINTENANANCE OF WATER SUPPLY SYSTEM

8.1 General

This section describes to the specifications of materials used for operation and maintenance, the workmanship, periodical and preventive maintenance, parameters and standards for the acceptable quality of treated water, maintenance of records, and responsibilities during operation and maintenance period. The Contractor shall operate and maintain the Jackwell with raw water pumping station, complete pipeline including allied valves, pipe appurtenances from Jackwell to BPT at Varwade (Raw water rising main), BPT to Soregaon WTP with allied systems, 33 kV/ 3.3 kV/ 415 V substations at Jackwell, all ancillary buildings, campus area, for period of five years and to prevent any further sudden failure or breakdown through maintenance works on plant operation and its operation works. It is essential that Employer and contractor need to have sufficient information on operational issues under normal and emergency condition.

8.2 Obligation of the Employer and Contractor

8.2.1 Obligation of the Employer

- (i) The Employer shall provide only raw water which shall be lifted from Ujani Dam. The cost of raw water shall be paid by the Solapur Municipal Corporation (SMC) to the concern authority
- (ii) Complete power cost payments for operation and maintenance of complete plant shall be borne by the Solapur Municipal Corporation (SMC).

8.2.2 Obligation of the Contractor

- (i) The contractor shall obtain all statutory, legal permissions, Licenses to operate and maintain the complete plant and systems including Substation.
- (ii) Procurements of spares, consumables, oils, lubricants and chemicals in sufficient quantity storage and use, Consumption & Stock record

required for Jackwell and other purposes shall be the contractor's responsibility.

- (iii) The contractor shall update operation and maintenance manual every year indicating every year Edition number as Edition number 1, Edition number 2 etc.
- (iv) The contractor shall organize training and deployment of advisors as details in Employers requirement.
- (v) Insurance: The Contractor shall, without limiting his or the Employer's obligations and responsibilities, insure;
 - a. The work together with material and plant for incorporation therein, to the full replacement cost (term "cost" in this context shall include profit).
 - b. 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.
 - c. 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.
 - d. Any amount not insured or not recovered from the insurer shall be borne by the Contractor.

8.3 Definitions of Operation and Maintenance

8.3.1 Operation Work

This work consists of operation work and monitoring work:

Operation work is executing the plant operation based on the scheduled process and procedure to meet designed criteria including set up or adjust the operational index or data according to the water quality or demand.

Monitoring work is to confirm the operation data, and readout its measurement value on panels, and checkup the working performance of plant appropriately, as well as keep the records of the output.

8.3.2 Maintenance Work

The work consists of inspection work and maintenance work as mentioned below:

Inspection work, that includes physical appearance, inspection and measurement with testing equipment to verify and survey that the plant performance whether operation in normal or not

- The inspection work shall be daily executed by each technical specialist as a routine and/or regular inspection and shall be recorded each time. The evaluation on the collected data shall be immediately reviewed by the chief operational engineer to instruct the staff member for the operation on the same day and/or make a plan of detail inspection and/or make repair schedule to make sure continuous plant operation without any problem.
- Maintenance work, for which main task-work shall include activities, such as lubrication, overhaul, replacement of parts

8.3.2.1 Preventive Maintenance

Preventive maintenance consists of all the regular work carried out in order to sustain the conditions necessary or smooth operation of the plant and to keep the performance of the equipment as close as possible to its original performance level. Its purpose is to reduce the probabilities of failure or deterioration of equipment of the plant. In simple terms, preventive maintenance involves the elementary operations such as lubrication, mechanical servicing, electrical and instrumentation servicing.

8.3.2.2 Corrective or Remedial Maintenance

Corrective or remedial maintenance consists of all works needed to re-establish the conditions necessary for an apparatus or set of equipment to operate properly after rectification subsequent to failure or

deterioration of the results observed from the equipment. It includes the following operations,

- Dismantling or equipment
- Replacement of parts

The work may be scheduled for the short or medium term in accordance with the checks carried out as part of the preventive maintenance procedure, the number of hours as apparatus has been operating, or an alarm factor (abnormal noise, repeated cut-out, weakening of the insulation, etc.) or may be dictated by an unexpected breakdown

Maintenance covers all the techniques and systems which, by means of regular monitoring of equipment and scheduled maintenance procedures, prevent failures and, in the event of problems, enable repairs to be carried out with the minimum disruption of the process. Maintenance is therefore a combination of technical, administrative, and management activities. Maintenance consists of preventive and corrective procedures.

8.4 Specification

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.

8.5 Strategy for Good Operation and Maintenance

8.5.1 Introduction

The minimum requirements for good operation and maintenance are:

1. Preparation of a plan for operation and maintenance.
2. Providing required personnel to operate and maintain.
3. Providing Capacity building programmers for the O&M personnel.
4. Availability of spares and tools for ensuring maintenance.
5. Preparation of GIS based maps of the system.
6. Preparation of a water audit and leakage control plan.
7. Maintaining MIS records on the system including history of equipment, costs, life etc.
8. Action Plan for energy audit for saving on energy.
9. Establishing a sound financial management system.

8.5.2 Preparation of a Plan

A program or a plan has to be prepared for operation and maintenance of every major unit to be specifically written for that particular unit. The overall operation and maintenance plan of an organization is made up of collecting operation and maintenance programs of various individual units. This plan has to contain procedures for routine tasks, checks and inspections at intervals viz. daily, weekly, quarterly, semi-annually or annually.

The individual plans must be prepared for all units and all pieces of equipment. Each unit must have a plan to fix responsibility, timing of action, ways and means of achieving the completion of action and contain what objectives are meant to be achieved by this action. Generally, actions recommended by the manufacturer or by the engineer who has installed the equipment or who has supervised the installation can be included. Often the contractor's recommended operation and maintenance procedures at the time of design or construction will be a good starting point for writing a sound Programme. This plan has to be followed by the operation and maintenance staff and also will be the basis for supervision and inspection and also can be used for evaluation of the status of operation and maintenance.

If the labor costs for operation and maintenance are high compared to replacement cost, the latter course of action will be preferable. The

managers shall realize that most of the operation and maintenance can be carried out without more staff. The existing operation and maintenance staff with little training can do the operation and maintenance work without any extra expense. Similarly, record keeping and analysing does not require any additional cost. However, costs have to be provided in the budgets for spares, tools and plants, training to operation and maintenance staff and any specialized services for important equipment. Briefly the plan shall contain what actions are required, when these actions are to be taken, who has to take these actions, how these actions are to be achieved and why these actions are required. The nature of maintenance can be described in a separate maintenance manual and related by numbers in the plan for reference, so that the maintenance staff know as to how to carry out the numbered actions. Checklists can be prepared for use by the supervision or inspecting officers to ensure that the actions indicated in the operation and maintenance plan are carried out promptly and properly. Check lists for various units of O&M of water supply and treatment are listed in the respective chapters.

8.5.3 Categories

The O&M function is performed by:

- (a) operating staff and
- (b) supervisory staff. While the former actually run the system, the latter monitor the operations and provide managerial support. It is difficult to propose a rigid organizational structure model for use at all places. It is likely to vary from place to place due to factors like site-specific requirements, availability of suitable manpower and age-old practices.

8.5.4 Job Description

When the plan or programme containing procedures to be adopted or actions to be taken is prepared for each piece of equipment, the person to carry out this action is to be identified. This person's job description should contain reference to the maintenance plan/programme. The job description of operating personnel shall clearly define the limits up to which these

personnel can carry out normal maintenance. The job description of the Supervisor/Manager shall include the requirement that they shall ensure that the operating personnel conform to these limits and thus ensure the safety of the equipment.

8.5.5 Training

The personnel who are already available or chosen to carry out the actions contained in the programme may have to be trained through special courses or by “on the job training” to ensure that these personnel are thoroughly trained to carry out the actions listed in the plan of maintenance. This training is essential to prevent experimentation by operating personnel to meddle with equipment since often these operating personnel may not be capable to take up the required maintenance. On the job training is preferred to class room training. The supervisors can be trained initially and they can later train their operators.

- i) Supervisory organization of engineers, accountants, managers belonging to the O&M agency.
- ii) Day to day operation and maintenance of units like, pumping stations and large transmissions.
- iii) Day to day operation and maintenance of transmission mains.
- iv) Repairs such as meter repairs and instrumentation repair, maintenance and calibration.
- v) Supply of spares to be arranged by O&M agency.

8.6 Activities during O&M Period

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) Providing water at the flow rates on 22 hr/ day 110 ML/day or as directed by, Employers Representative.
- b) Providing the required staff of specified qualification and experience, but not less than the minimum specified numbers, for operation and maintenance and additional staff as per requirement for repairs.
- c) Providing all consumables, spares, oils, lubricants, etc. required for functioning of Jackwell.
- d) Maintenance of 33 kV/ 3.3 kV/ 415V substations etc. at the pumping stations. (all works constructed in this Contract) in neat and clean condition.
- e) Entering into AMC contracts with system / equipment suppliers, as necessary. It is mandatory to enter into an agreement for an 5-year maintenance contract with the PLC supplier or the authorized system integrator, whosoever has executed the work for this project and their representative should be available at site within 24 hours.
- f) Maintenance of the lighting fixtures and the lighting system of all areas and replacement of all non-functional lighting fixtures within 24 hours.
- g) Maintaining the following;
 - Repair history of all mechanical, electrical and instrumentation control equipment in pumping stations, water treatment plant, and communication instruments, Complete Pipe line and allied valves;
 - Logbooks through PLC system;
 - Every day power availability, input voltage and current, frequency, power factor, kWh meter readings and kW reading for Substation at Jackwell Raw water pumping station;
 - Daily log of operations of all the important equipment such as Jackwell, Raw water pumping station;

- Hourly levels of sumps at Raw water pumping station;
- 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 Employer's representative;
- Last periodic maintenance done for all equipment/buildings of the system;
- Observation made during patrolling of the pipe line and roads;

In addition to maintenance of above logbooks the Contractor is required to maintain one inspection registers and complaint registers at each pumping station. The complaints entered in the complaint register must be investigated and remedial measures must immediately be taken.

- h) Providing required spares, special tools and test equipment 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 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 employer.
- 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 at Jackwell & Raw water Pumping station.
- k) Maintaining stores for the electrical, mechanical and instrumentation and control equipment as well as that for the chemicals and laboratory consumables at the filter plant. 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 Employer.
- l) Periodic routine maintenance of structures/buildings of campus areas of treatment plant and others built in the Contract. 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 / buildings pleasant.
- m) Updating and periodic submissions of the operation and maintenance manual. The Contractor shall take up all periodic maintenance works provided in the approved O&M manual.
- n) Providing transportation facilities between various areas from Jackwell to Transmission mains
- o) Submission of monthly report
- Co-ordination with other contractors and/ or agencies responsible for the execution, operation and maintenance of the Substations, Raw water pumping station, including all electric supply company and other government agencies
 - The Employer's representative shall be entitled to audit any aspect of the system and the contractor shall ensure remedial action as directed

- Safety reporting: Necessary reporting of all accidents and hazardous incidents of all accidents and hazardous incidents including descriptions of cause, extent of injuries, action taken, as per prescribed format detail information required to submit to Employer, Client, government agencies and precautions instituted to prevent repetition of such events

8.7 Operations and Maintenance Manual

Operation and Maintenance manual shall incorporate all the equipments, technical information for following systems/ units/ structures –

1. Jackwell
2. Substations
3. Raw water Pumping Station
4. Rising Main
5. Rising Main with Break Pressure Tank
6. Gravity Main

8.7.1 Contents of O&M 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 downs) 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 33/3.3 kV /415 V sub-station, 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. Records of the raw water quality, as monitored during very day of the O&M period, must be maintained and handed over after the expiry of Contract period.
9. 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.
10. 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.

11. At the time of handing over after completion of O&M period, all the equipment, including standby equipment, must be in good working order.

8.7.2 Related Dimensions of O&M

The Contractor, before commencement of the Tests on Completion, shall submit 8 (Eight) copies of the operation and maintenance manuals for the pipe line, power supply systems including 33 kV/ 3.3 kV /415V overhead single circuit lattice tower line, pump stations Raw water, in the English language, containing descriptions, illustrations, sketches, drawings, sectional drawings, sectional arrangement view and manufacturer's parts numbers to enable the connections, functions, operation and maintenance of all components of the complete System to be easily followed and for all parts to be easily identified to facilitate ordering of the replacement parts. Exploded views of the items/ works where appropriate shall be used for clarity. The Contractor shall provide the contact address and telephone number (Hotline) in the manual.

- Technical data of all equipment and their performance. Including name plate
- Instructions for servicing and overhauling
- Particulars of lubricating oil and grease to be used, also alternative indigenous commercial lubricating oils suitable for use
- Performance curves for all units regarding efficiency loading and output
- Performance curves for the motors
- List of tools mounted on wall panels
- List of spares provided in the spare box
- Spare parts list, with manufacturer's part numbers
- Operator's log
- List of the photographs of the plant and machinery as fabricated by the manufacturer

The maintenance manual shall also include the following:

- Procedures for maintenance
- Preventive maintenance procedures for all the equipment
- Emergency maintenance management of the plant and equipment

8.7.3 History Sheet

History of major equipment's shall be maintained for all mechanical, electrical equipment like transformers, Switchgears, important relays, Vertical turbine pumps & its motors, Air Blowers, Ventilation system, pipeline Air valves, line valves and scour valves major instrumentation with calibration in Jackwell, Raw water pumping station,

8.8 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 All managerial staff will have to be got approved from the Employer's representative.

Note:

1. 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 pipe line from Jackwell to BPT to Soregaon WTP and will ensure regular watch on pipe line. Minimum 2 jeeps /vehicles shall be provided for maintenance of 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. Deployment of staff will be with prior permission of Employer
5. Internally deployment will be approved by Employer

8.9 General Requirement for Operation and Maintenance

8.9.1 Jackwell System

- i) Operation of stop logs (inlet arrangement) / gate, Manual operated gantry, chain pulley block with its periodical maintenance including provision of required manpower for routine operation.
- ii) Screen – Cleaning of Screen daily and its periodical maintenance.
- iii) Operation of Sluice gates and its operating arrangement with its periodical maintenance including provision of required manpower for routine operation.
- iv) Jackwell structure

8.9.2 Pumping Stations

- i) Operation of plants as required, including provision of required manpower for routine operation of pumping station.
- ii) Periodic upgrading, as required, of the impellers and wearing rings by replacement with the intermediate impellers and wearing rings, and subsequently with the final impellers and wearing rings, for the clear water pumping station (replacement impellers and accessories to be provided as a part of the Contract).
- iii) 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.
- iv) Routine and periodic maintenance of the entire control system and instruments as per the manufacturer's recommendations.
- v) Replacement of damaged control, communication cables, and power supply cables.

- vi) 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.
- vii) 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.
- viii) Preparation and submission of daily and monthly customized reports
- ix) Repair or replacement, as required, of damaged electrical equipment/ parts for proper functioning of electrical system.
- x) Maintenance of the cooling and lubricating systems.
- xi) Routine maintenance of the pumps/ motors as per recommendation of the manufacturer.
- xii) 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.
- xiii) Routine and periodic maintenance of the EOT cranes as per the manufacturer's recommendations.
- xiv) Breakdown maintenance of all electrical, mechanical, instrumentation and control equipment, EOT crane, etc.
- xv) Re-painting of the exposed mild steel components of pipe line, ladders, railings etc. in the pump house in the 3rd and 5th year of O&M to keep them in good shape & appearance.

- xvi) Maintaining the surrounding areas of the pumping stations free from shrubs, weeds, grass and other unplanned vegetation.
- xvii) Routine monitoring of substation equipment and taking preventive measures as required
- xviii) Routine maintenance of VFD as per manufacturer's recommendation.
- xix) 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 xx)

Disposal of screened material.

- xxi) Providing all consumables such as grease, oil, stationery, water for gardening, etc.
- xxii) Providing office furniture for operating and maintenance staff.
- xxiii) Providing safety accessories such as gloves, shoes, first aid box etc.
- xxiv) Ensuring safety of plant and equipment.
- xxv) Furnishing required information to Employer.
- xxvi) Any compensation charges levied by Electricity providing company, MSEDL, towards low power factor, overloading or any other such penalties will be borne by the Contractor.

xxvii) Contractor will be given a minimum of 15 days' advance notice by the Employer's Representative for changing the impellers when required.

8.9.3 Specific Requirements of Pumping Station Maintenance

Table 8.1: Maintenance Schedule for Pumping Stations

Activity	Frequency
Removal of clogged materials from screens (only for raw water pumping station / plant)	Daily 6 times
Temperature of WTI/OTI w.r.t ambient temperature	Daily 4 times
Oil level in the conservator	Daily 3 times
Oil level in the bushing	Daily 3 times
Temperature of RTD, BTD in motors w.r.t. ambient temp.	Daily 3 times
Watering garden around plant, if provided	Daily 3 times
Checking of dis-connectors' 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
Greasing, oiling	As per manufacturers
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 (through secondary injection)	Yearly
Condition of gasket and replacement (if required)	Yearly

8.9 Indicative Maintenance Schedules for Jackwell

Following schedule for maintenance is only indicative and for reference only. The contractor shall prepare the maintenance schedule as per system and equipment manufacturers recommendation and submit for approval to Employer's representative.

8.9.1 Stop Log Gates

Monthly: Check operation (lowering & raising) of stop log by lifting equipment

Annually: Check the rubber seal condition and replace if necessary.

- Place stop log gates in position and remove

8.9.2 Screen

Daily: Check clogging and differential level across the screen (morning and evening)
Clean if level difference is 100 mm or higher.

Monthly: Raise each screen to cleaning platform level, clean and lower
Check the condition of screen, report if any damage and rectify, otherwise write OK

8.9.3 Sluice gate

Monthly: Check operation (opening and closing).
Check condition of gate, report if any damage and rectify if necessary otherwise write OK

8.9.4 Ventilation system

Monthly: Check operation of each fan and noise level
Check condition of duct
Check effectiveness to restrict temperature rise within the limit or otherwise Annual Dismantle rotating element and do servicing

8.9.5 Civil works:

Six monthly: Check condition and rectify damage if any

8.9.6 Silt deposition in Pump well

Remove silt before and after monsoon

8.9.7 Maintenance of Pumps

PERIODIC INSPECTION AND TEST

The maintenance schedule should enlist items to be attended to at different periods, such as daily, semi-annually, annually, etc.

8.9.7.1 Daily Observations

A log book should be maintained to record the observations, which should cover the following items.

- (i) timings when the pump was run during the previous 24 hours,
- (ii) at the time: of observation, whether the leakage through the stuffing box is alright,
- (iii) whether any undue noise or vibration,
- (iv) reading so f pressure, voltage and current.

8.9.7.2 Semi-Annual Inspection

- (i) free movement of the gland of the stuffing box,
- (ii) cleaning and oiling of the gland bolts,
- (iii) inspection of the packing and repacking, ft. necessary,
- (iv) alignment of the pump and the drive,
- (v) cleaning of oil lubricated bearings and replenishing fresh oil. If bearings are grease lubricated, the condition of the grease should be checked and replaced/replenished to correct quantity. An antifriction beating should have its housing so packed with in case that the void spaces in the bearings and the housing be 1/3 to 1/2 filled with greases. A fully packed housing will cause the bearing to overheat and will result in reduced life of the bearing.

8.9.7.3 Annual Inspection

- (i) cleaning and examination of all bearings for flaws developed, if any.
- (ii) examination of shaft sleeves for wear & scour.
- (iii) checking clearances.

Clearances at the wearing rings should be within the limits recommended by the manufacturer. Excessive clearances cause a drop in the efficiency of the pump. If the wear is only one side, it is indicative of misalignment. Not only that the misalignment should be set right, but also the causes for the disturbance of the alignment should be investigated when the clearances have to be

redeemed to the values recommended by the manufacturers, some general guidelines detailed in 'Table would come handy.

If the clearance on wear is seen to be 0.2 or 0.25 mm more than the original clearance, the wearing ring should be renewed or replaced to get the original clearance.

In using the tolerance given in Table, below they are to be used unilaterally. For example, while machining the i.d. of the wearing ring of basic size, say 175 mm the limits for machining would be 175.00 minimum and 175.04 maximum. For the corresponding O.D. at the hub of the impeller, the basic size will be with a clearance of 0.35, hence 174.65 mm and the machining limits will be 174.65 maximum and 174.61 minimum.

Wearing Ring I.D. Diameter Clearance and Machining Tolerance

Inside diameter of wearing ring in	Diameter of clearance in	Machining tolerance in
Up to 100	0.3	0.04
100-150	0.35	0.04
150-200	0.4	0.06
200-300	0.45	0.06
300-500	0.55	0.06
500-750	0.58	0.06
750-1200	0.69	0.08
1200-1500	0.79	0.1

- iv) Impeller hubs and vane tips should be checked for any pitting or erosion.
- (v) End play of the bearings should be checked.
- (vi) All instruments and flow meters should be recalibrated.
- (vii) Pump should be tested to determine whether proper performance is being obtained. In the case of vertical turbine pumps, the inspection can be bi-annual. Annual inspection is not advisable, because it involves disturbing the alignment and clearance

8.11 Transmission System

8.11.1 Checks to be Carried out

Programme has to be prepared for complete transmission system which shall contain procedures for routine tasks, checks and inspections at intervals i.e. Daily, weekly, quarterly, semiannually or annually. This plan shall fix responsibility, timing for action ways and means of completing the action as to when and who shall take the action and need to take these actions. The check list can be prepared for the use of managerial and technical staff shall be prepared to ensure that the O & M staff have completed the tasks assigned to them.

Table 8.2: Check List

S. No.	Checks Required /Undertaken	Status	Frequency	Attended by
1	Check the operation of valves is smooth			
	without any abrupt stoppage during closure.			
2	Check the closure of valves results in complete stoppage of flow or if any flow passes the valves			
3	Check for status of scouring and then proper closure of washout valves			
4	Check for leaks through pipes			
5	Check leakage from glands , nut bolts or any other place			
6	Check for leakage through appurtenances including flange adaptor			
7	Check for signs of corrosion of pipeline			
8	Check the status of functioning of cathodic protection			
9	Check the status of manhole covers over the chamber for corrosion and physical condition			
10	Inspect for any possibilities of pollution of the transmission system			

11	Check the status of outfall drain of scour valves and chances of contamination at scours			
12	Assess the need of corrosion protection for exposed piping work			
13	Check availability of spares for valves flange adaptors , expansion joints and pipes and jointing material			
14	Review of pressures			
15	Review of flows			
16	Check the age of pipes / c value s of pipes			
17	Check for corrosive water			
18	Study and report inflows and outflows into the reservoirs linked to transmission system			
19	Identify the source of leakages			
20	Status and calibration of flow meters			
21	Availability of updated transmission system layout /map			
22	Check tapings valve for leakage and proper working of flowmeter			
23	Check the Railway crossing pipeline transmission system status and leakages etc			
24	Check bridge / river /nala /road crossing pipeline transmission system status and leakage			

8.11.2 Safe Operating Limits (SOL) and Maximum Operating Pressure (MOP)

Prior to operating a pipeline, it is essential to establish appropriate safe operating limits based on the pipeline design, test pressure, and any operational constraints that may need to be applied. The SOL for pressure will be related to the declared maximum operating pressure (MOP). The operator must ensure that the pipeline is maintained within these limits.

These SOLs, along with the declared MOP should be periodically reviewed and redeclared as part of a procedure designed to confirm continued fitness for purpose of the pipeline.

8.11.3 Provision of Information

The operator is required to provide those involved in operating, maintaining, inspecting, modifying and repairing a pipeline with sufficient written information as needed to perform their duties correctly and safely.

It is important that owners and occupiers of land through which a pipeline is routed, and third parties who may require to work in the vicinity, are reminded of, or made aware of, the pipeline's location.

Regular contact with owners and occupiers is essential

In order to assist third parties, the operator should make available pipeline location plans of a scale suitable to identify the approximate location of the pipeline. Use of 'one-call' systems such as Line search should be considered.

The pipeline route should be marked with location markers at all road, rail and river crossings. It is noted that the operator should provide information on the location of the pipeline, the installations of markers along the route to identify the accurate location of the pipeline should be adequate for surveillance purposes and provision of general information to 3rd parties.

8.11.4 Route Surveillance

It is essential to take all reasonable precautions to reduce the risk of pipelines being struck or damaged by third party activities. The risk of damage to a pipeline or pipeline system needs to be assessed in order to determine appropriate surveillance methods and frequencies.

Route surveillance is employed to ensure that there are no unknown activities being carried out in the vicinity of pipelines that could cause damage to it. It should also be used to monitor building developments that may result in proximity or population density infringements. Where infringements do occur, they should be subjected to a risk assessment in order to determine if any additional protection or surveillance needs to be

undertaken to reduce the risk posed by the pipeline to the surrounding population.

8.11.5 Line Walk Survey

Regular contact should be maintained with owners, tenants, occupiers and managers of land through which a pipeline runs. Contact with local authorities, statutory bodies, and selected contractors are also recommended. The purpose of this is as a reminder of the existence of the pipeline, to establish future intended work in the vicinity of the pipeline, and as an aid to updating records of those responsible for the land.

8.14 Record Keeping

Proper recording format of pumping and operations are given below. The format can be finalized during execution stage.

Table 8.3: Daily Data

S. No.	Description / Data	Unit	Data	Quantity Output	REMARKS
	Ujani Dam water level near stop log gates	m		-	
2	Jackwell Sump level	m		-	
3	Water input Quantity to water treatment plant	Mld		Mld	
4	Rainfall	mm		-	
5	Temperature atmosphere at Ujani Dam	0C		-	

B Plant Data

Raw water Pumping Station:

Table 8.4: Plant Data

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 =				

* Applicable for _____ section

C. Pump Operation

Raw water Pumping Station: **Table 8.5: Pump Operation**

Date:

Time Hrs	Pump no								
	1	2	3	4	5	6	7	8	
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 operati									

Mark 'X' if pump is not available

Mark 'S, if pump is standby

Mark 'R' if pump is running

Indicate Starting and Stopping time

D Power Statement

Pumping Station: Month:

Table 8.6: Power Statement

Date

Date	Theoretical Power Consumption (kWh)	Allowances	Actual Power Consumption	Difference	Signature
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					
22.					

Date	Theoretical Power Consumption (kWh)	Allowances	Actual Power Consumption (kWh)	Difference	Signature
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					
31.					

8.15 Electrical

Table 14.31: Electrical Indicative Maintenance Schedule

S. No	Equipment		Maintenance Activity	Frequency
1	33 kV Substation			
a	Visual Inspection	Installed & Running	Connection, Insulators, clamps conductors, support structures for any damage, cracks, deformation and loose connection.	Daily
			SF6 breaker - Gas pressure	
			Earthing connection	
			hissing sound, corona, pre and post imprisonment inspection	
b	Visual Inspection	Offline	Operating mechanism of all equipments	
			Control and Power cable	

S. No	Equipment		Maintenance Activity	Frequency
			connection	
			Earthing pit and Earth connection	
			clamp connections, busbars, all porcelain parts and bushings of Transformer CT's, PT's, LA's, breakers,	
2	SF6 - CIRCUIT BREAKER			
	Visual Inspection	Installed & Runnin	Gas pressure, corona, bushings condition, loose connections, structural damage	Daily
		Offline	Operational check	Overhaul period
		Offline	General Inspection	Overhaul period
			Cleaning	Overhaul & Post Fault
			Opening Device(trip)	Inspection & Overhaul period
			Circuit- Breaker Enclosure	Overhaul period
		Offline	Gas System	Overhaul period
		Offline	Sulphur hexafluoride gas	Overhaul & Post Fault
		Offline	Insulation	Overhaul & Post

S. No	Equipment		Maintenance Activity	Frequency
				maint
		Offline	Local control kiosk	Overhaul 1 period
			Pressure gauges	Overhaul 1 period
			Pressure Switches	Overhaul 1 period
			Main connection	Overhaul 1 period
			Secondary wiring and fuses	Overhaul 1 period
			Earth Connection	Overhaul 1 period
			SF6 heater	Overhaul 1 period
		Offline	Interpole linkages	Overhaul 1 period
			main mechanism	Overhaul 1 period
			Auxiliary switches indicating devices and	Overhaul 1 period
			interrupters	Overhaul & Post Fault
			Local air receives and pressure vessels	
			Filter and desiccants	Overhaul 1 period
		Offline	Overload devices and protective Relays	Overhaul 1 period
			Instrument and Protective Relays	

S. No	Equipment		Maintenance Activity	Frequency
			Control relay and contactor	Overhaul 1 period
			Bus bar and Bus bar chamber	Overhaul 1 period
		Offline	Final verification	Overhaul & Post Fault
3	TRANSFORMER			
a	Visual Inspection	Installed &Running	Oil Level	Daily
			Winding Temperature at WTI	
			Oil Temperature at OTI	
			Pressure at Pressure Gauge	
			Noise	
			Silica gel colour	
b	Visual Inspection	Offline	Examine the transformer tank and bushings for evidence of leakage. Inspect the bushings, insulators, and surge arrestors for broken or damaged parts, signs of overheating or arcing, or tracking. Clean all bushings, insulators and surge arrestors.	Half Yearly / Yearly
c	Connection	Offline	Tighten all conductor connections in accordance with manufacturer's	Half Yearly / Yearly
d	Reading	Running	Voltage	Daily

S. No	Equipment		Maintenance Activity	Frequency
			Ampere kVAr, kVA, Power factor at 132kV Metering Panel & for Auxilary Transformer at 6.6kV	
e	Insulation test	Offline	Additional suggested testing includes an insulation resistance test and a power factor test. These are non- destructive tests which can be performed to track the condition of the insulation over time. Detailed records should be maintained and analyzed to identify undesirable trends that may	Yearly
f	Breakdown voltage for Transformer Oil	offline	Taking sample of offline Transformer check BDV test of oil sample and Filtration	Yearly
4	SWITCH GEAR			
a	Visual	Offline	cleanness	
		Running	Voltage, kwh , Kva &	daily
		Running	Indication Lamp	daily
b	Push Button	Every 12 Months	Local/Remote & Stop/start	
c	Bushing Tightness	Offline	checking Tightness of all busing connection	Every 12 Months

S. No	Equipment		Maintenance Activity	Frequency
d	Contact		connection and Damaged Due to wear and tear to be	Offline
e	IR Test		insulation Resistance test for Bus Bar	Offline
f	Phase Sequence Test	After Maintenance	Phase Sequence Test after maintenance	
g	Breaker Mechanism		check the operating speed	after overhaul
5	MOTORS			
a	Visual Inspection	Installed and Running	Inspection should look for:	6 Months
			Evidence of damage caused by dirt, loose parts, or foreign objects.	
			Verification that air inlets are not blocked	
			Evidence of moisture and/or dirt build-up	
			Unusual noises, leaking oil seals, or high	
			Evidence of degradation of foundation, bed plates, anchor bolts	
b	Temperature monitoring of bearings	Installed and Running	This data should be trended. The monitoring should be completed at similar motor loading and ambient temperature to allow for accurate trending.	6 Months

S. No	Equipment		Maintenance Activity	Frequency
	windings			
c	Vibration	Installed and Running	Record and trend vibration levels.	6 Months
			This should be done by a trained and experienced technician,	
			preferably a qualified level II technician	
d	Running current	Installed and Running	Record and trend all three phase currents and verify the currents are balanced and do not exceed	Daily
			Each phase should be within +/- 5% of the average of all three	
			phases	
e	Insulation resistance(IR)	Installed and offline	Perform IR check between motor leads and ground. This determines condition of the ground insulation. Record, temperature correct and trend	
			6600 V Motors IR Value > 100 megohm	12 Months
			415V Motors IR Value > 5 megohm	24Months
f	Winding resistance	Installed and offline	A comparison of the line to line resistances of the motor's winding. This test should	

S. No	Equipment		Maintenance Activity	Frequency
			done at the motor terminals using a meter capable of measuring low resistance (milliohms). A typical ohm meter does not have adequate accuracy. Record, temperate correct	
			Each phase should be within +/- (3% - 5%) of the average of all three phases	
g	Stator visual Inspection	Overhaul	Inspection should look for:	2 Yearly or winding fault tripping
			coil movement	
			plugged vent holes	
			soft or degraded insulation	
			coil bracing adequate and intact	
			lamination damage	
			partial discharge activity	
			tightness of wedges	
h	Rotor / Shaft visual Inspection	Overhaul	Inspection should look for:	2 Yearly or major fault tripping
			cracks in rotor bars	
			balance weights properly secured	
			signs of bar movement	
			signs of rotor/stator rub or lamination damage	
			cooling ducts clear	
			rubbing marks on shaft	
			keyway distortion	

S. No	Equipment		Maintenance Activity	Frequency
i	Clean*, bake dry and varnish (as needed)	Overhaul	All parts should be cleaned and baked dry to remove all dirt and contamination. The windings should be reinsulated as	
j	Insulation resistance	Overhaul	Perform IR check between motor leads and ground. This determines condition of the ground insulation required IR values shall be obtained as mentioned below	
			6600 V Motors IR Value > 100 megohm	
			415V Motors IR Value > 5 megohm	
6	CABLE			
a	IR Value	Installed & offline	Insulation Resistance	
b	Continuity	Installed & offline	Continuity test for cable	
c	End termination	Installed & offline	End termination connection to be checked	
7	COMMON MAINTENANCE FOR ALL ELECTRICAL EQUIPMENT			
a	Preventive maintenance	offline	Maintenance as per manufacture's recommendations i.e. replacement of work out	Quarterly/Half Yearly/ Yearly

S. No	Equipment		Maintenance Activity	Frequency
			check permissible clearances, calibrations etc.	
			Earth grid resistance measurement and	Yearly
			Maintain Records	
b	Break down maintenance	offline	Fault detection and remedial measures, replacement of damaged	As and when Fault occurs
			Visual Inspection of all parts	
			Taking in to service and observe	
			Recording of all events, indications	

8.16 Operation & Maintenance practices (Instrumentation, Control & Automation)

8.16.1 General Maintenance

A comprehensive maintenance program is critical to attaining long-term reliable performance of / ICA systems. Periodic device calibration, preventive maintenance, and testing allow potential problems to be identified before they can cause mission failure. Prompt corrective maintenance assures reliability by minimizing downtime of redundant components.

The DBO contractor has to enter in to AMC contracts with system / equipment suppliers of ICA, as necessary. It is mandatory to enter into an agreement for a 8 years operation and maintenance contract with the instrumentation, PLC and supplier and wireless communication supplier or the authorized system integrator, whosoever has executed the work for this project.

8.16.2 Preventive Maintenance

Table below provides a list of recommended maintenance activities and frequencies for ICA systems and their components.

Preventive maintenance schedules for ICA components and subsystems should be coordinated with those for the mechanical/electrical systems they serve to minimize overall scheduled down time.

Table 8.32: Activity & Frequency

Activity	Frequency
Electrical Systems/Components/Instruments	
Check Regulators and Filters	Monthly
Inspect Tubing and Piping	Monthly
Actuate Pressure Switches	3 months
Calibrate Switches and Sensors	Yearly
Calibrate Pressure Gauges	Yearly
Calibrate Level Transmitters	Yearly
Calibrate Flow transmitters	Yearly
Calibrate Pressure Transmitters	Yearly
Calibrate Thermometers	Yearly
Calibrate Analytical Instruments/Online Instruments(p H, Residual Chlorine, Turbidity	6 Months
Change Sampling solution of Analytical Instruments	As required
Electronic Systems	
Lamp Test/Verify Indicators	Monthly
Inspect Enclosures for Dirt, Water, Heat	Monthly
Run PLC Diagnostics	3 Months
Calibrate Sensors and Transmitters	Yearly
Calibrate Meters	Yearly

Activity	Frequency
PLC Communication Modules	Monthly
PLC Batteries	Yearly
Test Automatic control Sequences	Monthly
Verify Alarms	Weekly
Software Maintenance and Patching	3months
Anti-virus Definition Updates	Monthly
Inspect Wire, Cable and Connections	Monthly
Inter site Communication Network	Weekly
Dead Bus Relays	3 Months
UPS setting with SCADA	Weekly
PLC Redundant Power back up	Monthly
Network Redundancy	Weekly
Data Archiving	Monthly

- a) Periodic system testing procedures can duplicate or be derived from the functional performance testing procedures.
- b) Faulty Instruments, sensors, transmitters, communication modules, computer hardware should be replaced with new components. Repair of the items would not be accepted.

8.16.3 Operations and maintenance documentation

The contractor should perform an O&M analysis to determine the O&M data required to support maintenance of the SCADA system. This analysis should be coordinated with MMRDA to determine maintenance parameters and O&M data that are available. Typical O&M data requirements include the following items:

- a. System documentation as defined in FDS, FAT & SAT documents
- b. Minimum spare parts list.
- c. Recommended spare parts list.
- d. Recommended onsite test equipment.
- e. Recommended O&M training.
- f. Manufacturer's Recommended O&M to be performed by contractor

8.16.4 O & M SCHEDULE: Excess Electricity Consumption

The monitoring of consumption of electrical energy for all the installations shall be done at optimum level. The contractor shall operate and maintain all the plants equipment's in proper manner to ensure the desired electricity consumption as per the bid offer at all the time. In case, contractors fail to do so and consume excess power for getting the desired output then the charges towards the excess power consumption shall have to be borne by the contractor. The charges towards the same shall be worked out at the prevailing rate at that time. All the motor feeders in the pumping stations are with independent energy meters and same be used to record the power consumption. In case of auxiliary load at pumping station, Sub-station & WTP the arrangement/provision of measurement of power consumption shall be made during the design stage as required by the contractor.

8.16.5 Spare parts stocking

An adequate on-site stock of spare parts is essential to obtaining high availability of ICA systems.

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 labelled 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.

Minimum recommended stocking levels include the following. These quantities may need to be increased for components which are used in large numbers in the facility:

- (1) Manufacturer's recommended spare parts list.
- (2) One each of all line replaceable boards or modules.
- (3) Six each power and control fuses used in the system.
- (4) Tools required to terminate coaxial or fiber optic cables.

Automation:

- (1) PLC CPU, Power supply module, 1 DI, DO, AI, AO modules, Communication module, protocol converter etc.
- (2) PLC batteries, fuses, etc.

8.16.6 Utilities & Consumables

The contractor has to provide consumables for printers e.g.: Ink cartridges (color & B/W), A4, A3, A1 size of paper, dot-matrix print paper for a period of 8 years.

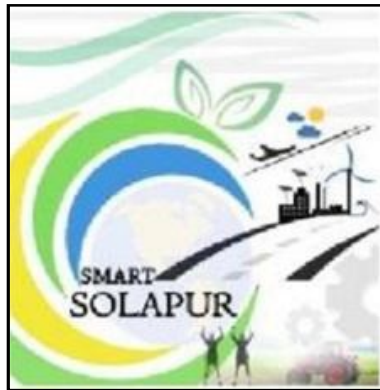
Downtime of the above system should not exceed more than 2 hours.

8.16.7 Technical support

The Contractor should specify functional areas of the operating system and/or equipment where a technical representative will be furnished by the manufacturer for training, test, checkout, validation, or pre-operational exercises.



Solapur City Development Corporation Limited



Tender No.

**Augmentation to Solapur City Water Supply Project
(Ujani Dam As A Source – 110 MLD)**

On

Design, Build, Maintain, Operate and Transfer (DBMOT) Basis

PART – 6D: DRAWINGS

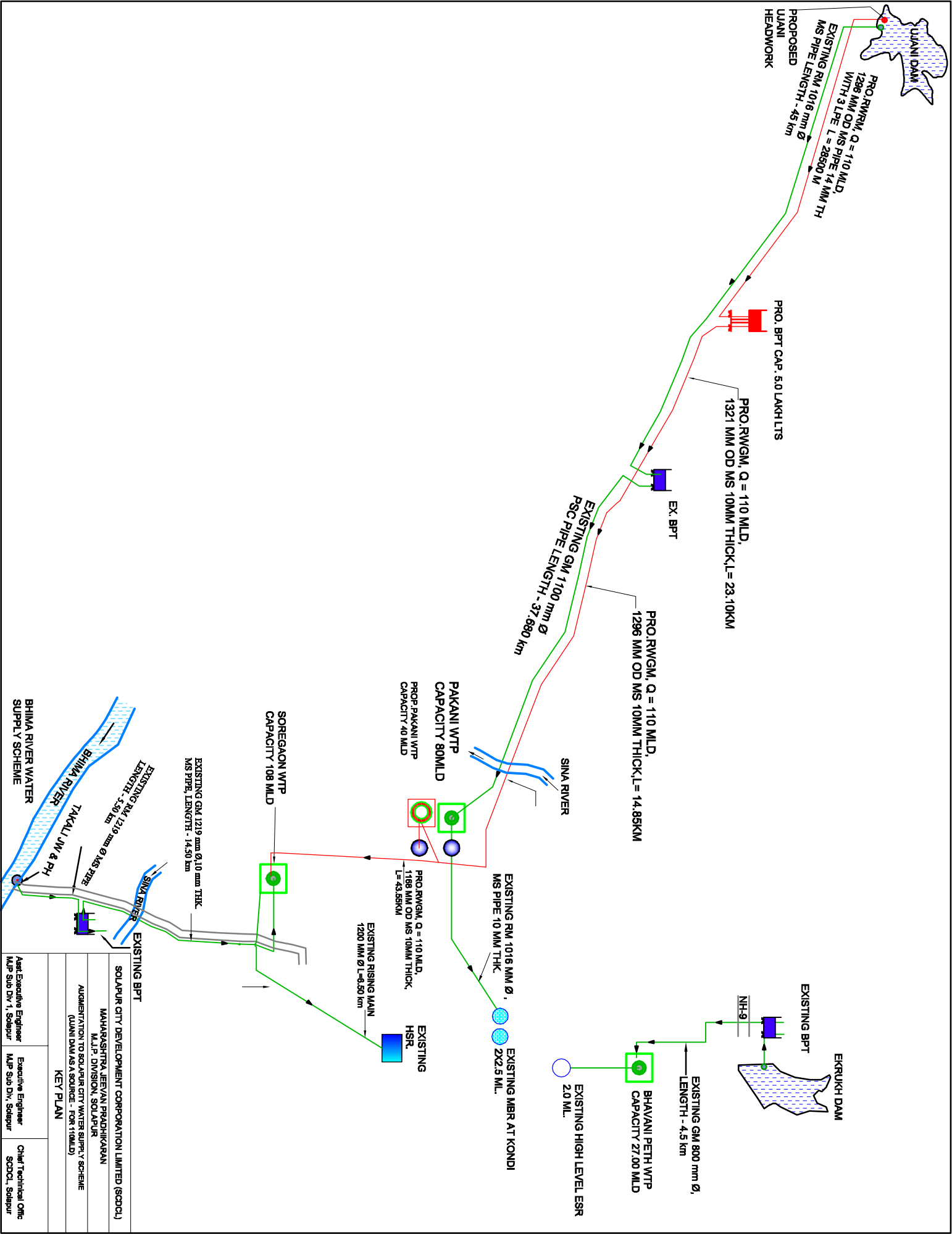
**Solapur City Development Corporation Limited,
Dist. Planning Office, New Collector Office premises, Near Govt. Milk Dairy,
Saat Rasta, Solapur - 413003, Maharashtra, India**

NOVEMBER 2018

**Augmentation to Solapur City Water Supply Scheme
(Ujani Dam as a source – 110 MLD) on Design, Build, Maintain, Operate and
Transfer (DBMOT) basis**

LIST OF DRAWINGS

Sr. No	PARTICULARS
1	Key Plan
2	Key Plan (Google Earth)
3	Flow Diagram
4	Location of Jackwell (Google Earth)
5	Contour Plan of Jackwell
6	Plan and Elevation of Jackwell
7	Details of Head works 1
8	Details of Head works 2
9	L-section of Raw Water Rising Main
10	L-section of Raw Water Gravity Main (Ch 0 to 23100 m)
11	L-section of Raw Water Gravity Main (Ch 23100 to 38100 m)
12	L-section of Raw Water Gravity Main (Ch 38100 to 81500 m)
13	Cross section of Pipeline
14	Railway Crossing Details Near Modnimb Railway Station
15	Railway Crossing Details Near Mohol Railway Station
16	Railway Crossing Details Near Bale Railway Station



SOLAPUR CITY DEVELOPMENT CORPORATION LIMITED (SCDCL)		
MAHARASHTRA JEEVAN PRADESHIKARAN		
M.I.T. DIVISION, SOLAPUR		
AUGMENTATION TO SOLAPUR CITY WATER SUPPLY SCHEME (QUANI DAM AS A SOURCE - FOR 110MLD)		
KEY PLAN		
Asst. Executive Engineer M.P. Sub Div 1, Solapur	Executive Engineer M.P. Sub Div, Solapur	Chief Technical Offic SCDCL, Solapur

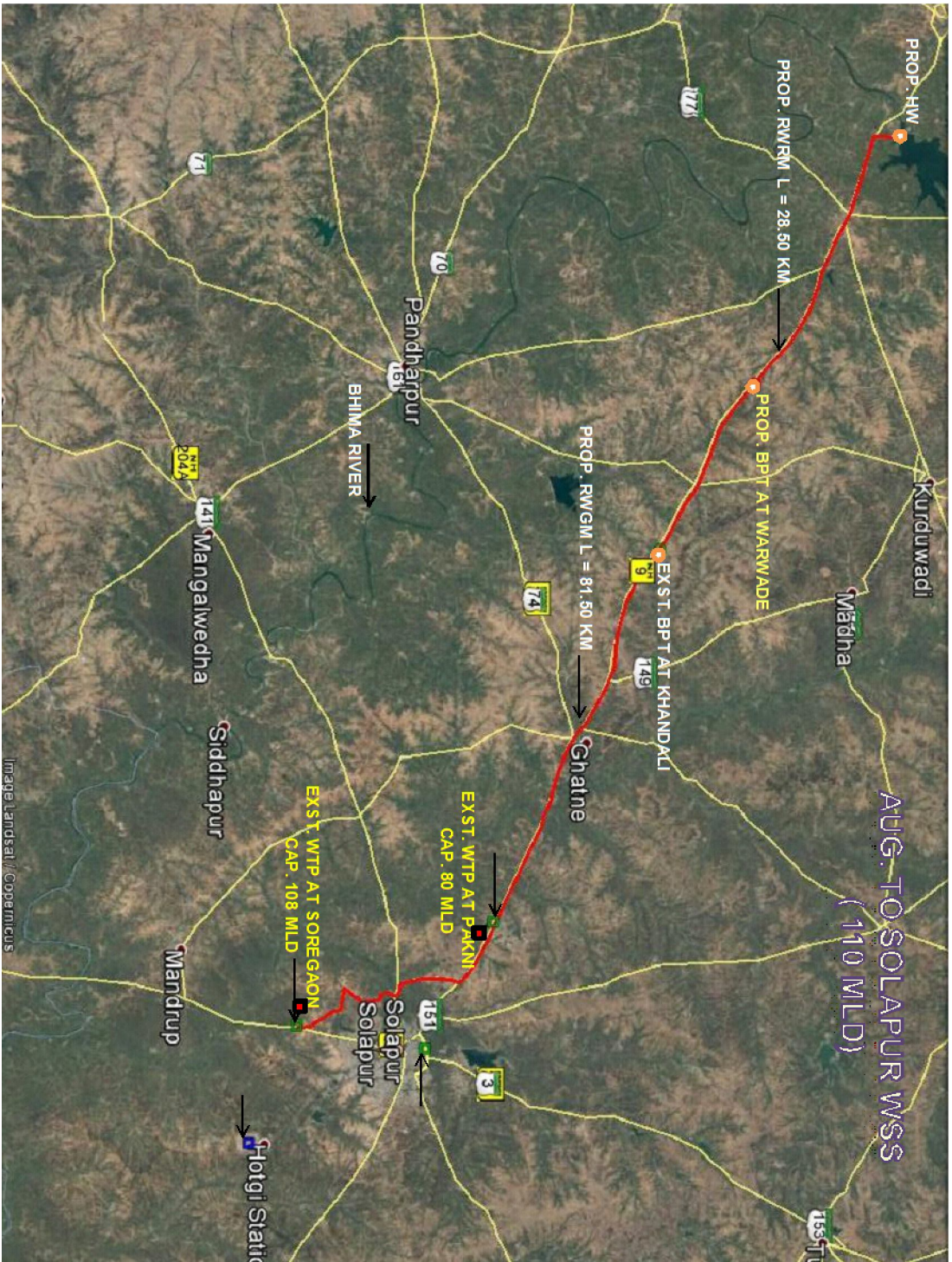
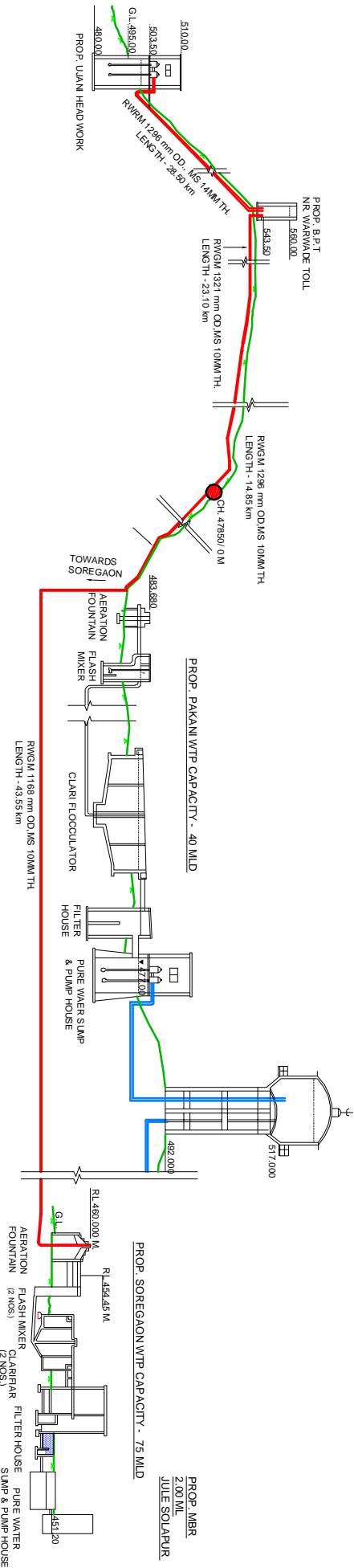


Image Landsat / Copernicus

SOLAPUR CITY DEVELOPMENT CORPORATION LIMITED (SCDC)		
MAHARASHTRA, JEEVAN PRADHAKARAN		
M.J.P. DIVISION, SOLAPUR		
AUGMENTATION TO SOLAPUR CITY WATER SUPPLY SCHEME		
(UNANI DAM AS A SOURCE - FOR 110MLD)		
KEY PLAN (GOOGLE)		
Asst Executive Engineer MJP Sub Div 1 Solapur	Executive Engineer MJP Sub Div, Solapur	Chief Technical Officer SCDC, Solapur

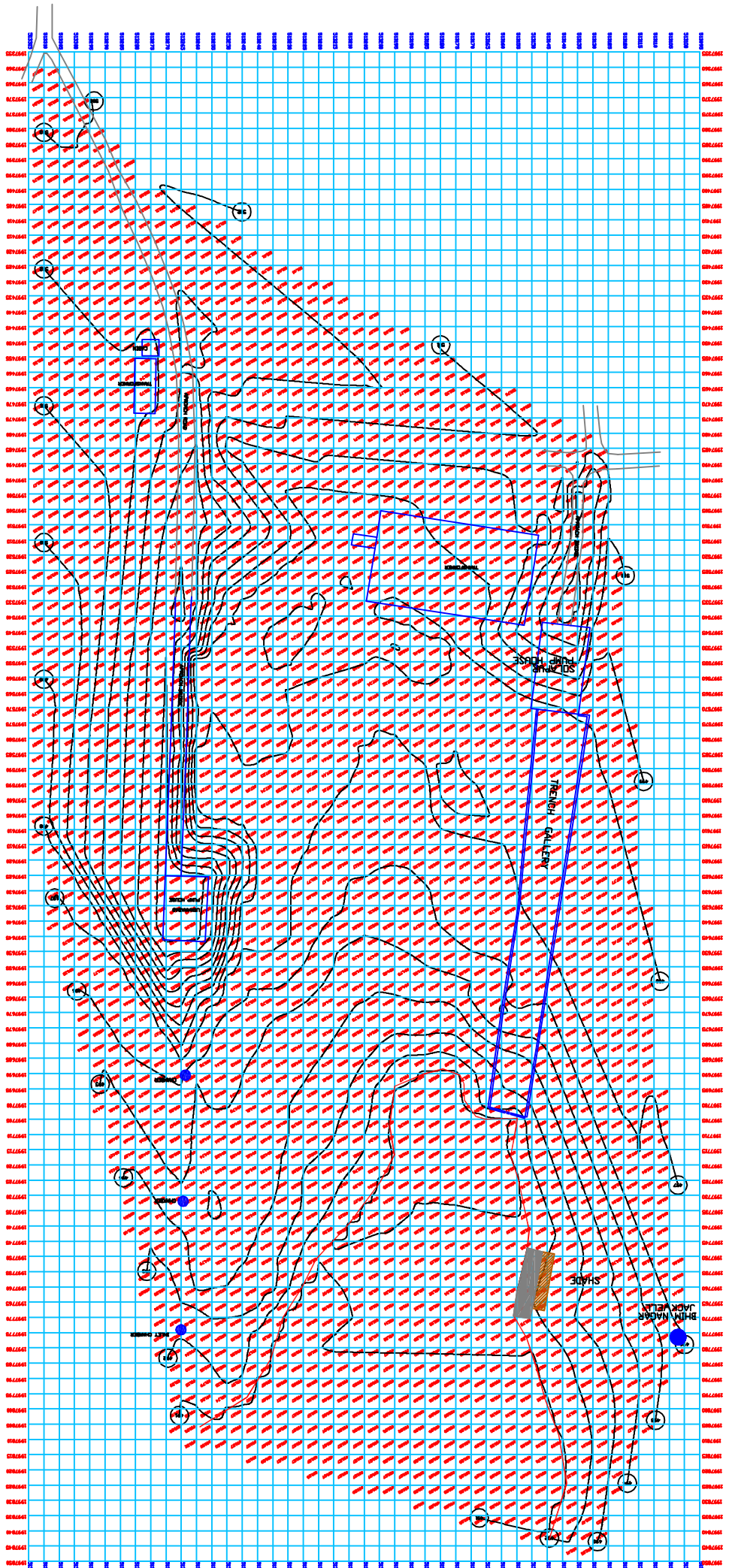


PROP. FLOW DIA. SOLAPUR CTY WSS -110 MLD.



SOLAPUR CITY WATER SUPPLY SCHEME (UJANI DAM AS A SOURCE - 110 MLD)

SOLAPUR CITY DEVELOPMENT CORPORATION LIMITED (SCDC)			
MAHARASHTRA, JERIAN PRADESHKARAN			
M.P. DIVISION, SOLAPUR			
AUGMENTATION TO SOLAPUR CITY WATER SUPPLY SCHEME			
UJANI DAM AS A SOURCE - 110 MLD			
DETAILS OF HEADWORKS (GOOGLE)			
Astt Executive Engineer M.P. Stp Div 1, Solapur	Executive Engineer M.P. Stp Div, Solapur	Chief Technical Offr SCDC, Solapur	

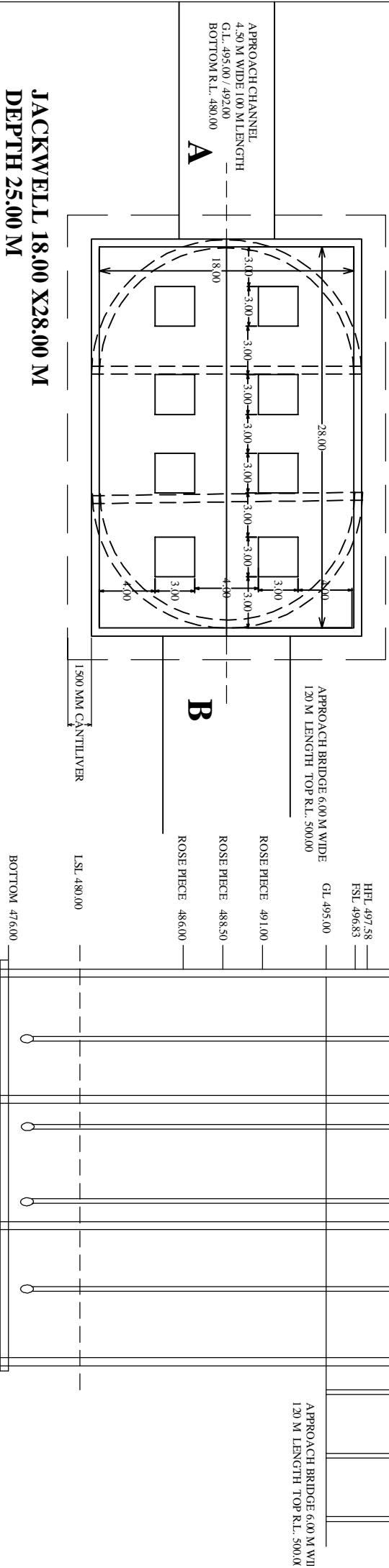


SOLAPUR CITY DEVELOPMENT CORPORATION LIMITED (SCDCL)		
MAHARASHTRA JEEVAN PRADHIKARAN		
M.J.P. DIVISION, SOLAPUR		
AUGMENTATION TO SOLAPUR CITY WATER SUPPLY SCHEME (UJANI DAM AS A SOURCE - FOR 100M3)		
CONTOUR DETAILS OF HEAD WORKS AT UJANI DAM		
Asst. Executive Engineer MJP Sub Div 1, Solapur	Executive Engineer MJP Sub Div, Solapur	Chief Technical Off SCDCL, Solapur

UJANI DAM	
CAPACITY	117.23 TMC
DAM TOP	501.40
HFL	497.58
FSL	496.83
SPILLWAY	490.83
MDDL	491.03
CBL	487.20
LWL	486.23
RIVER BED	458.17

AUGMENTATION TO SOLAPUR WATER SUPPLY SCHEME (110 MLD) UJANI DAM AS SOURCE PROPOSED HEAD WORKS AT DAM

**PUMP HOUSE (SIZE 21.00 X 31.00 M)
HEIGHT 10.00 M**



PLAN

SECTIONAL ELEVATION A-B

PROPOSED HEAD WORKS AT DAM

**JACKWELL 18.00 X 28.00 M
DEPTH 25.00 M**

A

B

APPROACH CHANNEL
4.50 M WIDE 100 M LENGTH
G.L. 495.00 / 492.00
BOTTOM R.L. 480.00

APPROACH BRIDGE 6.00 M WIDE
120 M LENGTH TOP R.L. 500.00

APPROACH BRIDGE 6.00 M WIDE
120 M LENGTH TOP R.L. 500.00

ROOF LVL 510.00
GANTRY LVL 508.20

MOTOR LVL 503.70

PUMP FLV 500.00

HFL 497.58
FSL 496.83

G.L. 495.00

ROSE PIECE 491.00

ROSE PIECE 488.50

ROSE PIECE 486.00

LSL 480.00

BOTTOM 476.00

VENTILATORS 2.00 X 0.60
16 NOS

WINDOWS 2.00 X 1.20
32 NOS

ROLLING SHUTTER

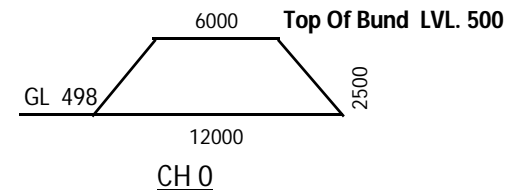
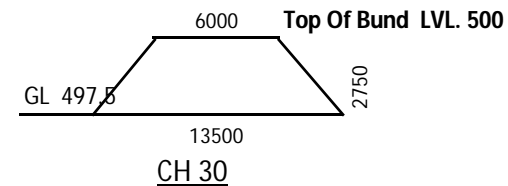
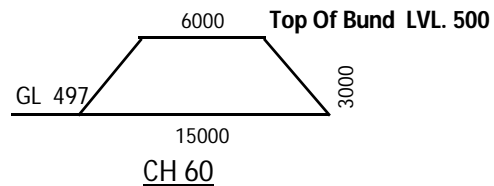
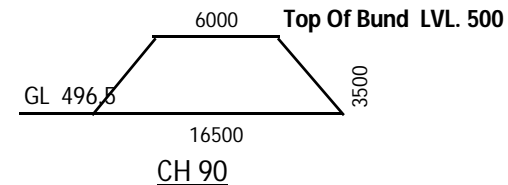
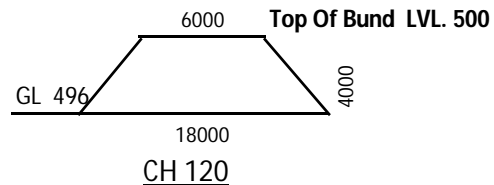
Details of Ujani Dam

L = 2540 M

Cap 63.66€ + 53.579 TMC
= **117.23 TMC**

Dam Top Masonry	501.40	M	
Dam Top Earthen	499.87	M	
HFL	497.58	M	
FSL	497.33	M	
Av. Water LVL	495.00	M	
MDDL	491.03	M	
Spillway LVL	490.83	M	Gate 12 x 7 m = 41 Nos
CBL	487.20	M	
Lowest Water LVL	485.75	M	
Bhima River Bed	458.17	M	

APPROACH BUND 6 M WIDE, LENGTH = 120 M



APPROACH CHANNEL 4.50 M WIDE @ BOTTOM , LENGTH = 100 M

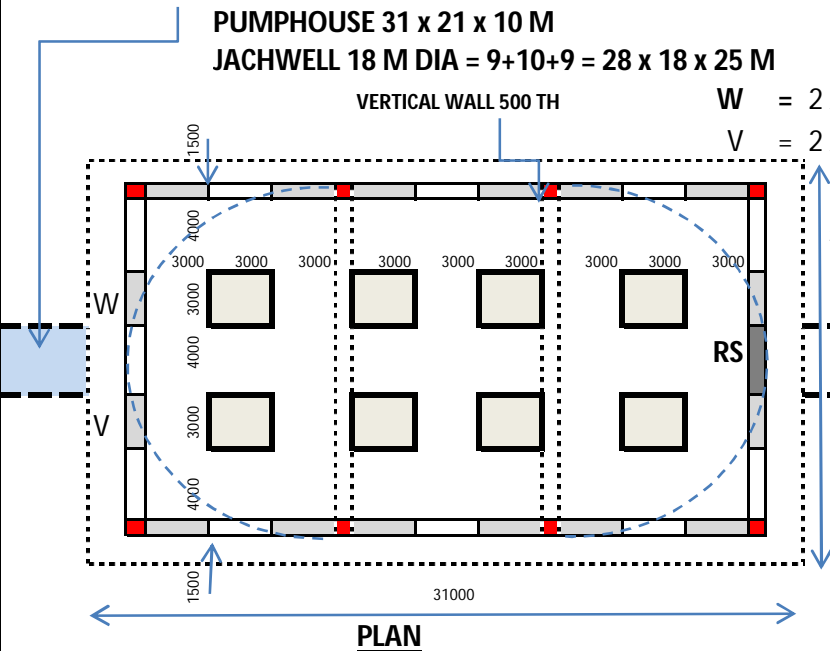
PUMPHOUSE 31 x 21 x 10 M

JACHWELL 18 M DIA = 9+10+9 = 28 x 18 x 25 M

VERTICAL WALL 500 TH

W = 2 x 1.20 M - 32 Nos

V = 2 x 0.60 M - 16 Nos



APPROACH BUND 6 M WIDE, LENGTH = 120 M

APPROACH BRIDGE 6 M WIDE, LENGTH = 120 M

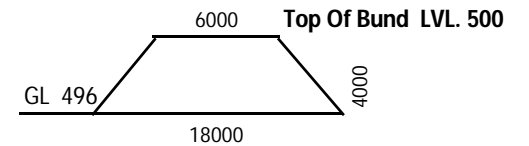
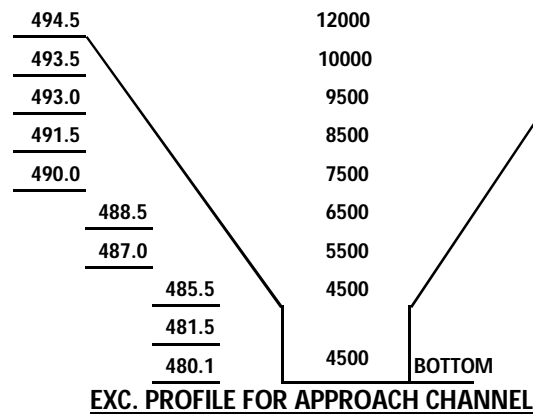
DETAILS OF HEADWORKS @ UJANI DAM

**MAHARASHTRA JEEVAN PRADHIKARAN DIVISION SOLAPUR
AUG. TO SOLAPUR WATER SUPPLY SCHEME**

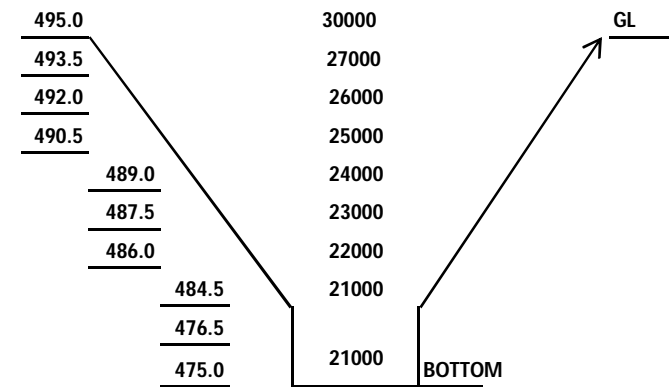
Details of Ujani Dam

L = 2540 M

Cap	63.66€	+	53.579 TMC	
				= 117.23 TMC
Dam Top Masonry	501.40	M		
Dam Top Earthen	499.87	M		
HFL	497.58	M		
FSL	497.33	M		
Av. Water LVL	495.00	M		
MDDL	491.03	M		
Spillway LVL	490.83	M	Gate 12 x 7 m = 41 Nos	
CBL	487.20	M		
Lowest Water LVL	485.75	M		
Bhima River Bed	458.17	M		



APPROACH BUND 6 M WIDE, LENGTH = 120 M



EXCAVATION PROFILE FOR JACKWELL

APPROACH CHANNEL 4.50 M WIDE @ BOTTOM , LENGTH = 100 M

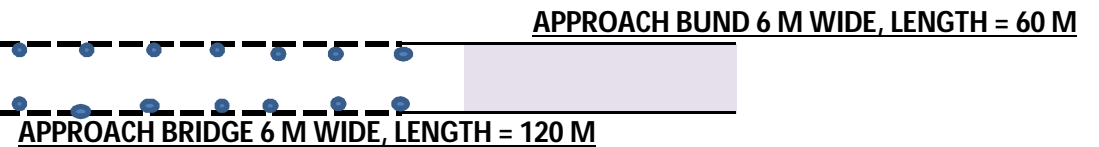
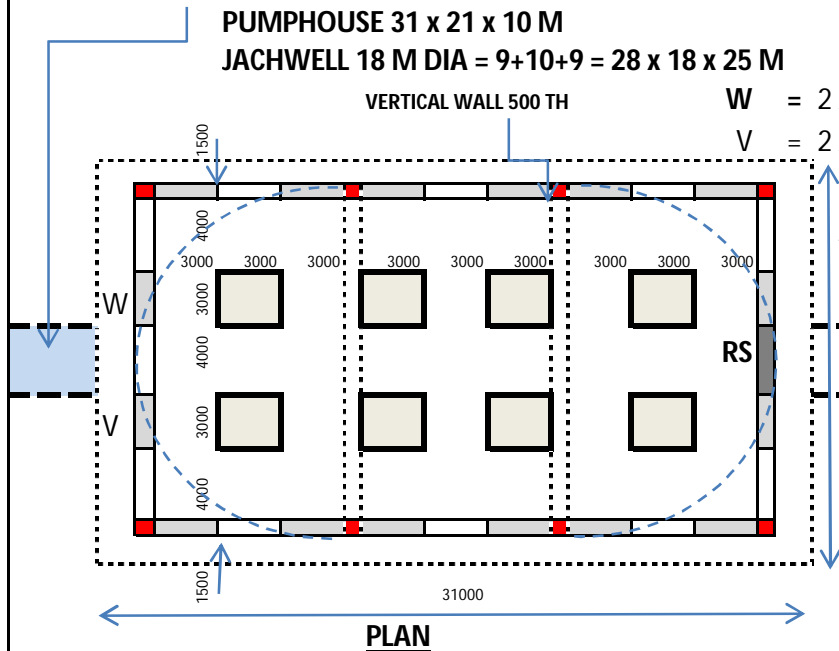
PUMPHOUSE 31 x 21 x 10 M

JACHWELL 18 M DIA = 9+10+9 = 28 x 18 x 25 M

VERTICAL WALL 500 TH

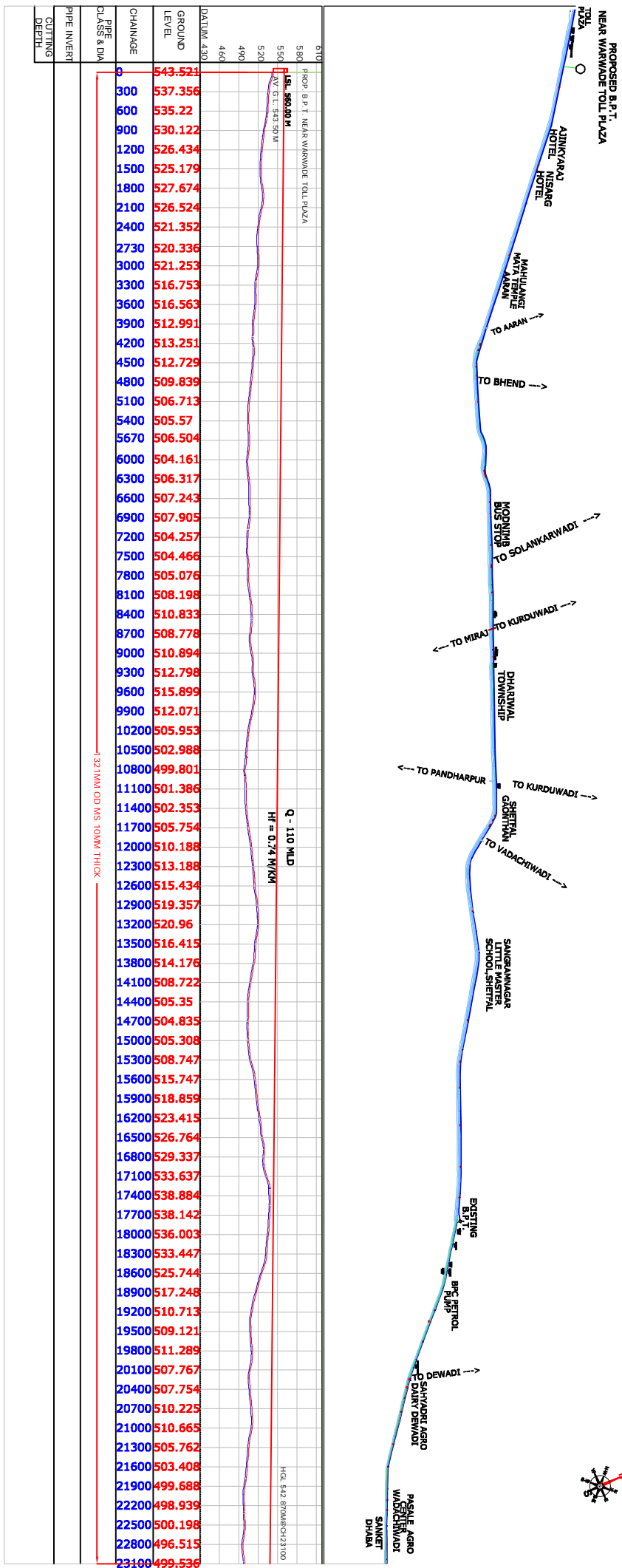
W = 2 x 1.20 M - 32 Nos

V = 2 x 0.60 M - 16 Nos



DETAILS OF HEADWORKS @ UJANI DAM

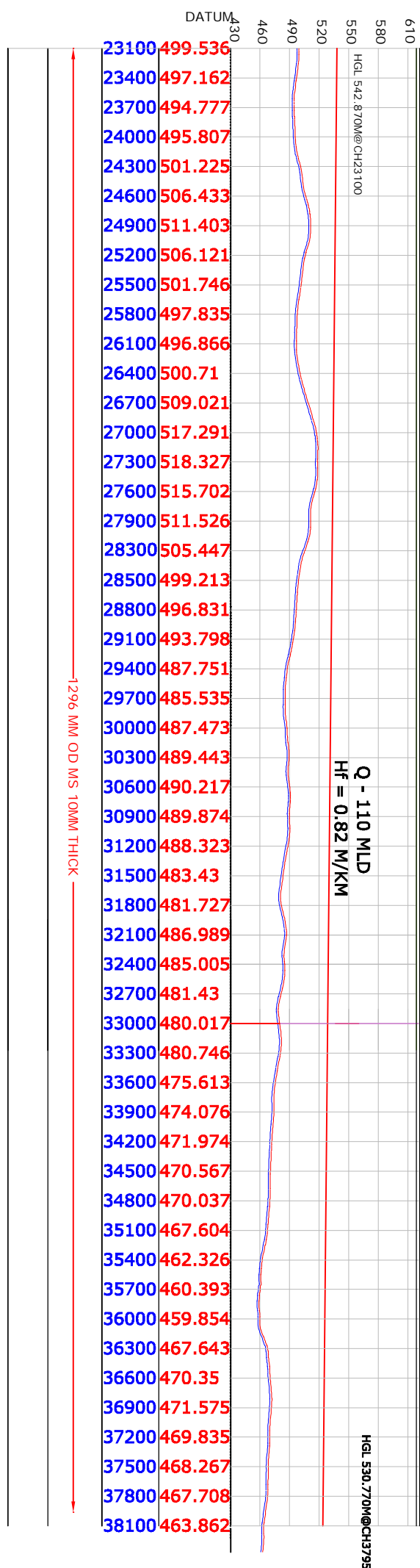
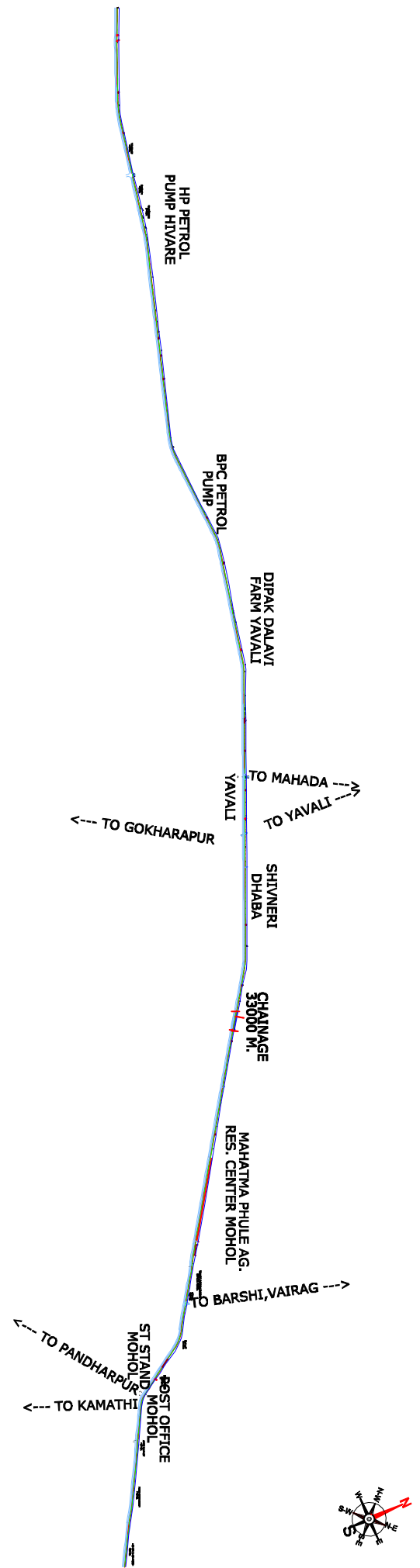
**MAHARASHTRA JEEVAN PRADHIKARAN DIVISION SOLAPUR
AUG. TO SOLAPUR WATER SUPPLY SCHEME**



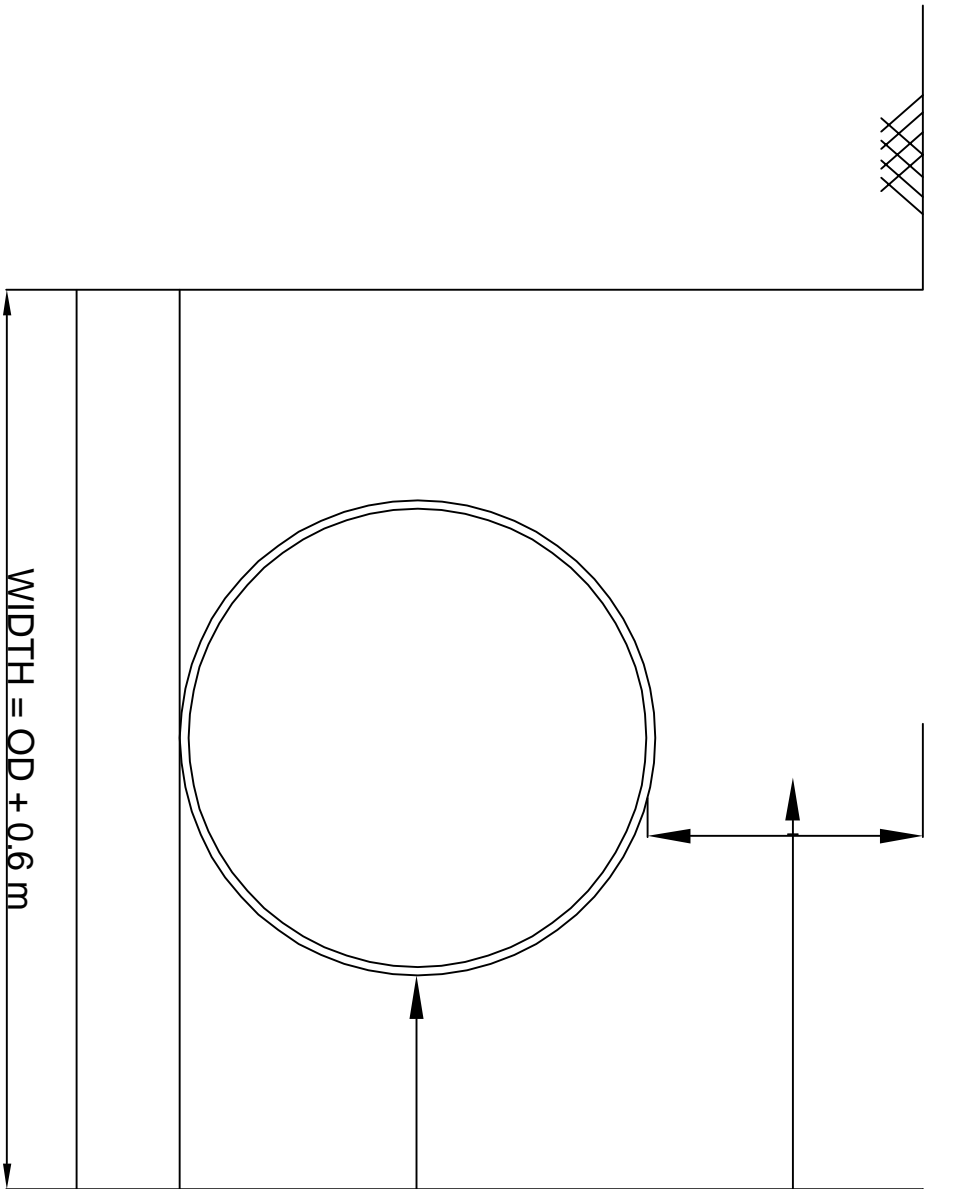
CHAINAGE	GROUND LEVEL	PIPE INVERT
0	543.521	
300	537.356	
600	535.22	
900	530.122	
1200	526.434	
1500	525.179	
1800	527.674	
2100	526.524	
2400	521.352	
2730	520.336	
3000	521.253	
3300	516.753	
3600	516.563	
3900	512.991	
4200	513.251	
4500	512.729	
4800	509.839	
5100	506.713	
5400	505.57	
5670	506.504	
6000	504.161	
6300	506.317	
6600	507.243	
6900	507.905	
7200	504.257	
7500	504.466	
7800	505.076	
8100	508.198	
8400	510.833	
8700	508.778	
9000	510.894	
9300	512.798	
9600	515.899	
9900	512.071	
10200	505.953	
10500	502.988	
10800	499.801	
11100	501.386	
11400	502.353	
11700	505.754	
12000	510.188	
12300	513.188	
12600	515.434	
12900	519.357	
13200	520.96	
13500	516.415	
13800	514.176	
14100	508.722	
14400	505.35	
14700	504.835	
15000	505.308	
15300	508.747	
15600	515.747	
15900	518.859	
16200	523.415	
16500	526.764	
16800	529.337	
17100	533.637	
17400	538.884	
17700	538.142	
18000	536.003	
18300	533.447	
18600	525.744	
18900	517.248	
19200	510.713	
19500	509.121	
19800	511.289	
20100	507.767	
20400	507.754	
20700	510.225	
21000	510.665	
21300	505.762	
21600	503.408	
21900	499.688	
22200	498.939	
22500	500.198	
22800	496.515	
23100	499.536	

SOLAPUR CITY DEVELOPMENT CORPORATION LIMITED (SCDCL)
 MAHARASHTRA, JEEVAN PRAJALIKARAN
 M.J.P. DIVISION, SOLAPUR
 AUGMENTATION TO SOLAPUR CITY WATER SUPPLY SCHEME
 (DANI DANI AS A SOURCE - FOR TOWN)
 L SECTION FROM B. P. T. TO CHAINAGE 23100 M.

Asst. Executive Engineer MJP Sub Div 1, Solapur	Executive Engineer MJP Sub Div, Solapur	Chief Technical Offr SCDCL, Solapur
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SOLAPUR CITY DEVELOPMENT CORPORATION LIMITED (SCDCL)		
MAHARASHTRA JEEVAN PRADHIKARAN		
M.J.P. DIVISION, SOLAPUR		
AUGMENTATION TO SOLAPUR CITY WATER SUPPLY SCHEME (UJANI DAM AS A SOURCE - FOR 110MLD)		
L SECTION FROM CH 23100 TO CH 38100 M.		
Asst. Executive Engineer MJP Sub Div 1, Solapur	Executive Engineer MJP Sub Div, Solapur	Chief Technical Office SCDCL, Solapur



MINIMUM COVER
1.2 m - FOR VEHICULAR TRAFFIC
1.0 m - FOR NORMAL

MS/DI PIPE

FOR BC SOIL - SAND BOXING
FOR SLUSHY/MARSHY - RUBBLE SOLING
FOR OTHER - MURUM BEDDING

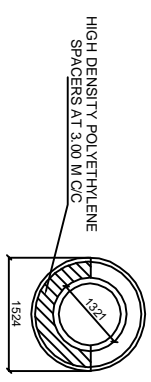
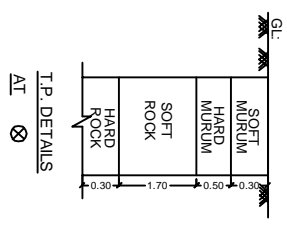
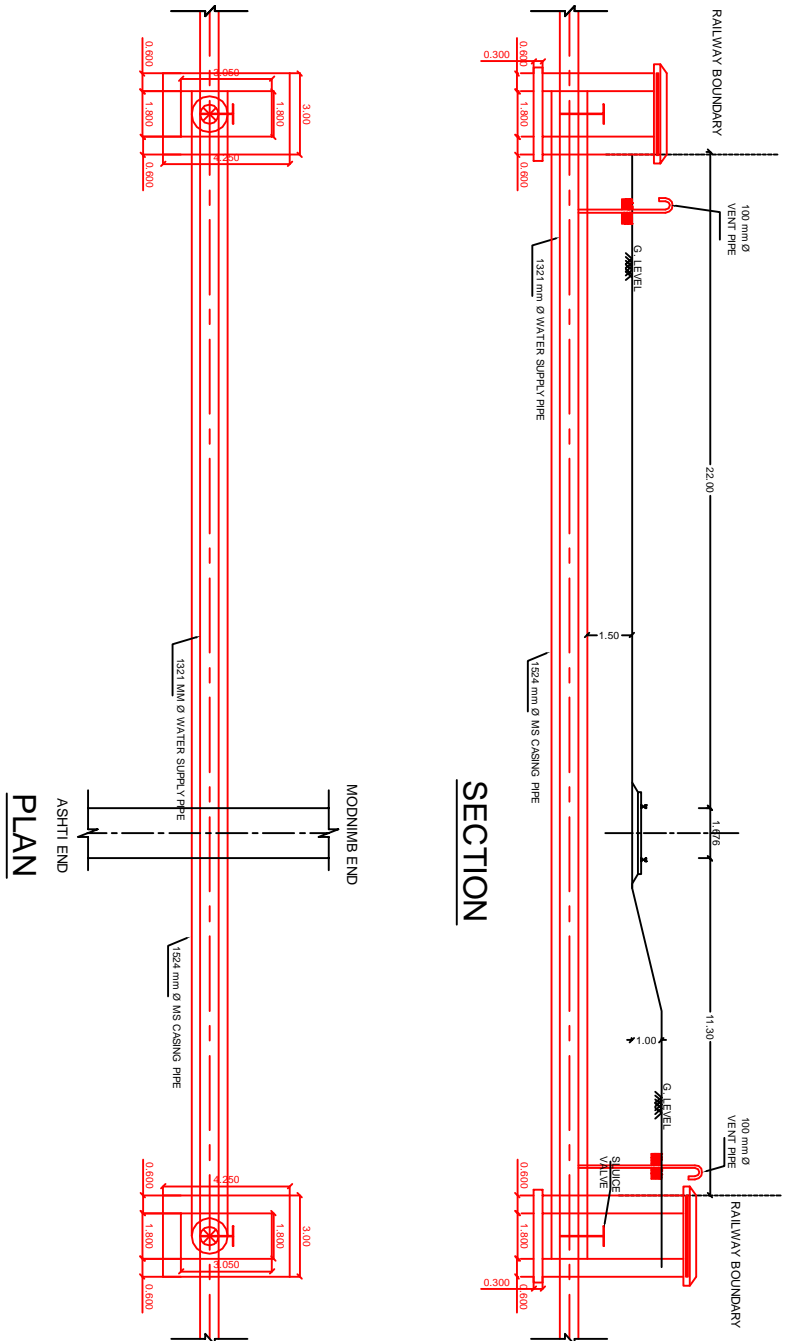
SOLAPUR CITY DEVELOPMENT CORPORATION LIMITED (SCDCL)

MAHARASHTRA JEEVAN PRADHIKARAN
M.J.P. DIVISION, SOLAPUR

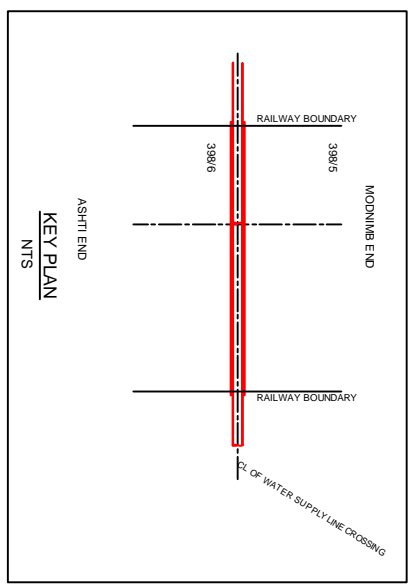
AUGMENTATION TO SOLAPUR CITY WATER SUPPLY SCHEME
(UJANI DAM AS A SOURCE - FOR 110MLD)

CROSS SECTION OF PIPELINE

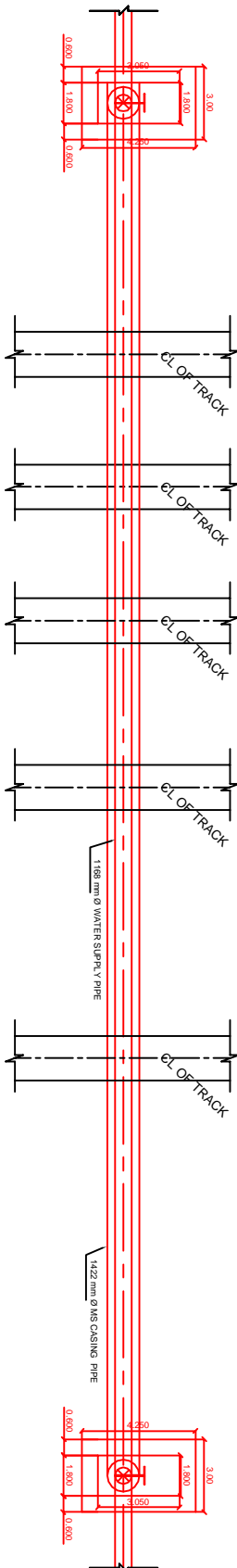
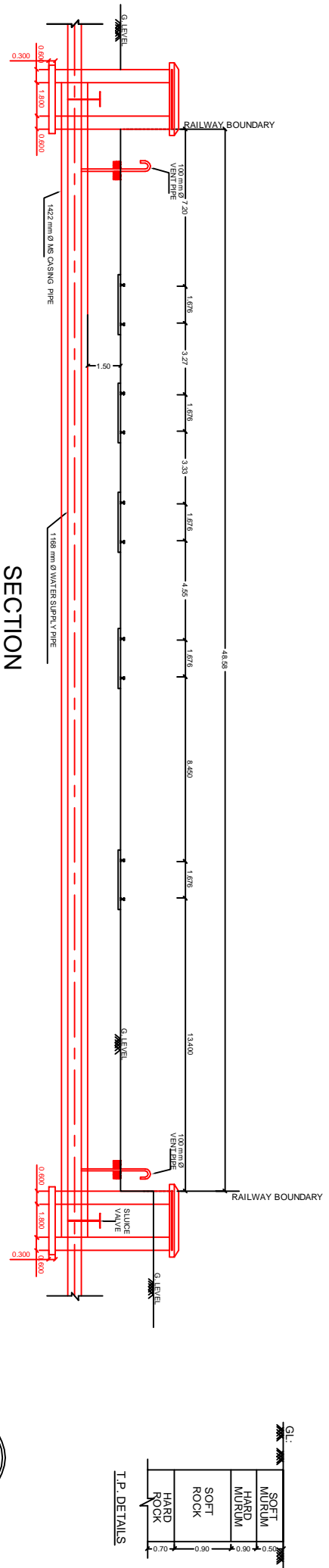
Asst. Executive Engineer MJP Sub Div 1, Solapur	Executive Engineer MJP Sub Div, Solapur	Chief Technical Offi SCDCL, Solapur
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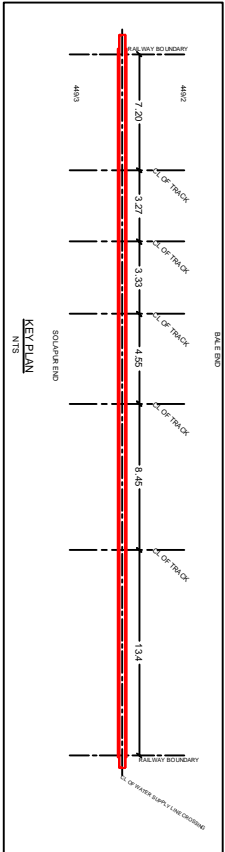
CROSS SECTION OF PIPES



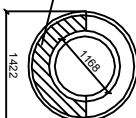
<p>SOLAPUR CITY DEVELOPMENT CORPORATION LIMITED (SCDCL)</p> <p>MAHARASHTRA JEEVAN PRADHIKARAN</p> <p>M.J.P. DIVISION, SOLAPUR</p> <p>AUGMENTATION TO SOLAPUR CITY WATER SUPPLY SCHEME (UJANI DAM AS A SOURCE - FOR 110MLD)</p> <p>PROPOSED RAILWAY CROSSING BY PUSH THROUGH METHOD NEAR MODNIMB STATION @ Km 398/5-6</p>		
Asst. Executive Engineer MJP Sub Div 1, Solapur	Executive Engineer MJP Sub Div, Solapur	Chief Technical Officer SCDCL, Solapur



PLAN

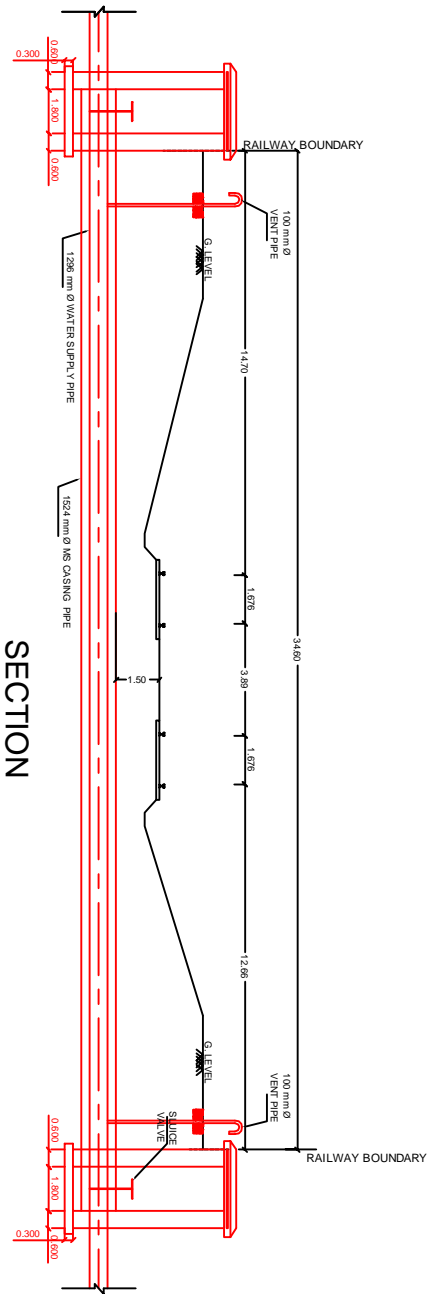


HIGH DENSITY POLYETHYLENE SPACERS AT 3.00 M C/C

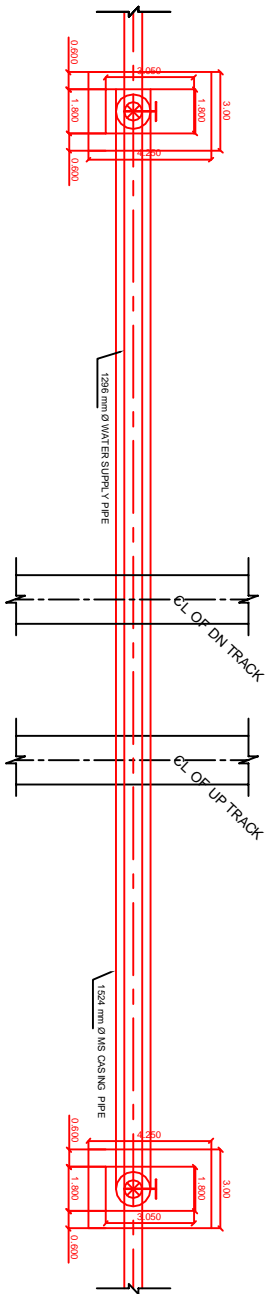


CROSS SECTION OF PIPES

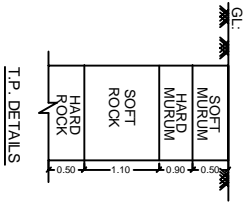
SOLAPUR CITY DEVELOPMENT CORPORATION LIMITED (SCDCL)		
MAHARASHTRA JEEVAN PRADHIKARAN		
M.J.P. DIVISION, SOLAPUR		
AUGMENTATION TO SOLAPUR CITY WATER SUPPLY SCHEME (JUANI DAM AS A SOURCE - FOR 110MLD)		
PROPOSED RAILWAY CROSSING BY PUSH THROUGH METHOD NEAR BALE STATION @ Km 449/2-3		
Asst. Executive Engineer MJP Sub Div 1, Solapur	Executive Engineer MJP Sub Div, Solapur	Chief Technical Officer SCDCL, Solapur



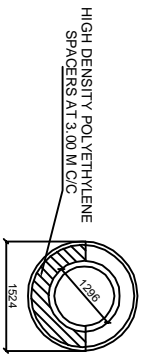
SECTION



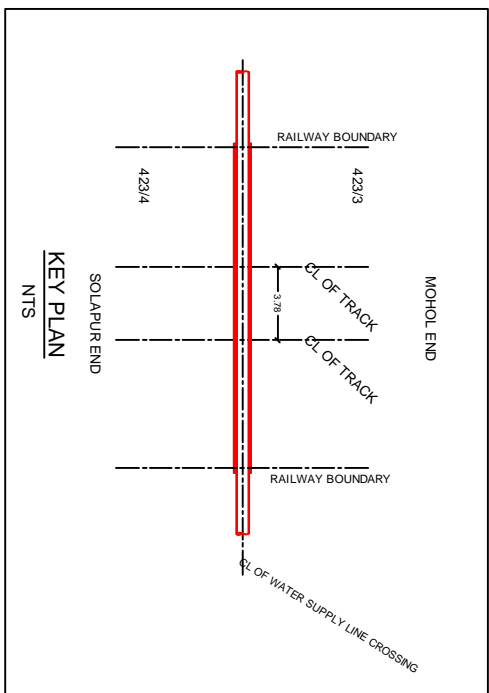
PLAN



T.P. DETAILS



CROSS SECTION OF PIPES

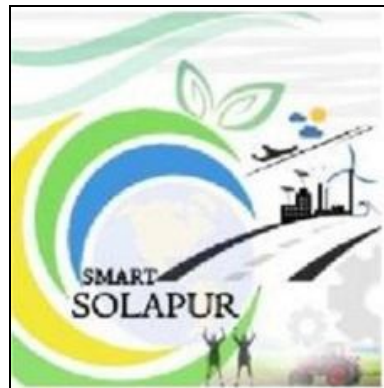


KEY PLAN
NTS

SOLAPUR CITY DEVELOPMENT CORPORATION LIMITED (SCDCL)		
MAHARASHTRA JEEVAN PRADHIKARAN		
M.J.P. DIVISION, SOLAPUR		
AUGMENTATION TO SOLAPUR CITY WATER SUPPLY SCHEME (JLANI DAM AS A SOURCE - FOR 110MLD)		
PROPOSED RAILWAY CROSSING BY PUSH THROUGH METHOD		
NEAR MOHOL STATION @ Km 423/3-4		
Asst. Executive Engineer MJP Sub Div 1, Solapur	Executive Engineer MJP Sub Div, Solapur	Chief Technical Officer SCDCL, Solapur



Solapur City Development Corporation Limited



Tender No.

Augmentation to Solapur City Water Supply Project (Ujani Dam as a source – 110 MLD) on Design, Build, Maintain, Operate and Transfer (DBMOT) Basis

Part - III: CONDITIONS OF CONTRACT AND CONTRACT FORMS

NOVEMBER 2018

SECTION 7: GENERAL CONDITIONS OF CONTRACT- FIDIC (GCC)

The FIDIC Conditions of Contract for DBO Projects, 2011 shall constitute the General Conditions of Contract that shall form part of the Contract Agreement, as amended by the Contract Data Sheet (Section 2 of the Bidding Documents) and the following Particular Conditions of Contract.

Copies of the above FIDIC publication i.e. "FIDIC Conditions of Contract for DBO Projects, 2011" can be obtained from:

International Federation of Consulting Engineers
FIDIC Bookshop – Box- 311 – CH – 1215
Geneva 15 Switzerland
Fax: +41 22 799 49 054
Telephone: +41 22 799 49 01
E-mail: fidic@fidic.org
Website: www.fidic.org

SECTION 8 : PARTICULAR CONDITIONS OF CONTRACT (PCC)

1. (a) The word '**tender**' is synonymous with '**bid**';

(b) The term "GCC" shall mean the General Conditions of Contract.

2. **CLAUSE 1 - THE CONTRACT**

2.1 **Clause 1.1 - Definitions**

- a) Subparagraph 1.1.10 of Sub-Clause 1.1 of the GCC shall be deleted and replaced with the following:

'1.1.10 (a) "**Contract**" means these Conditions of Contract (comprising the General Conditions of Contract, Particular Conditions of Contract and the Contract Data Sheet), the Employer's Requirements, the Bidding document, the Contractor's Proposal, the Schedules, the Letter of Acceptance, the Contract Agreement and such other documents as may be expressly incorporated in the Letter of Acceptance or Contract Agreement or any other document necessary and as may be designated as a part of the Contract by the Employer.

For the purposes of defining the different activities and obligations under the Contract, the Contract comprised of a "**Works Contract**" and an "**O&M Contract**", as defined in the following Subparagraph 1.1.10(b) and 1.1.10 (c), respectively; such definitions are for convenience only and shall not affect the rights or obligations of the Employer or the Contractor under the Contract.

1.1.10 (b) "**Works Contract**" means that portion of the Contract that refers to the design, execution, completion, trial run and commissioning of the Works within 30 months from the date of issuance of the notice to proceed with respect to the construction Works by the Employer and the remedying of any defects, within period of one (01) year from date of commissioning at the Contractor's own cost but excluding Operation and Maintenance of the facilities ("**O&M Works**") for the Operation and Maintenance Period, in accordance with the provisions of the Contract.

1.1.10 (c) "**O&M Contract**" means that portion of the Contract that refers to the Operation and Maintenance of the facilities for the Operation and Maintenance Period, as defined in the Tender, but excluding the costs of design, execution, completion, trial run and commissioning of the Works and the remedying of any defects, in accordance with the provisions of the Contract.'

- b) The following definitions shall be added to Clause 1.1 of the GCC:

"**Engineer**" means the person or persons of the engineering department or engineering consultants appointed by the Employer to assist the Employer's Representative.'

"**Engineer-in charge**" means Executive Engineer of the engineering department or engineering consultants appointed by the Employer.

"**SMC**" means Solapur Municipal Corporation

"**MJP**" means Maharashtra Jeevan Pradhikaran

- c) Subparagraph 1.1.32 of Sub-Clause 1.1 of the GCC to be amended to state as follow:

“Employer” means “Solapur Smart City Development Corporation Limited (SCDCL)”

2.2 Clause 1.4 - Law and Language

Sub-Clause 1.4 of the GCC to be deleted and replaced with the following:
replace it with the following:

‘The Contract shall be governed by the law of India. The language of the contract shall be English language, which shall be the binding language and controlling language for all the matters relating to the meaning, interpretation and communication of the Contract.’

2.3 Clause 1.5 - Priorities of Documents

Clause 1.5 of the GCC shall be deleted and replaced with the following:

‘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 and in the event of any conflict of provisions appearing in two or more of the documents as listed below, the provision provided in the document that is listed higher shall prevail:

- (a) the Contract Agreement;
- (b) the Letter of Acceptance;
- (c) the Employer's Requirements;
- (d) the Bid (accepted Price Proposal);
- (e) Contract Data Sheet as provided in Section 2 of the Bidding Documents (Bid Data Sheet);
- (f) Particular Conditions of Contract;
- (g) General Conditions of Contract;
- (h) the Schedules;
- (i) the Drawings;
- (j) the Contractor's Proposal (Technical Proposal);
- (k) Standard Specifications; and
- (l) Quality Assurance/Quality Control Manual.’

2.4 Sub-Clause 1.6 - Contract Agreements

Clause 1.6 of the GCC shall be deleted and replaced with the words:

‘The costs of stamp duties and similar charges imposed by the law in India in connection with the execution of the Contract Agreement shall be borne by the contractor.’

3. CLAUSE 3 - THE EMPLOYER’S REPRESENTATIVE

3.1 Clause 3.1 - Employer Representative's Duties and Authority

The following provision shall be added to the in Clause 3.1 of the GCC after the existing Clause 3.1:

‘The Employer's Representative shall obtain the specific approval of the Employer before taking action under the following clauses of the GCC:

- (a) Recommending approval of Sub-contracting of any part of the Works under Sub-Clause 4.4.
- (b) Recommending additional cost to the Contract if such a certification would adjust the Contract Price by more than 5% (five percent) of the Contract Price.
- (c) Recommending extension of the time for completion under Sub- Clause 8.3.
- (d) Suspending progress of part or all of the Works under Sub-Clause 8.7.

Notwithstanding the obligation to obtain approval as set out in the preceding paragraph if, in the opinion of the Employer's Representative, an emergency occurs affecting the safety of life or of the Works or of adjoining property, it may, without relieving the Contractor of any of its duties and responsibilities under the Contract, instruct the Contractor to execute all such Work or to do all such things as may, in the opinion of the Employer's Representative, be necessary to abate or reduce the risk. The Contractor shall forthwith comply with the instructions of the Employer's Representative despite the absence of approval of the Employer. The Employer's Representative shall determine the extra cost to the Contractor for carrying out of such instruction and obtain the Employer's approval for an addition to the Contract Price.'

3.2 Clause 3.4 - Replacement of the Employer's Representative

Sub-Clause 3.4 of the GCC is deleted.

4. CLAUSE 4 - THE CONTRACTOR

4.1 Clause 4.1 - General Obligations

The following provision shall be included prior to the first paragraph in Section 4.1 of the GCC:

'The Contractor shall check the design criteria and calculations (if any) included in the Employer's Requirements, to confirm their correctness in its bid and to assume full responsibility for them.'

4.2 Clause 4.2 - Performance Security

Sub-Clause 4.2 of the GCC shall be deleted and replaced with the following:

'The Contractor shall provide 2% (two percent) of the Contract Price as performance security for its proper performance of the Contract to the Employer within 28 (twenty-eight) days from the receipt of the Letter of Acceptance from the Employer. The performance security shall be denominated solely in Indian Rupees in the amount specified in the Tender, and shall be in the form of an unconditional and irrevocable bank guarantee issued by a Nationalized Bank located in India. The issuing branch of such bank shall be located in Solapur, Maharashtra. When providing such security to the Employer, the Contractor shall notify the Employer's Representative of so doing.

Without limitation to the provisions of the preceding paragraph, whenever the Employer's Representative determines an addition to the Contract Price as a result of a change in cost and/or legislation or as a result of a variation amounting to more than ten percent (10%) of the portion of the Contract Price, the Contractor, at the written request of the Employer's Representative, shall promptly increase the value of the performance security by an equal percentage.

The Contractor shall have to furnish additional performance security if it quotes the tender cost Ten (10) % below the estimated cost. The amount of additional

performance security shall be equal to the sum which is worked out with the given formula.

Formula for Amount of Additional Security from the Contractor:

Where,

X=Estimated cost of Tender

Y= Amount quoted by Bidder

Amount of Additional Security from Bidder (Z) = (0.89 X- Y)

The performance security shall be valid until the Contractor has completed the whole of the Works, remedied any defects, and completed his obligations for operation and maintenance of the constructed facilities. 50% of the amount of the Performance Security will be released to the Contractor within 14 days of the issue of the certificate evidencing completion of all works contemplated under the Works Contract, i.e. Commissioning Certificate under Clause 11.7.

The balance amount of the Performance Security will be released to the Contractor within 14 days of the issue of the certificate evidencing completion of all works contemplated under the O&M Works, i.e. Contract Completion Certificate under Clause 10.8.

Prior to making a claim under the performance security, the Employer shall, in every case, notify the Contractor stating the nature of the default for which the claim is to be made.'

4.3 Clause 4.4 - Subcontractors

Sub-Clause 4.4 of the GCC shall be deleted and replaced with the following:

The Contractor shall not subcontract more than 50% (fifty percent) of the value of the whole of the Works. Any proposed subcontracts entered into by Contractor shall be subject to the following conditions:

- (a) the Contractor shall obtain prior consent of the Employer for engaging all subcontractors (including the subcontractors whose details have been provided to the Employer under the Bidding Documents) and vendors and registered with employer;
- (b) for all other subcontracts, the Contractor shall, in the format provided in Schedule 13 of Section 4 of the Bidding Documents, submit a list of proposed subcontractors along with credentials about their technical capacity, financial capability and experience in works similar to those which are proposed to be subcontracted and other relevant information to the satisfaction of the Employers;
- (c) the Employer's Representative will scrutinize the proposals submitted by the Contractor and approval of the subcontractors will be based on their overall capacity to execute the works proposed to be subcontracted;
- (d) the prior approval of the Employer's Representative shall be obtained for all proposed Subcontractors, as well as for the proposed agreement(s) between the Contractor and such proposed Subcontractors;
- (e) the Contractor shall submit a copy of the proposed agreement between the Contractor and the proposed subcontractor, and such agreement shall

require approval of the Employer's Representative. Such proposed agreement(s) should be reasonable, workable and justified; and

- (f) where practicable, the Contractor shall give a fair and reasonable opportunity for contractors from India to be appointed as Subcontractors.

The Contractor will be responsible to ensure that no unauthorized subcontractors are permitted to work at any part of the Site. If, at any stage during execution, a subcontractor is found working at the Site without prior approval of the Employer's Representative, then the work being done by that subcontractor shall be stopped, the subcontractor shall be expelled from the Site, and an amount equivalent to 50% (fifty percent) of the value of the works done by that subcontractor will only be paid against such work.

The act of subcontracting any Part or Section of the Works will not relieve the Contractor of his overall responsibilities under the Contract. The Contractor shall be responsible for observance by all Subcontractors of all the provisions of the Contract. The Contractor shall be responsible for the acts or defaults of any Subcontractor, his agents or employees, as fully as if they were the acts or defaults of the Contractor, his agents or employees.

In the event that the Employer's Representative determines that any Subcontractor's performance with respect to progress, quality or behavior is unsatisfactory, then the Contractor will be required to remove such Subcontractor from the Site and either undertake the Works itself or provide a suitably qualified replacement. If any delays occur as a result, the Contractor will be responsible to take any necessary actions to make up the lost time, for which no additional payments or extension of time will be granted.'

4.4 Clause 4.7 – Setting Out

Sub-Clause 4.7 (b) of the GCC shall be deleted.

4.5 Clause 4.8 - Safety Precautions

The following subsection shall be added to Clause 4.8 of the GCC after sub- Section 4.8(e):

'(f) The Contractor shall submit, within 14 (fourteen) days of signing of Agreement, the proposed Safety Plan for approval by the Employer's Representative. Such Safety Plan shall be developed to ensure Zero fatal accidents and Zero hazardous incidents/occurrences in all construction works, and during operation and maintenance of the Project. The Employer's Representative shall scrutinize, modify if required and approve such proposed Safety Plan, in consultation with the Contractor, within 14 days of submission by the Contractor. Nevertheless, any approval by the Employer's Representative, or failure to object to the proposed Safety Plan, will not relieve the Contractor of any of its obligations or responsibility under the contract and/ or under applicable law.'

4.6 Clause 4.9 - Quality Assurance

The following provision shall be added to the existing provision of Clause 4.9 of the GCC after the third paragraph of the GCC:

'The Contractor shall submit, within 14 (fourteen) days of signing of Contract, the proposed quality assurance and quality control (QA/QC) Program for approval

by the Employer's Representative. Such QA/QC Program shall be developed to describe the type, frequency and procedure of tests to be done on the Site(s); type, frequency and procedure of tests to be done in pipe manufacturing units at Site, if applicable; type, frequency and procedure of tests to be done at manufacturers' locations outside the Site; all parameters to be measured in these tests; permissible limits of such parameters; details of laboratories to be established at the Site(s); details of testing equipment and machines and their calibration schedules; details of the contractor's internal control systems for assuring quality control at locations of manufacturers' outside the Site; details of qualifications and experience of the Quality Control professionals to be deployed by the contractor for the entire project; and the systems of Quality Audit to be instituted by the contractor, etc., essential for systematic and professional management as well as adherence to the highest standards of quality of all construction works. The Employer's Representative shall scrutinize, modify if required and approve such proposed QAQC Program, in consultation with the Contractor, within 14 days of submission by the Contractor. If the Employer's Representative does not give its approval or objection within the stated period, the QAQC Program shall be deemed to be accepted. Nevertheless, any approval by the Employer's Representative, or failure to object to the proposed QAQC Program, will not relieve the Contractor of any of its obligations or responsibility under the contract.

The Contractor, prior to commencement of permanent works at the Site, shall set up his own laboratory, with prior notification to the Employer's Representative. The calibration of the laboratory equipment and instruments shall at the initial stages be certified by agencies approved by the Employer's Representative. Laboratory equipment shall be properly maintained and calibrated throughout the period of the Contract by the Contractor at his own expense.

The Contractor shall give the Employer's Representative at least 24 (twenty- four) hours advance notice prior to conducting any tests for materials and work. The Employer's Representative will also inspect the laboratory if deemed necessary and the Contractor shall provide adequate facilities to the Employer's Representatives for his independent verification of the accuracy and adequacy of the facilities. The Contractor shall arrange visit of Employer's representative to equipment manufacturing plants for inspection of material before supply of equipment or machinery to site. The list of mandatory equipment to be provided at the Site by the Contractor is indicated in the Bidding Documents.'

4.7 Clause 4.10 - Site Data

The following provision shall be added to the existing provisions of Clause 4.10 of the GCC:

'The Employer does not warrant either the sufficiency or accuracy of data provided in this document or elsewhere. The Contractor shall be wholly responsible for interpreting all data, including any data listed elsewhere in the Contract as open for inspection at the office of the Employer, and for undertaking any necessary confirmatory or additional surveys that he deems necessary before submitting the Tender.'

4.8 Clause 4.17 - Contractor's Equipment

The following provision shall be added to the existing provisions of Clause 4.17 of the GCC: -

'Unless otherwise stated in the Employer's Requirements, the Contractor shall provide all Contractor's Equipment necessary to complete the Works, including testing, trial run and commissioning, and to operate, maintain, inspect and repair

as necessary the constructed facilities during the period of the operation and maintenance Works.

The Contractor shall submit, within 14 days of signing the Agreement, the proposed deployment program of all necessary equipment, plant and machinery to be used for construction (such as pipe fabricating plant, pipe coating plant, pipe lining machines, excavators, concrete batching plants, hot mix plants, generators, welding sets, shuttering sets, soil compactors, etc.) for approval by the Employer's Representative. Such Deployment Program shall be developed on a normally available commercial project management software showing detailed micro-level equipment, plant and machinery along with bar charts, essential for systematic and professional management of all construction works. The Employer's Representative shall scrutinize, modify if required and approve such proposed deployment program, in consultation with the Contractor, within 14 days of submission by the Contractor. If the Employer's Representative does not give its approval or objection within the stated period, the Deployment Program shall be deemed to be accepted. Nevertheless, any approval by the Employer's Representative, or failure to object to the proposed deployment program, will not relieve the Contractor of any of its obligations or responsibility under the contract.'

4.9 Clause 5.1 - General Obligations

The first sentence of Clause 5.1 of the GCC shall be deleted and replaced by the following sentence:

'The Contractor shall carry out, and be responsible for, the design of the Works, including any site surveys, subsoil investigations, materials testing, and all other things necessary for proper planning and design.'

The following provision shall be added to the existing provisions of Clause 5.1 of the GCC at the end of the existing Clause 5.1 of the GCC as modified to the extent and by clause 4.8 of these Particular Conditions of Contract above:

'The Contractor will be required to establish a fully equipped design office located near site, within 14 days of receipt of the notice to commence to facilitate preparation and submission of designs, drawings, construction documents, etc., for review and approval of designs by the Employer's Representative. The design office shall preferably be located near the Employer's office to facilitate communications and frequent interactions with the Employer's Representative. The Contractor shall provide full time design staff and continuously maintain the design office until such time as all necessary designs and Construction Documents have been completed, reviewed and approved by the Employer's Representative.

The Contractor will be fully responsible to ensure that its designs, drawings and construction documents satisfy the requirements for constructing Works that are complete and sufficient in all respects, and satisfy the objectives of providing completed facilities that can be operated efficiently and economically. No approval of, or failure to object to, the Contractor's designs, drawings or Construction Documents by the Employer's Representative will relieve the Contractor of its responsibility.'

4.10 Clause 5.2 - Construction Documents

The first paragraph of Clause 5.2 of the GCC shall be deleted and replaced with the following:

'(a) The Contractor shall submit, within 14 days of signing the Agreement, the proposed submission and anticipated approval program ("Program") of all

necessary construction documents for approval by the Employer's Representative. Such Program shall be developed in order to ensure availability of all construction documents on site in a timely manner essential for systematic and professional management of all construction works. The Employer's Representative shall scrutinize, modify if required and approve such proposed Program, in consultation with the Contractor. Nevertheless, any approval by the Employer's Representative, or failure to object to the proposed Program, will not relieve the Contractor of any of its obligations or responsibility under the Contract. Construction shall not commence until the Contractor receives from the Employer's Representative approval of the Construction Documents relevant to the design and construction of such parts.'

4.11 Clause 5.4 - Technical Standards & Regulations

The following provision shall be added to the existing provisions of Clause 5.4 of the GCC after the existing provisions of Clause 5.4 of the GCC:

'In respect of technical specifications and standards, any National or International Standards which promise to confer equal or better quality than the standards specified, to the sole satisfaction of the Employer, will also be acceptable.'

5. CLAUSE 6 - STAFF AND LABOUR

Clause 6.1 - Engagement of staff and labour

The following provision shall be added to the existing provisions of Clause 6.1 of the GCC after the existing provisions of Clause 6.1 of the GCC:

a) The employment of female laborers on works in neighborhood of soldiers barracks should be avoided as far as possible. The Contractor shall employ any famine, convict or other labour of a particular kind or class if ordered in writing to do so by the Employer/Employers Representative. If Government declares a site of scarcity or famine to exist in any village situated within 16 Kms of the work, the Contractor shall employ upon such parts of the work, as are suitable for unskilled labour, any person certified to him by the Employer, or by Employers Representative to be in need on relief and shall be bound to pay to such person wages not below the minimum wages which Government may have fixed in this behalf. Any disputes which may arise in connection with the implementation of this clause shall be decided by the Employer in charge whose decision shall be final and binding on the Contractor.

b) Contractor shall not employ any person who is under the age of 18 years.

c) No work shall be done on Sunday without the sanction in writing of the Employers Representative.

d) No Contractor shall employ donkeys or other animals with breaching of string or thin rope. The breaching must be at least three inches wide and should be of tape (Nawar). No animal suffering from sores, lameness or emaciation or which is immature shall be employed on the work. The Employer or Employers Representative is authorized to remove from the work, any person or animal found working which does not satisfy these conditions and no responsibility shall be accepted by the Employer for any delay caused in the completion of the work by such removal.

e) The Contractor shall pay fair and reasonable wages to the workmen employed by him in the contract undertaken by him, In the event of the dispute arising between the Contractor and his workmen on the grounds that the wages paid are not fair and reasonable, the dispute shall be referred without delay to the Employers Representative who shall decide the same. The decision of the Employers Representative shall be conclusive and binding on the Contractor but such decision shall not in any way affect the conditions in the contract regarding the payment to be made by the Employer at the sanctioned tender rates.

f) Contractor shall provide drinking water facilities to the workers. Similar amenities shall be provided to the workers engaged on large work in urban areas

g) Contractor to take precautions against accidents which taken place on account of labour using loose garments while working near machinery.

5.1 Clause 6.4 - Labour Laws

Clause 4.4 of the GCC shall be deleted and replaced with the following:

'The Contractor shall take all practicable steps to ensure that the Contractor and any sub-contractors, comply with all the relevant labor Laws applicable to the Contractor's personnel and the personnel of the sub-contractor, including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all legal rights.

The Contractor shall require the Contractor's personnel and the personnel of the sub-contractor to obey all applicable Laws, including those concerning safety at work.'

5.2 Clause 6.5 - Working Hours

The following provision shall be added to the existing provisions of Clause 6.5 of the GCC:

'The Contractor shall abide by Maharashtra Essential Services Maintenance Act, 2011. The Operation and Maintenance work shall be carried out 365 days, 24 hours a day in 3 (three) shifts.'

5.3 Clause 6.8 - Contractor's Superintendence

The following provision shall be added to the existing provisions of -Clause 6.8 of the GCC after the existing provisions of Clause 6.8 of the GCC:

'The Contractor shall submit, within 14 days of signing the Contract, the proposed deployment program of all key personnel as well as workers for superintendence of construction activities for approval by the Employer's Representative. Such deployment program shall be developed showing details of qualifications and experience of key personnel and number of skilled/semi-skilled/un-skilled workers to be deployed on a timeline essential for proper superintendence and systematic and professional management of all construction works. The Employer's Representative shall scrutinize, modify if required and approve such proposed Deployment Program, in consultation with the Contractor. Nevertheless, any approval by the Employer's Representative, or failure to object to the proposed Deployment Program, will not relieve the Contractor of any of its obligations or

responsibility under the contract. A reasonable proportion of the Contractor's Superintending staff shall have a working knowledge of the English language, or the Contractor shall have sufficient competent interpreters available on site during all working hours.'

6. CLAUSE 7 - PLANT, MATERIALS AND WORKMANSHIP

6.1 Clause 7.1 - Manner of Execution

The following provision shall be added to the existing provisions of Clause 7.1 of the GCC after the existing provisions of Clause 7.1 of the GCC:

'The Contractor shall submit, within 14 days of signing the Agreement, the proposed Procurement Program of all necessary Equipment, Plant and Materials to be incorporated in the Permanent Works for approval by the Employer's Representative. Such Procurement Program shall be developed on a normally available commercial project management software showing detailed planning for placing of orders, inspection by the representatives of the Contractor, Employer or Third Party Agencies, as applicable, transportation plans and delivery schedules for all Equipment, Plant and Materials to be incorporated in Permanent Works essential for systematic and professional management of all construction works. The Employer's Representative shall scrutinize, modify if required and approve such proposed Procurement Program, in consultation with the Contractor. Nevertheless, any approval by the Employer's Representative, or failure to object to the proposed Procurement Program, will not relieve the Contractor of any of its obligations or responsibility under the contract.'

6.2 Clause 7.5 - Rejection

The following provision shall be added to the existing provisions of Clause 7.5 of the GCC after the second paragraph of Clause 7.5 of the GCC:

'The additional costs will be calculated based on the direct cost of any labor, equipment, materials, superintendence and other services provided by the Employer for carrying out such retesting, as certified by the Employer's Representative, plus an administration fee of 10% (ten percent) of the direct costs to cover overheads and other indirect costs.'

Clause 7.8 – Royalties

The following provision shall be added to the existing provisions of Clause 7.8 of the GCC after the second paragraph of Clause 7.8 of the GCC:

All quarry fees, royalties, octroi duties and ground rent for stacking materials, if any should be paid by Contractor, which will not be entitled to a refund of such charges from the Employer.

During execution of work and till completion if point of royalty is raised by collector office it will be sole responsibility of the contractor to pay royalty charges/compensation if any to concern. Until the certificate from the collector office regarding royalty charges is not submitted by the contractor, final bill and security deposit for such work will not be payable to the contractor.

7. CLAUSE 8 - COMMENCEMENT, DELAYS AND SUSPENSION

7.1 Clause 8.1 - Commencement of Works

Clause 8.1 of the GCC shall be deleted and replaced with the following:

'The Contractor shall commence the design of the Works as soon as is reasonably possible after the receipt of a notice to this effect from the Employer's Representative, but in any event not later than 14 days after establishing the design office or not later than 30 days after issue of Notice to Commence. The Contractor shall commence the execution of the Works as soon as is reasonably possible after the receipt of a notice to this effect from the Employer's Representative, but in any event not later than 21 days after commencing establishment of the Site offices and field laboratories or not later than 60 days after issue of Notice to Commence/ Notice to Proceed. Unless otherwise stated in the particular conditions, the Commencement Date shall be within 42 days after the Contractor receives the Letter of Acceptance. The Contractor shall commence the Operation and Maintenance services immediately after successful commissioning of the Works and issuance of the Taking-Over Certificate by the Employer. The Works will be handed over back to the Contractor for the purpose of Operation and Maintenance.'

7.2 Clause 8.2 - Time for Completion

Clause 8.2 of the GCC shall be deleted and replaced with the following:

'Time is of the Essence under the Contract and the Contractor will be required to take all possible measures to ensure that the Works are executed in conformity with the key milestones as set out in Section 6 of the Bidding Documents (Employer's Requirements), and that the whole of the Works are completed within the scheduled time for completion of the Works. Any hindrances which are outside the control of the Contractor and which may cause a delay in completing some components or parts of the Works will not be construed as justification for delaying completion of, or not executing, those components or parts which are not affected by such hindrance. Time extensions, if any, will only be considered for those components or parts of the Works which have been delayed for reasons outside the control of the Contractor, as defined under Sub-Clause 8.3. In case any hindrance occurs which is outside the control of the Contractor that will cause a delay in completion of any of the key activities which are defined as a Milestone, but will not cause a delay in the Time for Completion of the whole of the Works, then the Employer will only consider a time extension for the affected activity, and not for the whole of the Works.

The whole of the Works and each Section (if any) shall be completed and shall have passed the Tests on Completion, trial run and commissioning within the Time for Completion of the Works as specified in the Tender. The Taking-Over Certificate will be issued upon successful completion of the Test on Completion, trial run and commissioning, including rectification of any defects observed during this period, in accordance with the provisions of Sub-Clause 12.1.

Operation and Maintenance of the facilities shall be carried out for the period as specified in the Bidding Documents.'

8. CLAUSE 9 - DESIGN- BUILD

8.1 Clause 9.9 - Payment for plant and Material in event of suspension.

The following provision shall be added to the existing provisions of Clause 9.9 of the GCC after the existing provisions of Clause 9.9 of the GCC.

'The payment may be part or full as per the discretion of Employer's Representative and shall be made after the inspection of plant /material and certification.'

8.2 The provisions contained in each of Clause 9.10 (Prolonged Suspensions) of the GCC and Clause 9.11 (Resumption of Work) of the GCC shall stand deleted and the existing provisions in the said Clauses shall be replaced by the words "Not used".

9. CLAUSE 10 - OPERATION SERVICE

9.1 Clause 10.3 - Independent Compliance Audit

The first paragraph of Clause 10.3 of the GCC shall be deleted and replaced with the following:

'The Employer shall appoint the Auditing Body at least 182 (one hundred and eighty-two) days prior to the commencement of the Works under the Operations and Maintenance Works.'

9.2 Clause 10.7 - Failure to reach production Outputs

The last sentence of point (a) of Clause 10.7 of the GCC shall be deleted and replaced with the following:

'If the Contractor suffers any additional cost as a result of the failure or the measures instructed by the Employer, the Employer, subject to Sub-Clause 3.5 (Determinations) and Sub-Clause 20.1 (Contractor's Claims), shall pay the contractor his cost as agreed by the Employer.'

10. CLAUSE 12 - DEFECTS

10.1 Clause 12.7 - Completion of Operations and Maintenance Services

The following provisions shall be inserted as new Clause Sub-Clause 12.7 to the GCC:

'The Contractor shall ensure that the Works under the O&M Contract shall be in the condition required by the Contract upon completion of the Works under the O&M Contract, including the handing over of the facilities to the Employer in good operating condition (other than fair and reasonable wear and tear in the normal and ordinary course of Works). The Contractor shall:

- (a) ensure that all mechanical and electrical Plant and Equipment are fully functional and in good operating condition, suitable for the purposes for which they were intended;
- (b) ensure that all defects or damages which may have arisen from the design, workmanship, materials, or improper operating conditions or maintenance practices, have been identified and remedied;
- (c) provide replacements for all spare parts that were used/consumed during the Operations and Maintenance Period; all such replacements shall be new manufacturer's original equipment only; and
- (d) execute all required work of amendment, reconstruction, repair and remedying defects or damage as may be instructed by the Employer or Employer's Representative.

All such work shall be executed by the Contractor at its own cost before handing over the facilities. In the event that the Contractor fails to carry out the necessary

remedial works, the Employer's Representative shall notify the Contractor accordingly, and proceed in accordance with the provisions of Sub-Clause 12.4 (a) and (b). Any costs incurred by the Employer in so doing shall be recoverable from the Contractor and will become a debt due and payable by the Contractor to the Employer and the Employer may, at his sole discretion, recover such amount by invoking the Contractor's bank guarantee provided as a performance security.

The Contract shall not be considered to be completed until the Final Contract Completion Certificate has been signed by the Employer's Representative and delivered to the Contractor, stating the date upon which the Contractor has completed his operation and maintenance obligations to the Employer's Representative's satisfaction. The Final Contract Completion Certificate shall be given by the Employer's Representative by the date falling 28 days after expiry of the Operation and Maintenance Period, or as soon after such date as the Contractor has completed his obligations.

Only the Contract Completion Certificate under Clause 10.8 shall be deemed to constitute final certification that the Contractor has satisfactorily fulfilled all of his obligations under the Contract.'

11. CLAUSE 13 - VARIATIONS

- 11.1 Add a new clause as Clause 13.9 of the GCC after the existing Clause 13.8 of the GCC as follows:

'Clause 13.9 - Amendments to the Contract Conditions/Specifications

If the Employer's Representative determines that if, it would be in the best interests of the Project to modify or amend some of the Contract Conditions/ Specifications, such modifications or amendments may be made if mutually agreed by the Employer and the Contractor.'

12. CLAUSE 14 - CONTRACT PRICE AND PAYMENT

12.1 Sub-Clause 14.1 - The Contract Price

Clause 14.1 of the GCC shall be deleted and replaced with the following:

The tender rates are inclusive of all taxes, rates, cess and are also exclusive of the livable tax in respect of sale by transfer of property in goods involved in the execution of work contract under the provision of CGST & MGST rules of Finance Department.

The rates to be quoted by the contractor must be inclusive of all taxes including CGST & MGST . No extra payment on this account will be made to the contractor

'(a) Payment for the Works shall be made on percentage basis, as applicable, under four major work categories as follow:

- (i) Design and documentation, including all necessary designs and documentation required for the Work;
- (ii) Civil works, installation, testing, commissioning and other services required for the different components in accordance with the payment units as set out in the Schedule of Prices and/or as proposed by the Contractor and approved by the Employer's Representative;

- (iii) Plant and equipment, whether manufactured or fabricated outside or within the Employer's country, including supply of all electro-mechanical, electrical and instrumentation equipment, mandatory spare parts, etc., for the different components according to the payment units as set out in the Schedule of Prices and/or as proposed by the Contractor and approved by the Employer's Representative; and
- (iv) Operation and maintenance of the constructed facilities after completion and acceptance of the Works.

Selection of any of the recommended spare parts will be solely at the Employer's option, and payment for such spare parts, if any, will be made at the quoted percentage basis.

The Contract Price shall be adjusted for changes in the cost of labor and materials.

- (b) The Contractor shall pay all the duties and taxes in consequence of his obligations under the Contract, and the Contract Price shall not be adjusted for such costs except Sub Clause 13.6 of the GCC.
- (c) Any quantities which may be set out in the Schedule are only estimated quantities and are not to be taken as the actual and correct quantities of the Works to be executed by the Contractor in fulfillment of his obligations under the Contract. The Contractor is responsible to assess the exact requirements and quantities for all items for the purpose of quoting his rates, and no variation in rates will be allowed on account of any variation in the estimated quantities unless specifically provided elsewhere in the Bid Document.
- (d) Any quantities, prices or rates of payment per unit quantity which may be set out in the Schedule are only to be used for the purposes stated in such Schedule.

Progressive payments shall be made for the work completed by the Contractor in accordance with the provisions of Sub-Clause 13.4.'

12.2 Clause 14.2 - Advance Payment

First two paragraphs (first seven lines) of Clause 14.2 of the GCC shall be deleted.

12.3 Clause 14.3 - Application for Advance and interim Payment Certificates

The following provisions shall be added to Clause 14.3 of the GCC after Clause 14.3 (k) of the GCC:

'(l) Payment for the interim bills shall be on the basis of recording measurements like levels, length etc. taken jointly by Contractor and Employer's representative and Engineer in charge before work commencement and after its entire completion. Major items like Excavation of all components, Providing & laying of pipes, Construction of pumping station, compound walls etc. will be paid for quantities recorded in jointly.

(m) The contractor shall make available surveyor and software with minimum one number of Dual frequency DGPS with star fire subscription coupled with two numbers of Total station and Terrestrial Laser Land Scanner.

(n) The excavated material will be calculated based on levels taken by hydrographic survey/total station survey (Volumetric calculations on LBO basis). For any material royalty payable shall be responsibility of contractor.

The contractor shall indemnify employer and its representative of any liability arising out of this.

(o)The Contractor shall be required to take sufficient nos. of coloured photographs at their own cost with Camera having date printing arrangements along the length or as directed by the Engineer's representative before commencing the work and equal Nos. After completion of work and during progress of the work at the same locations of initial set of photographs. Contractors shall submit the photos to the Engineer-in charge in the Albums and in soft format for proper records as directed.

(p)The contractor shall be required to take video shooting at his own cost along the stretch of his work as directed by Engineer-in charge before commencing the work, during the progress of work and after completion of the work.

(q) Project Director or Person nominated by him shall verify the utilization of the fund paid by the Employer towards advanced payments and interim payments till date through auditing the bank statements provided by the Contractor before making subsequent interim payments.'

12.4 Clause 14.8 – Payment

Clause 14.8 (a) of the GCC shall be deleted.

12.5 Clause 14.8 – Delayed Payment

Clause 14.9 of the GCC shall be deleted.

12.6 Clause 14.10 – Payment of Retention Money

Clause 14.10 of the GCC shall be deleted and replaced with the following:

'Payment shall be restricted to 90% of the quoted price up to completion of erection, construction, testing, commissioning and completion of works. Remaining 10% will be payable in equal yearly installment in 5 years (operation and maintenance period).'

12.7 Clause 20.8 – Arbitration

Clause 20.8 of the GCC shall be deleted and replaced with the following:

In case any dispute arises out during execution of works, no arbitrator shall be appointed for redressal of the dispute. In this regard, decision of the CEO, SCDCL shall be final and remain binding on both parties.

SECTION 9: CONTRACT FORMS

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(ON THE BIDDER LETTERHEAD)

LETTER OF TENDER

Name of Contract: AUGMENTATION TO SOLAPUR CITY WATER SUPPLY PROJECT
(UJANI DAM AS A SOURCE – 110 MLD)

Contract No: -----/----/--/-----

To:

Chief Executive Officer,
Solapur City Development Corporation Limited
Dist. Planning Office, New Collector Office premises,
Near Govt. Milk Dairy, Saat Rasta, Solapur, 413003

Respected Sir

We have examined the Conditions of Contract, Employers Requirements, Schedules, Addenda Nos. and the _____ matters set out in the Appendix hereto. We have understood and checked these documents and have not found any errors in them. We accordingly offer to design, execute and complete and operate and maintain the said Works and remedy any defects, fit it's for purpose in conformity with these documents and the enclosed proposal. I/ We hereby tender for the execution for the Solapur Smart City Developement Corporation Limited, Solapur (herein before and herein after referred to as SCDCL of the work specified in the underwritten memorandum within the time specified in such memorandum. At Rs. In words _____). The

above amounts are in accordance with the Price Schedules herewith and are made part of this bid.[the following sentence is for consortium only] We hereby confirm that all partners in the Consortium are jointly and severally liable for execution of the Contract in accordance with the terms and conditions of the Contract.

The estimated, rates entered in Section "5" (Financial Bidding Forms) are in accordance, in all respects with the specifications, designs, drawings. I/We hereby tender for the execution, for the Solapur Smart City Developement Corporation Limited, Solapur (herein after referred to as SCDCL of the work specified in the under conditions of contract

We agree to abide by this Bid until [insert the date **180 days after the date of submission** of _____ the _____ Technical Propos _____, 201x, and it shall remain binding upon us and may be accepted al] _____ at any time before that date. We acknowledge that the Price Proposal and Technical Proposal form part of our Bid with all its contents.

If our Bid is accepted, we will provide the specified Performance Security commence the Works as soon as reasonably possible after receiving the SCDCL notice to commence, and complete the Works in accordance with the above-named document within the time stated in the Technical Proposal.

Unless and until a formal Agreement is prepared and executed this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.

We understand that you are not bound to accept the lowest or any bid you may receive. Yours faithfully

Signature _____ in capacity _____ duly
to sign bids for and on behalf of _____
Address: _____
Date: _____, 201x

LETTER OF ACCEPTANCE

Name of Contract: Augmentation To Solapur City Water Supply Project
(Ujani Dam As A Source – 110 Mld)

Contract No.: ----/--/--/----

To:

Chief Executive Officer,
Solapur City Development Corporation Limited
Dist. Planning Office, New Collector Office premises,
Near Govt. Milk Dairy, Saat Rasta, Solapur, 413003

Your Reference:

[Reference] Our Reference:
[Reference]

We thank you for your Tender dated 20-- Notice No -----/---/---/----- for the design, execution and completion of the Works comprising the above-named Contract and remedying of defects therein so that they are fit for the purposes defined in the Contract, and for the operation and maintenance thereof under licence for the period of 8 years, all in conformity with the terms and conditions contained in the Contract as amended by the attached Memorandum, signed by you and ourselves.

We have pleasure in accepting your Tender (as corrected/adjusted in accordance with the Memorandum) for the Accepted Contract Amount of:

This amount is made up of the following components:

For the Design-Build of the Works, the amount of: [Currency and amount in figures]
([Currency and amount in words]).

For the Operation and Maintenance Service, the amount of: [Currency and amount in figures] ([Currency and amount in words]).

In consideration of you properly and truly performing the Contract, we agree to pay you the Accepted Contract Amount or such other sums to which you may become entitled under the terms of the Contract, at such times and as prescribed by the Contract.

We acknowledge that this Letter of Acceptance creates a binding Contract between us, and we undertake to fulfil all our obligations and duties in accordance with the terms of this Contract.

Signed by (signature):

For and behalf of:

[Name] Date:

[Date]

CONTRACT AGREEMENT

This Agreement made the
Contract],

[*Name of Contract*] day of [*Name of*

20[*Contract Number*]

Between
Corporation Limited

Solapur Smart City Developement

Of

Solapur,

Maharashtra (herein called "the Employer"), of the one part,

[*Name of Contractor*] And

Of

[*Address*

of Contractor] (herein called "the Contractor"), of the other part:

Whereas the Employer desires that the Works
known as Augmentation To Solapur City
Water Supply Project
(Ujani Dam As A Source – 110 Mld)on
Design, Build, Maintenance, Operate and
Transfer ("**DBMOT**") basis

should be designed, executed and operated by the Contractor and has accepted a Tender
from the Contractor for the design, execution, completion and operation and maintenance of
these Works and services, and the remedying of any defects therein,

The Employer and the Contractor agree as follows:

1 In this Agreement, the words and expressions shall have the same meanings as are
respectively assigned to them in the Conditions of Contract hereinafter referred to.

2 The following documents shall be deemed to form and be read and construed as a part of
this

Agreement:

- a) The Letter of Acceptance dated [Date]
- b) The Letter of Tender dated [Date]
- c) The Addenda Nos. [Numbers]
- d) The General Conditions of Contract
- e) Particular Conditions of Contract
- f) Evaluation and Qualification
- g) Technical Bidding Proposal, Schedule and appendix
- h) Financial Bidding Forms
- i) The Employer's Requirements

3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to design, execute, complete, operate and maintain the Works and remedy any defects therein in conformity with the provisions of the Contract and the Operating License granted by the Employer.
4. The Employer hereby covenants to pay the Contractor, in consideration of the design, execution, completion, operation and maintenance of the Works and the remedying of defects therein, the Contract Price at the times and in the manner prescribed by the Contract, and to grant the Contractor a royalty-free license to enable him to operate and maintain the Works during the Operation Service Period.

Notwithstanding anything contained to the contrary in the Contract Agreement or any other document, the Contractor shall at all times ensure compliance with Section 1 of Part 1 of the Bidding Document.

In witness whereof the Parties hereto have caused this Agreement to be executed on the day and year first above written.

Signed by (signature):

for and on behalf of the Employer in the presence of

Witness (signature):

Name:

[Name] Address:

[Address] Date:

[Date]

Signed by (signature):

for and on behalf of the Contractor in the presence of

Witness (signature):

Name:

[Name] Address:

[Address] Date:

[Date]

AGREEMENT FOR DISPUTE ADJUDICATION BOARD MEMBERS

Name of Contract: Augmentation To Solapur City Water Supply Project (Ujani Dam As A Source – 110 Mld)

This Agreement made the --day of----, 200

[Year] Between

Name and address of Employer: Chief Executive Officer,
Solapur City Development Corporation Limited
Dist. Planning Office, New Collector Office premises,
Near Govt. Milk Dairy, Saat Rasta, Solapur, 413008

Name and address of Contractor: [Name and

Address] Name and address of DAB Member: To

be declared later

Whereas the Employer and the Contractor have entered into a Contract and desire jointly to appoint the above-named Member to act on the DAB as [delete where not applicable] sole adjudicator/one of three adjudicators/chairman of the DAB,

And whereas the Member accepts the appointment.

The Employer, Contractor and Member jointly agree as follows:

- 1 The conditions of this Dispute Adjudication Agreement comprise the "General Conditions of Dispute Adjudication Agreement" which are appended hereto, and the following provisions. In these provisions, which include amendments and additions to the "General Conditions of Dispute Adjudication Agreement", words and expressions shall have the same meanings as are assigned to them in the "General Conditions of Dispute Adjudication Agreement".
- 2 [Details of any amendments or additions or deletions from the "General Conditions of Dispute Adjudication Agreement" should be given here or in an attachment hereto.]
- 3 In accordance with Clause 6 of the "General Conditions of Dispute Adjudication Agreement", the Member shall be paid as follows:
A of [Amount] per calendar month, and retainer fee
A daily fee of [Amount] per day spent on Site visits, hearings, and other time in connection with submissions to the DAB made in accordance with the provisions of the Contract between the Employer and the Contractor.
- 4 In consideration of these fees and other payments to be made by the Employer and the Contractor in accordance with Clause 6 of the "General Conditions of Dispute Adjudication Agreement", the Member undertakes to act as the DAB Member in the capacity abovementioned in accordance with the terms of this Dispute Adjudication Agreement.

AGREEMENT FOR OPERATION SERVICE DISPUTE ADJUDICATION BOARD

[All italicised text and any enclosing square brackets is for use in preparing the form and should be deleted from the final product.]

Name of Contract : Augmentation To Solapur City Water Supply Project (Ujani Dam As A Source – 110 Mld)

This Agreement made the [Day] day of [Month],

20 [Year] Between

Name and address of Employer:

Chief Executive Officer,
Solapur City Development Corporation Limited
Dist. Planning Office, New Collector Office premises,
Near Govt. Milk Dairy, Saat Rasta, Solapur, 413003

Name and address of Contractor:

[Name and

Address] Name and address of DAB Member:

To

be declared later

Whereas the Employer and the Contractor have entered into a Contract and desire jointly to appoint the above-named Member to act as the sole adjudicator on the Operation Service DAB for a period of five (5) years from the date of this Agreement,

And whereas the Member accepts the appointment.

The Employer, Contractor and Member jointly agree as follows:

1 The conditions of this Dispute Adjudication Agreement comprise the “General Conditions of Dispute Adjudication Agreement” which are appended hereto, and the following provisions. In these provisions, which include amendments and additions to the “General Conditions of Dispute Adjudication Agreement”, words and expressions shall have the same meanings as are assigned to them in the “General Conditions of Dispute Adjudication Agreement”.

2 [Details of any amendments or additions or deletions from the “General Conditions of Dispute Adjudication Agreement” should be given here or in an attachment hereto.]

3 In accordance with Clause 6 of the “General Conditions of Dispute Adjudication Agreement”, the Member shall be paid as follows

:

A fee of [Amount] per calendar month, and retainer

A daily fee of [Amount] per day spent on Site visits, hearings, and other time in connection with submissions to the DAB made in accordance with the provisions of the Contract between the Employer and the Contractor.

PERFORMANCE SECURITY – DEMAND GUARANTEE

Name of Contract/Contract No.: Augmentation To Solapur City Water Supply Project
(Ujani Dam As A Source – 110 Mld)

Name and address of Beneficiary (“the Employer”): Chief Executive Officer,
Solapur City Development Corporation Limited
Dist. Planning Office, New Collector Office premises,
Near Govt. Milk Dairy, Saat Rasta, Solapur, 413003

We have been informed that (name of Contractor): [Name]

(hereinafter called the “Principal”) is your contractor for the above-named Contract which requires him to obtain a performance security.

At the request of the Principal, we (name of bank): [Name]
undertake to pay you, the Beneficiary/Employer, any [Amount]
sum or sums not exceeding in total the amount of

(amount in words [Amount in words])

(the “guaranteed amount”) upon receipt by us of your demand in writing with your written statement stating:

(a) that the Principal is in breach of his obligations under the Contract, and

(b) the respect in which the Principal is in breach.

Any demand for payment must contain your signature [Date]
which must be authenticated by your bankers or by a
notary public. The authenticated demand and statement
must be received by us at this office on or before (the
date 70 days after the expected date issue o the
Commissioning Certificate):

(the “expiry date”), when this guarantee shall expire and shall be returned to us.

We have been informed that the Beneficiary may require the Principal to extend this guarantee if the Commissioning Certificate has not been issued 28 days prior to such expiry date and we hereby undertake to extend this guarantee until the date 70 days after the actual date of issue of the Commissioning Certificate upon receipt of your written statement advising us of the actual date of issue, and that the late issue was for reasons attributable to the Principal. In such a case, the expiry date shall be adjusted accordingly.

This guarantee shall be governed by the laws of [Name],

and shall be subject to the Uniform Rules for Demand Guarantees, published as number 458 by the International Chamber of Commerce, except as stated above. Signed by

(signature):

Name:

[Name]

Date:

[Date] Signed by (signature):

Name:

[Name]

Date:

[Date]

MAINTENANCE RETENTION GUARANTEE

Name of Contract/Contract No.: Augmentation To Solapur City Water Supply Project
(Ujani Dam As A Source – 110 Mld)

Name and address of Beneficiary ("the Employer"): Chief Executive Officer,
Solapur City Development Corporation Limited
Dist. Planning Office, New Collector Office premises,
Near Govt. Milk Dairy, Saat Rasta, Solapur, 413003

We have been informed that (name of Contractor): [Name]

(hereinafter called the "Principal") is your contractor for the above-named Contract and wishes to receive early payment of, for which the Contract requires him to obtain a guarantee.

At the request of the Principal, we (name of bank): [Name]
hereby irrevocably undertake to pay you, the [Amount]
Beneficiary/Employer, any sum or sums not
exceeding in total the amount of

(amount in words [Amount in words])

(the "guaranteed amount") upon receipt by us of your demand in writing with your written statement stating:

- (a) that the Principal has failed to carry out his obligation(s) to rectify certain defect(s) for which he is responsible under the Contract, and
- (b) the nature of such defects.

This guarantee shall become effective upon receipt of the advance payment, or, where applicable, the first instalment thereof, by the Principal. Such guaranteed amount shall be reduced by the amounts of the advance payment repaid to you from time to time as evidenced by the Interim Payment Certificates issued under Sub-Clause 14.7 of the Conditions of Contract. Following receipt by us from the Principal of each Interim Payment Certificate, we shall promptly notify you of the revised guaranteed amount.

Any demand for payment must contain your [Date]
signature(s) which must be authenticated by your
bankers or by a notary public. The authenticated
demand and statement must be received by us at
this office on or before (the date 70 days after the
expected date of completion of the Design-Build)

(the "expiry date"), when this guarantee shall expire and shall be returned to us.

If the advance payment has not been fully repaid 28 days prior to the expiry date, we undertake, upon receipt of your written demand and statement that the advance payment has not been repaid, to pay you the guaranteed amount within 28 days of your demand.

This guarantee shall be governed by the laws of [Name],

and shall be subject to the Uniform Rules for Demand Guarantees, published as number 458 by the
International Chamber of Commerce, except as stated above.

Signed by (signature):

Name:

[Name] Date:

[Date] Signed by (signature):

Name:

[Name] Date:

[Date]