	Surat Smart City Development Limited (SSCDL) South Zone Vahivati Bhavan, Udhana Main Road, Opp. Satya Nagar, Udhana, Surat - 394210, Gujarat. **Notice Inviting RFP for** **"Design, Construction, Erection, Testing and commissioning of (i) Augmentation of existing Sewage Pumping Station, (ii) Augmentation of existing 66 MLD up to 167 MLD Capacity STP and (iii) 40 MLD net Output TSTP to generate Industrial grade Water including operation and maintenance of all the above (i), (ii) and (iii) for 10 Years Period Under SMART CITY , Surat "** Tender Notice No: **GM (Drainage & SWM)/SSCDL/ABD(6B & 7)/1/2016-2017**	

Bid for Design, Construction, Erection, Testing and commissioning of (i) Augmentation of existing Sewage Pumping Station, (ii) Augmentation of existing 66 MLD up to 167 MLD Capacity STP and (iii) 40 MLD net Output TSTP to generate Industrial grade Water including operation and maintenance of all the above (i), (ii) and (iii) for 10 Years Period Under SMART CITY , Surat Basis is invited online on https://smc.nprocure.com from the bidder meeting the basic eligibility criteria as stated in the bid document.

Bid Fee (Non-refundable)	Rs.18000/- (Rupees Eighteen Thousand only)by Demand Draft
Last date to submit the Pre Bid Queries	Bidders shall have to post queries by email to dmc@suratmunicipal.org/ exen.drainage@suratmunicipal.org on or before 07/04/2017, 17:00 hrs
Start date for downloading Bid Document	Dt. 31/03/2017
Last date for downloading Bid Document and online submission	Till 17/04/2017 up to 18:00 hrs.
Submission (in Hard Copy) of Bid fee & E.M.D.	In sealed envelope strictly by RPAD/Postal Speed Post from 18/04/2017 to 21/04/2017 up to 17:00 hrs. To the Chief Accountant, Surat Smart City Development Limited, Muglisara, Surat – 395003, Gujarat by RPAD or Speed Post Only.
Earnest Money Deposit (E.M.D)	**2,45,60,000.00**
Opening Of tender Documents	Dt. 22/04/2017
Bid Document Availability	https://smc.nprocure.com, http://suratsmartcity.com/Tenders, https://www.suratmunicipal.gov.in/Information/News

Bidders have to submit Price bid and Technical Bid online along with all necessary documents as per tender document requirement in Electronic format only on https://smc.nprocure.com website till the Last Date & time for Online Submission.

The right to accept/reject any or all bid(s) received is reserved without assigning any reason thereof.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd

SURAT SMART CITY DEVELOPMENT COPORATION

VOLUME-I
CONDITIONS OF CONTRACT AND SPECIFICATIONS
INDEX

1. NOTICE INVITING TENDERS

(A) RECEIPT AND OPENING OF TENDER :

Online Tenders will be received from the established and reliable contractors on or before 18.00 hours on 17/04/2017 on website smc.nprocure.com. The tender received after due time and date specified will not be accepted.

(B) NAME OF WORK:- **Design , Construction , Erection , Testing and commissioning of (i) Augmentation of existing Sewage Pumping Station, (ii) Augmentation of existing 66 MLD up to 167 MLD Capacity STP (iii) 40 MLD net Output TSTP to generate Industrial grade Water including operation and maintenance of all the above (i), (ii) and (iii) for 10 Years Period, Under SMART CITY , Surat**

1. EARNEST MONEY DEPOSIT : Rs. 2,45,60,000.00
2. TIME LIMIT : 24 (Twenty Four) months incluidng testing, trial run and commissioning [Including monsoon]
3. Document Fee : Rs. 18,000.00

(C) OPENING OF TENDERS :

The tenders will be opened online in presence of bidders and opening authority subject to receipt of Tender Fees, EMD in hard copy. The tenders will be opened in three stages i.e Qualification Bid, Technical Bid and Commercial Bid.

(D) PURCHASE OF TENDER DOCUMENTS :

Tender Documents can be downloaded from smc.nprocure.com up to 17/04/2017.

Tender documents fees of Rs. 18,000.00 towards the cost of tender documents in pay order or by demand draft of any nationalized bank, in favour of " Surat Smart City Development Limited " payable at Surat and shall be submitted along with EMD and other documents. The cost of the Tender Documents will not be refunded in any circumstances. The Surat Smart City Development Limited shall not be liable for any postal delay in any case.

(E) CONTRACT PERIOD :

The total contract period is hereby fixed as 24 (Twenty Four) months incluidng testing, trial run and commissioning [Including monsoon] from the 15th Day of issuance of work order.

(F) Tenderer must comply with and agree to all instructions & requirements in the Notice and in the Instructions to Tenderers, including requirements in the Contract Documents.

(a) All tenders must be submitted in the prescribed Tender form.
(b) Each Tender must be accompanied by the completion Schedule.
(c) Each tender must be accompanied by the Tender Security (Earnest Money Deposit) Rs. 2,45,60,000.00 as specified in the tender notice
(d) The successful tenderer shall execute the Contract Agreement within fifteen days after the date of Notice of award.

(e) The successful Tenderer will be required to furnish a performance bond (Security Deposit) of and amount equal to (2%) Two percent of the tendered amount.
(f) The successful Tenderer shall furnish insurance in accordance with the contract documents.

(g) The Surat Smart City Development Limited may withhold issuance of the Notice of proceed for a period not exceeding fifteen days after the date of execution of the contract agreement.
(h) The tender and tender guarantee bond (Earnest Money Deposit) shall be submitted by the Agency in whose name tender has been issued. Transfer of tender documents to any other party is prohibited.
(i) All intending tenderers will have to purchase digital signatures in order to participate in the online bidding process.
(j) All the applicant contractors are required to have their own employers' code number under EPF Act, 1952 and are required to comply the applicable provisions of said statute regularly and totally.

(G) Tender Validity Period :

The validity period of the tender submitted for this work shall be of one hundred twenty (120) calendar days from the last day of online submission of tender for this work and the Tenderer shall not be allowed to withdraw or modify the tender offer on his own during the validity period.

(H) Rights Reserved :
Without assigning any reason, The Surat Smart City Development Limited reserves the right to reject the lowest or any other or all tenders or part of its. To waive any informality or irregularity in any tender, which in the opinion of the Surat Smart City Development Limited does not appear to be in its best interest and the tenderer shall have no cause of action or claim against the Surat Smart City Development Limited or its officers, employee, successors or assignees for rejection of this tender.

The Surat Smart City Development Limited further reserves the right to withhold issuance of the notice to proceed, after execution of the contract agreement by the successful Tenderer. The Surat Smart City Development Limited is not obliged to give reasons for any such action.
During Tender validity period, if any Tenderer withdraws or makes any modifications or additions in the terms and conditions on his own in this tender, then The Surat Smart City Development Limited shall without prejudice to any right or remedy be at liberty to reject the tender and forfeit the Earnest Money Deposit in full. Such Tenderer may be disqualified from tendering for further works under the jurisdiction of The Surat Smart City Development Limited.
The Surat Smart City Development Limited reserves the right to increase or decrease the scope of work and split the tender in two or more parts without assigning any reason even after the award of contract.

(I) SITE VISIT:

A joint site visit with eligible prospective bidders will be arranged on date 06/04/2017, 10.00 a.m. at Dindoli STP site. The manufacturers / Agents / Dealers will not be allowed during the visit. Responsible authorized person with authority letter of the eligible prospective bidders can only visit the site since the plant is in operation and for safety as well as security reasons.

Signature Of The Contractor.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

2. QUALIFICATIONS OF TENDERERS :

The tenderer shall fulfil the following all points A to N requirements / experiences for qualification in its own name. The submission shall be made as per provisions made under Chapter – 4 of this tender.

A. The Bidder must have achieved average annual turnover during last three financial years, ending on 31st March, 2016 (in all classes of engineering activities) of Rs. 3100.00 Lacs.

B. The bidder shall have Net worth of Rs. 1550.00 Lacs as on 31st March, 2016.

C. The Bidder should have satisfactorily constructed similar work of at least;

1. One number of 133.60 MLD capacity each

OR

2. Two number of 83.50 MLD capacity each

OR

3. Three number of 66.80 MLD capacity each

Sewage Treatment Plant based on Conventional Activated Sludge Process (CASP) OR Sequential Batch Reactor (SBR) OR Cyclic Activated Sludge Process (CASP) OR MBBR OR IFAS with PLC-SCADA system including Design, Procurement, Construction, Testing, Trial run and Commissioning in India during last 7 years (i.e. Financial year 2010-11 to 2016-17) on EPC / TURNKEY basis. The Bidder must have experience of Operation & Maintenance of the said plant(s) for minimum continuous Three years during last 7 years as prescribed above (i.e. financial year 2010-11 to 2016-17) as on date of bid submission.

D. Specific Experience of BNR System: The Bidder shall have experience in Design, Procurement, Construction, Testing, Trial Run and Commissioning of at least one (1) No. Sewage Treatment Plant in India of at least 50.50 MLD capacity with Biological Nutrient (Nitrogen and Phosphorus) Removal. The Plant must be in successful operation for at least one year period as on date of bid submission.

E. The specific experience of Fixed Film Biological Treatment Technology : The Bidder shall have experience in Sewage Treatment Plant based on Fixed Film biological treatment technology including Design, Procurement, Construction, Testing, Trial Run and Commissioning with PLC-SCADA system in India of at least 33 MLD Capacity during past 7 years (i.e. Financial Year 2010-11 to 2016-17). The Plant must be in operation for a minimum period of one year as on date of bid submission.

OR

1. The Bidder must submit notarized Memorandum of Understanding (MoU) with technology provider for this project alongwith the qualification / bidding documents without which the Bid shall be rejected.

2. The Fixed Film Biological Treatment technology supplier should have supplied the proposed technology coupled with fine bubble diffuser system to a sewage treatment

plant in India for a plant of minimum flow handling capacity of 33.00 MLD (Avg.flow). To maximize de-nitrification and consequently the savings in aeration energy requirements, the fixed film biological system should be able to perform with aeration On and Off. To avoid loss of media, Fixed Film Biological system with floating media are not allowed. The plant should have been completed, commissioned and running successfully for at least one year at this STP as on date of bid submission.

3. The Bidder will submit the Certificate of Agency to whom the technology provider has supplied the technology for Sewage Treatment Plant in India having minimum capacity as mentioned in (ii) above. The end user must be Government / Semi Government Authority.

F. The Bidder should have satisfactorily completed similar work of at least;

1. One Number of 32 MLD capacity net output (UF 40.8 MLD net output & RO 24 MLD net output)

   OR

2. Two Number of 20 MLD capacity net output (UF 25.5 MLD net output & RO 15 MLD net output)

   OR

3. Three number of 16 MLD capacity net output (UF 20.4 MLD net output & RO 12 MLD net output)

EPC contract of Tertiary Sewage Treatment Plant work including Design, Construction, Testing, Trial run and Commissioning of Plant in India having UF and RO as treatment units with PLC-SCADA in last 7 years. The Bidder must have experience of Operation and maintenance of the said plant(s) for minimum Two Years within past 7 years as prescribed above (i.e. financial year 2010-11 to 2016-17) preceding the date of bid submission.

OR

If Bidder does not meet the requirement of (F) above then Bidder can be qualified provided the bidder has completed and commissioned as EPC project at least

1. One Number of 48 MLD capacity (Design Inflow)
   OR
2. Two Number of 30 MLD capacity (Design Inflow)
   OR
3. Three number of 24 MLD capacity (Design Inflow)

of Tertiary Sewage Treatment Plant in India with treated sewage standard of S.S. < 5.0 mg/l and BOD < 5 mg/l and Bidder should have carried out O & M of the said plant for a period of two years and Bidder meets any one of the following criteria :

(i) Bidder can submit notarized MoU with the contractor who meets the requirement as per (F) above.

(ii) Bidder can submit notarized MoU with the contractor who has completed desalination plant with 32 MLD capacity net output RO membrane system on EPC basis for Government / Semi Government organization and the plant is running successfully for a period of minimum two years within past 7 years as prescribed above (i.e. financial year 2010-11 to 2016-17) preceding the date of bid submission.

G. The Bidder should have minimum one year experience of Operation and Maintenance of one number of 0.4 MWe capacity Bio Gas Based Power Plant with PLC-SCADA system through gas engine system in Sewage Treatment Plant in India as on date of bid submission.

H. To meet all financial criteria as indicated in notice inviting tender (NIT), the bidder may consider following enhancement factors for the cost of works executed and financial figures to arrive at common base for the value of the works completed in India. Cut of month shall be considered from month of tender submission.

Year	Multiplying factor
Immediate last year of the assessment year*	1.1
Second	1.21
Third	1.33
Fourth	1.46
Fifth	1.61
Sixth	1.77
Seventh	1.95

*Here assessment year shall be reckon from year and month in which tender is submitted

I. The experience of Joint Venture / Sub-contractors / back to back work SHALL NOT BE considered. However, if the work is jointly executed in India by an Indian subsidiary along with its parent holding company, the complete experience shall be considered for Indian subsidiary also for qualification.

J. The Bidder should submit Solvency Certificate of Rs. 5000 lacs, issued by schedule bank / Nationalized bank only. The validity shall be at least up to 31st December 2016.

K. The Bidder should submit the list of the works already completed during the year 2010-2011 to 2016-2017 in prescribed performa and attested copies of certificates issued by head of the office concerned for completed work.

L. The Bidder shall submit Declaration regarding the work on hand with the bidder in prescribed Performa. Attested copies of work orders, interim certificate if any shall also be attach as supporting documents for above.

M. The Bidder shall submit the attested copy of partnership deed, power of attorney, etc.

N. Joint Venture shall not be allowed.

O. Even though the Bidder meets the above criteria, they are subject to be disqualified if they have

i) Made misleading or false presentations in the forms, statements and attachments submitted in proof of the qualification requirements; and / or

ii) During verification if it is found from client that of poor performance such as abandoning the works, litigation history, or financial failure etc.

iii) Being debarred by R & B / PW Dept. or any State/ Central Government department as on the date of application - Even if the joint venture is debarred by R & B / PW Dept. or any State/ Central Government department as on the date of application each partner of joint venture is considered as debarred.

iv) Regarding Litigation in case where agency/JV partner involved in illegal practice like any activities of corruption, coercive practice or debarred by Any Govt / Organisation in respect of performance of agency/any of partner/JV partner, it is to state that SMC authority requires that bidders under this contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this, SMC authority (1) Will reject a proposal for award if it determines that the bidder has engaged in any corrupt or Fraudant practices in competing for this contracts or in past history of bidder/JV partners and (2) Will reject a proposal if it found debarred/black listed by any State Govt. /Govt. of India/Any recognized organization.

P. The Bidder shall note that in case the Bidder / MOU partner is blacklisted / stated as defaulter / barred participating in tenders by any of government agencies / semi government agencies in India during last 7 years then in that case, the Bidder will be disqualified though the bidder satisfies all the pre-qualification conditions mentioned above.

Signature Of The Contractor.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

3. INFORMATION TO TENDERER :

1. Tender validity period	120 days (One hundred & Twenty days) from the last date of receipt of tender
2. Earnest Money Deposit	Rs. 2,45,60,000.00
3. Security Deposit	Two Percent (2%) of tendered Amount.
4. Time of Completion	24 (Twenty Four) months incluidng testing, trial run and commissioning [Including monsoon]
5. Period of liability for defects.	Twelve Months after completion of work.
6. Penalty for delay	Zero Point two percent (0.2%) of the contract price per day maximum up to ten percent of the contract price.
7. Last date of download of tender	Date :- 17/04/2017 up to 18.00 hrs from smc.nprocure.com
8. Last date of submission of online Tender	Date :- 17/04/2017 up to 18.00 hrs
9. Last date of submission of Tender fees, EMD	From 18/04/2017 to 21/04/2017 up to 1700 hrs
10. Pre-Bid :	Bidders shall have to post their queries on e-mail address exen.drainage@suratmunicipal.org on or before Dt. 07/04/2017.

Signature Of The Contractor.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

4. SUBMISSION OF TENDER

(Following condition shall supersede relevant condition mentioned elsewhere in the bidding document)

- E.M.D & Tender fee shall be submitted in electronic format only through online (by scanning) while uploading the bid . This submission shall mean that E.M.D & tender fee are received for purpose of opening the Bid . Accordingly , offer/tenders of those tenders whose E.M.D & tenders fee is received electronically , shall be opened. However, for the purpose of realization of EMD and tender fee , bidder shall send the EMD as well as Tender fee in required format in original through RPAD/Speed post so as to reach to Account Department (Main office) within 7 days from the last date of submission of price-Bid . punitive action shall be initiated for non submission of EMD & Tender fees in original to Account Department (Main Office) by bidder including abeyance of registration and cancellation of E- tendering code for one year . All documents of supporting of Bid shall be in electronic format only through online (by scanning) during the bidding period & hard copy will not be accepted separately."
    - All Documents must be coloured scanned to be seen as original. Scanning in Black and White or gray shall not be acceptable .
    - All the Documents must be notarized with clearly displaying stamp , number and name of the notary.
    - Price Bid shall have to be quoted strictly online only. No hard copy of price bid shall be accepted.
    - Addenda/corrigenda to these tender documents , if issue must be signed and submitted online only.

"Following Documents shall only be submitted in HARD COPY to Surat Smart City Development Limited by all bidders"

- Earnest Money Deposit as mentioned in the Tender . (i.e DD/Bank Guarantee)
- Tender fees as mentioned in the tender
- Affidavit on Non judicial Stamp Paper of Rs. 100/-

Technical bid and qualification documents mentioned in the tender and price bid are not to be submitted in physical form . please note that Non – Submission of Hard Copies of technical Bid as well as price Bid does not absolve the bidders from any liability created from the bid condition and bidding process . price bid shall have to be quoted strictly online only. Technical –Bid in Hard copy shall be Submitted only by Successful bidders upon intimation from SMC."

Signature Of The Contractor.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

5. AFFIDAVIT

1.0 I, the undersigned, do hereby certify that all the statements made in the required attachments are true and correct.

2.0 The undersigned also hereby certifies that neither our firm M/s _____ _____ nor any of its constituent partners have abandoned any work in India nor any contract awarded to us for such works has been rescinded during last five years, prior to the date of this bid.

3.0 The undersigned hereby authorize(s) and request(s) any bank, person, authorities, government or public limited institutions, firm or corporation to furnish pertinent information deemed necessary and requested by the SMC to verify our statements or our competence and general reputation.

4.0 The undersigned understands and agrees that further qualifying information may be requested, and agrees to furnish any such information at the request of the SMC.

5.0 The SMC and its authorised representatives are hereby authorised to conduct any inquiries or investigations to verify the statements, documents, and information submitted in connection with this application and to seek clarification from our bankers and clients regarding any financial and technical aspects. This Affidavit will also serve as authorisation to any individual or authorised representative of any institution referred to in the supporting information, to provide such information deemed necessary and requested by yourselves to verify statements and information provided in the Tender or with regard to the resources, experience and competence of the Applicant.

_____

Signed by the authorised signatory of the firm

_____

Title of the office

_____

Name of the firm

_____

Date

Note: The affidavit format as indicated above to be furnished on non judicial stamp Paper of **Rs.*100.***

6. TURN KEY TENDER AND CONTRACT FOR WORKS

General Rules and Directions for the Guidance of Contractors.

1. All work proposed to be executed under this contract shall be notified in a form of invitation to tender Posted on a board hung up in the Municipal Office and signed by the Officer authorized by the Chairman, SSCDL.

   This form will state the work to be carried out, as well as the date for submitting and opening of the tender, earnest money to be deposited with the tender, and the amount of security deposit to be deposited by the successful tenderer and the percentage, if any to be deducted from bills. It will also state whether a refund of quarry fees, royalties, octroi dues, ground rents and water-charges will be granted. Copies of the specifications, designs, drawings and estimated rates, schedule rates and any other documents required in connection with the work which will be signed by the Dy. General Manager and Ex. Engr. (Drainage), for the purpose of identification shall also be opened for inspection by Contractors at the Office of the Drainage Department during office hours.

   Where the works are proposed to be executed according to the specification recommended by a Contractor and approved by a competent authority on behalf of the Surat Smart City Development Limited such specification with designs and drawings shall form part of the accepted tender.

2. In the event of the tender being submitted by a firm, it must be signed by each partner thereof, and in the event of the absence of any partner, it shall be signed on his behalf by a person holding a power-of-attorney authorizing him to do so.

3. Receipt for payments made on account of any work when executed by a firm, should also be signed by all the partners, except where the contractors are described in their tender as a firm in which case the receipts shall be signed in the name of the firm by one of the partners, or by some other person having authority to give effectual receipt for the firm.

4. Any person who submits a tender shall fill up the usual printed form including the column total according to sepific item, stating at what rate he is willing to undertake each item of the work. Tenders which propose any alteration in work specified in the said form of invitation to tender, or in the time allowed for carrying out the work, or which contain any other conditions of any sort, will be liable to rejection. No single tender shall include more than one work, but contractors who wish to tender for two or more works shall submit a separate tender for each. Tenders shall have the name and the number of the works to which they refer written outside the envelope.

5. The Chairman, SSCDL or his duly authorized Assistant will open tenders in the presence of any intending contractors who may be present at the time, and will enter the amounts of the several tenders in a comparative statement in suitable form. In the event of a tender being accepted, the contractors shall there upon, for the purpose of identification, sign copies of the specifications and other documents mentioned in Rule 1. In the event of a tender being rejected the deposit will be refundable on application.

6. The Surat Smart City Development Limited shall have the right of rejecting all or any of the tenders without assigning any reasons.

7. No receipt for any payment alleged to have been made by a Contractor regard to any matter relating to this tender or the contract shall be valid and binding to the Surat Smart City

Development Limited unless it is signed by the Dy. General Manager and Ex. Engr. (Drainage).

8. The memorandum of work to be tendered for and the schedule of materials to be supplied by the Surat Smart City Development Limited and their rates shall be filled in and completed by the office of the SSCDL before the tender form issued. If a form issued to an intending tenderer has not been so filled in and completed, he shall request the said office to have this done before he completes and delivers his tender.

9. All work shall be measured net by standard measure and according to the rules and custom of the Surat Smart City Development Limited without reference to any local custom.

10. Under no circumstances shall any Contractor be entitled to claim enhanced rates for any items in this Contract.

11. Every Contractor shall, if so desired by the Chairman, SSCDL, produce along with his tender a banker's certificate of his financial stability. If he fails to produce such a certificate his tender will not be considered.

12. All corrections and additions or pasted slips should be initialed.

13. The checking and measurements of work will be taken according to the usual method in use in the SSCDL and no proposals to adopt alternative methods will be accepted.

    The Chairman, SSCDL's decision as to what is the "usual method in use, in the SSCDL will be final".

14 For the Capital and O&M works, all the prevailing taxes (i.e. Excise duty, Sales tax, VAT, etc.) in the tender shall remain to the contractors account and it shall not be reimbursed / recovered, even if it changes during the contract period. However, if any new taxes or service tax is levied by the Government, during the period of contract (Capital and O&M); the same shall be reimbursed/recovered on submission of documentary proof of its payment. **In case, GST is applicable during the course of execution as well as O&M, the same shall be reimbursed / recovered against the existing applicable taxes (i.e. Excise duty, Sales tax, VAT, etc.) on submission of documentary proof of its payment.**

15 Tenderers shall also note that as per the provisions of government, 01 % (one percent) construction cess on the work done amount shall be levied and shall be deducted from each running bill & final bill. The contractor shall quote the rate accordingly. This shall be applicable on capital works only. This shall not be applicable on O&M works.

16 The successful tenderer shall submit the copy of technical bid duly sealed & signed within fifteen days of issue of work order.

17 The tenderer shall invariably submit the Certificate of Provident Fund of Employee without which bill for payment shall not be processed.

18 The successful tenderer shall submit the copy of labour lincense within fifteen days of issue of work order.

19 All the RCC NP3/NP4 Class pipes shall have ISI mark on it.

20 For the necessary modification / alteration / addition to complet the job, if any civil breaking or repairing is to be done, shall have to be carried out by contractor at his own cost, as per

standard engineering practice. It shall be sole responsibility of contractor to clear construction and demolition waste (C.D. Waste) by their own risk and cost. The contractor shall ensure that their site must be clear in all respect by disposing C.D. Waste generated during the work. If its found that contractor is irregular and showing negligence to dispose C.D. Waste than SMC is empowered to dispose the said C.D. waste through SMC authorized C.D. waste contractor /agency. All the necessary expenditure made towards disposal of this C.D. waste shall be recovered from the contractor along with the administrative charges and penalties.

Signature Of The Contractor.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

7. TENDER FOR WORKS

I/We hereby tender for the execution for the Surat Smart City Development Limited (herein before and herein after referred to as " Surat Smart City Development Limited ") of the work specified in the memorandum within the time specified in such memorandum at the tendered rates specified in schedule B (memorandum showing items of work to be carried out) and in accordance in all respects with the specification, designs, drawings, and instructions in writing referred to in clause 13 of the annexed conditions of contract and agree that when materials for the work are provided by Surat Smart City Development Limited such materials and the rates to be paid for them shall be as provided in schedule A hereto.

Should this tender be accepted I/We hereby agree to abide by and fulfill all the terms and provisions of the conditions of contract annexed hereto so far as applicable, and in default thereof to forfeit and pay to Surat Smart City Development Limited in office the sums of money mentioned in the said conditions.

Receipt No. _____dated _____from Surat Smart City Development Limited in respect of the sum of Rs._____ (Rupees _____ only) / A crossed order cheque of Rs._____ (Rupees_____ only) No._____ dated _____ on the _____ _____ in favour of the Surat Smart City Development Limited is herewith forwarded representing the earnest money the full value of which is to be absolutely forfeited to Surat Smart City Development Limited should I/We not deposit the full amount of security deposit specified in the Memorandum, in accordance with Clause 1 of the said conditions.

Contractor:

Address:

Dated the _____ day of _____2017

(Witness)

(Address)

(Occupation)

The above tender is hereby accepted by me on behalf of the Surat Smart City Development Limited.

General Manager,
Surat Smart City Development Limited

Dated _____day of _____2017

8. CONTRACT AGREEMENT FOR

Design , Construction , Erection , Testing and commissioning of (i) Augmentation of existing Sewage Pumping Station, (ii) Augmentation of existing 66 MLD up to 167 MLD Capacity STP (iii) 40 MLD net Output TSTP to generate Industrial grade Water including operation and maintenance of all the above (i), (ii) and (iii) for 10 Years Period, Under SMART CITY , Surat

Articles of agreement made this _____ day of the month of _____ 2017. Between the Chairman of SSCDL (which expression shall include his successors and assignees of one part) and_____ hereinafter called the contractor (which expression shall include their administrator and assignees of the other part).

WHEREAS the Contractors above named tendered for the works above mentioned and the same having been accepted by the General Body of the SSCDL vide Resolution No. _____ dated _____; it is hereby agreed that the Contractor should carry out the works according to the terms and conditions of the contract detailed in the Item Rate Tender Books, - conditions and specifications, which have been signed by the contractors on.

In witness whereof the said Contractors and the Chairman on behalf of the Surat Smart City Development Limited have hereinto set their respective hands this _____ day of the month of _____ of the year 2017.

Signed, sealed and delivered by the said contractor in the presence of

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

Contractor,

General Manager,
Surat Smart City Development Limited

9. SURETY

This bond is made this _____ day of the month of _____ 2017. The Two Thousand Sixteen _____ between Shri _____ _____ (hereinafter called the surety) of the first part and the Chaiman on behalf of the Surat Smart City Development Limited of the second part.

WHEREAS the Contractor/Contractors Shri/Ms._____ of _____ _____ has/have entered into a contract with the Surat Smart City Development Limited for the works detailed below :-

Name of the work	Tender Amount	G.B. Resolution No. & date Sanctioning Contract

_____

AND WHEREAS one of the conditions of the contract being that the Contractor/ contractors shall give surety/sureties to the Surat Smart City Development Limited for the due fulfillment of the contract to the full value of the total expenditure of the work.

NOW THIS BOND WITNESSES and it is hereby agreed and declared as follows :-

I/We Surety/Sureties hereby bind myself/ourselves responsible for the due fulfillment of the contract in all its respects by the Contractor/Contractors and I/We do hereby agree and undertake to indemnity and keep harmless.

The Surat Smart City Development Limited jointly as well as severally if the Contractor / Contractors fail / fails to carry out the whole or any part of the contract work as per the conditions and specifications of the work and as agreed to between the parties to the contract to the extent of full value of the total expenditure to be incurred in that behalf by the Surat Smart City Development Limited provided always that the expression "the Surety/Sureties" hereinbefore used shall include the heirs, executors, assigns or administrators of each and every person in this context.

IN WITNESS WHEREOF the said surety/sureties and the City Engineer on behalf of the Surat Smart City Development Limited have hereinto set their respective hands this _____ day the month of _____ of the year 2017.

Surety

Signed in the presence.

Signed in the presence.

General Manager,
Surat Smart City Development Limited

10. IMPORTANT POINTS TO BE BROUGHT TO TENDERER'S NOTICE

THE TENDER MAY BE REJECTED OUTRIGHT IF THE TENDERER

A. Stipulates the validity period less than what is stated in the form or tender.

B. Stipulates his own conditions.

C. Does not quote his rates inclusive of terminal or sales tax or central taxes etc. in his rates.

D. Does not disclose the full names and addresses of all his partners in the case of partnership concern.

E. Does not fill in and sign the tender form as well as the bill of quantities and rates, annexure, specifications etc.

F. Does not pay the Earnest Money Deposit by Pay Order or demand draft with the PART – A: QUALIFICATION BID of the tender.

A. Does not submit the tender before the stipulated time on the specified date in the accounts office as directed.

Signature Of The Contractor.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

11. CONDITIONS OF CONTRACT

Clause 1.

The Person/persons whose tender may be accepted [here-in after called the Contractor, which expression shall unless excluded by or repugnant to the context include his heirs, executors, administrators and assignees] shall [within 15 days of the receipt by him of the notification of the acceptance of his tender] deposit with SSCDL cash or D.D. or pay order endorsed to the SSCDL sum sufficient which will make up the full Security deposit specified in the tender.

If the amount of the Security Deposit to be paid in Lump Sum within the period Specified above is not paid the tender Contract already accepted shall be considered as Cancelled. The Security deposit lodged by Contractor Shall be refunded after the expiry Memorandum after deducting dues, if any which become liable to be recovered from the contractor under the terms and condition of this Agreement.

(A) Tender Costing Less than Rs. 1.00 Lac.
The Total Security deposit shall be recovered at the rate of 5% of approved tender Cost from contractor. Out of which 50% of amount as a Initial Security Deposit shall be payable at the rate of 2.5% of approved Tender Cost in form of Cash or D.D./ Pay Order of any Nationalized Bank (encashable at Surat city). The remaining amount of the Security deposits i.e. 2.5% of tendered amount shall be recovered from the running account bills in form of retention money at the rate of 2.5% of the gross amount of each bill. So as to make the total Security Deposit of 5% of the tendered amount up to the Final bill.

In Addition to 2.5% of RMD/ SD additional 10% Amount shall be retained from each Bill which shall be Released in Final Bill. Under no circumstances the said retention shall be released prior to Final Bill.

(B) Tender Costing More than Rs. 1.00 Lac and up to Rs. 2.00 Lacs.
The Total Security Deposit shall be recovered at the rate of 4% of approved tender Cost from contractor. Out of which, 50% of amount as a initial Security Deposit shall be payable at the rate of 2% of approved tender cost in from of Cash or D.D./ Pay Order of any Nationalized bank (encashable at Surat city). The remaining amount of the Security deposits i. e. 2% of tendered amount shall be recovered from the running account bills in form of retention money at the rate of 2% of the gross amount of each bill, so as to make the total Security Deposit of 4% of the tendered amount up to the Final bill.

In Addition to 2% RMD/ SD additional 10% Amount shall be retained from each Bill which shall be released in Final Bill. Under no circumstances the said retention shall be released prior to Final Bill.

(C) Tender costing more than Rs. 2.00 Lacs and up to Rs. 25.00 Lacs.
The Total Security Deposit shall be recovered at the rate of 4% of approved tender Cost from contractor. Out of which, 50% of amount as Initial security Deposit shall be payable at the rate of 2% of approved Tender Cost in from Cash or D.D. / Pay Order of any Nationalized bank (encashable at Surat city). The remaining amount of the Security deposits i. e. 2% of tendered amount shall be recovered from the running account bills in form of retention money at the rate of 2% of the gross amount of each bill, so as to make the total Security Deposit of 4% of the tendered amount up to the Final bill.

In Addition to 2% of RMD / SD additional 5% Amount shall be retained from each Bill which shall be released in Final Bill. Under no circumstances the said retention shall be released prior to Final Bill.

(D) Tender costing more than Rs.25.00 Lacs and up to Rs. 1.00 Crore.
The Total Security deposit shall be recovered at the rate of 4% of approved tender Cost from contractor. Out of which, 50% of amount as Initial Security Deposit shall be payable at the rate of 2% of approved Tender Cost in form of form D.D./ Pay Order / FDR/ Bank Guarantee of any Nationalized Bank

(encashable at Surat city). The remaining amount of the Security Deposit i.e. 2% of tendered amount shall be recovered from the running account bills in the form of retention money at the rate of 2% of the gross amount of each bill, so as to make the total security deposit of 4% of the tendered amount up to the Final bill.

In Addition to 2% RMD/ SD additional 5% Amount shall be retained from each Bill which shall be Released in Final Bill. Under no circumstance the said retention shall be released prior to Final Bill.

(E) Tender costing more than Rs.1.00 Crore.
The Total security deposit shall be recovered at the rate of 4% of approved tender cost from contractor. Out of which, 50% of amount as a initial security Deposit shall be payable at the rate of 2% of approved Tender Cost in form D.D./ Pay Order / FDR/ Bank Guarantee of any Nationalized Bank (encashble at Surat City). The remaining amount of the security deposit i.e. 2% of tendered amount shall be recovered from the running account bills in form of retention money at the rate of 2% of the gross amount of each bill, so as to make the total Security Deposit of 4% of the tendered amount upto the Final Bill.

In Addition to 2% of RMD/SD additional 5% amount shall be retained from each bill which shall be released in Final bill. Under no circumstances the said retention shall be released prior to Final Bill.

The amount recovered from the running bills/ retention money shall not be allowed to the transferred in the form of Bank Guarantee. However, the remaining 50% (2% of Security Deposit) of the amount so, deducted from running bills will be allowed for conversion in the form of interest bearing fixed deposit receipt, issue in favour of the Surat Smart City Development Limited, Surat by a Nationalized Bank located at Surat only. The initial Security Deposit at the rate of 2% submitted in form of Bank Guarantee will be refunded after payment of final bill and remaining 2% of Security Deposit deducted from the running bill shall be refunded only after the expiry of defect liability period, Audit related procedure and rectification of defects if any found so.

It is clarified that the amount of security deposit shall be collected on the basis of contract price and not on the basis of Estimated Amount put to tender. As initial Security Deposit as mentioned above (A) to (B) accepted by the competent Authority shall have to be paid toward Security Deposit at the time of execution of agreement.

Remaining amount towards SD shall be deducted from the runing bills as retention money.

Contractor will be eligible to get interest on FDR (that is deducted from Running Bill and converted in to FDR for initial SD) for One year, after actual completion of work. After that contractor will not be eligible to get interest for any extended period what so ever.

If the Security Deposit is not paid within 15 days from the date of Work Order than penalty at the rate of 0.065% per day of the amount of Security Deposit will charged. If the Security Deposit is not paid within one month with interest, necessary actions as per condition of contract will be taken.

The successful tenderer shall have to enter into an agreement on a non-judicial stamp paper of Rs. 100/- as per the form of the agreement approved by the Surat Smart City Development Limited, Surat.

The agreement shall be executed on stamp paper worth Rs. 100/-.

The Surety shall be executed on stamp paper worth Rs. 100/-.

Tenderer have to submit additional stamp papers @4.25% of Security deposit paid in FDR

The Bank Guarantee of Scheduled Bank / Private bank, those are approved by RBI, shall be accepted, subject to encashable at Surat

Clause 2.
The time allowed for carrying out the work as entered in the tender shall be strictly observed by the Contractor and shall be reckoned from the date on which the order to commence work is given to the Contractor. The work shall throughout the stipulated period of the contract be proceeded with, all due diligence [time being deemed to be the essence of the contract on the part of the Contractor] and the Contractor shall pay as compensation a percentage amount [shown in the attached Memorandum] of the tendered cost of the whole work as shown by the tender for every day that the work remains uncommented or unfinished after the proper days. And further to ensure good progress during the execution of the work the Contractor shall be bound, in all cases in which the time allowed for any work exceeds one month, to complete parts of the work during the period shown in the attached Memorandum.

In the event of the Contractor failing to comply with these conditions he shall be liable to pay as compensation, the amount mentioned above for every day that the due quantity of work remained incomplete, provided always that the total amount of compensation to be paid under the provision of this clause shall not exceed 10 percent of the tendered cost of the work as shown in the tender.

Clause 3.
In any case in which under any clause of or clauses this contract the Contractor shall have tendered himself liable to pay compensation amounting to the whole of this security deposit[whether paid in one sum or deducted by installments] or in the case of abandonment of the work owing to serious illness or death of the contractor or any other cause, the Chairman on behalf of the SSCDL shall have power to adopt any of the following courses, as he may deem best suited to the interest of the Surat Smart City Development Limited.

a To rescind the contract [of which rescission notice in writing to the Contractor under the hand of the Chairman, SSCDL shall be conclusive evidence] and in that case that security deposit of the Contractor shall stand forfeited and be absolutely at the disposal of the Surat Smart City Development Limited.

b To employ labour paid by the SSCDL and to supply material to carry out the works, or any part of the work debiting the Contractor with correctness of which cost and price the certificate of the Dy. General Manager and Ex. Engr. (Drainage) shall be final and conclusive against the Contractor and crediting him with the value of the work done, in all respects in the same manner and at the same rates as if it had been carried out by the Contractor under the terms of his contract, and in that case the certificate of the Dy. General Manager and Ex. Engr. (Drainage) as to the value of the work done shall be final and conclusive against the Contractor.

c To order that the work of the Contractor be in measured up and to take such part thereof as shall be executed out of his hands, and to give it to another Contractor to complete, in which case any expenses which may be incurred in excess of the sum which would have been paid to the original Contractor, if the whole work had been executed by him [as to the amount of which excess expenses the certificate in writing of the Dy. General Manager and Ex. Engr. (Drainage) shall be final and conclusive] be borne and paid by the original Contractor and shall be deducted from any money due to him by the Surat Smart City Development Limited under the contract or otherwise from his security deposit or the proceeds of sale thereof, or a sufficient part thereof.

In the event of any of the above courses be adopted by the Chairman, SSCDL the Contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchases or procured any materials or entered into any engagements, or made any advances on account of or with

a view to the execution of the work or the performance of the contract. And in case the contract shall be rescinded under provision aforesaid, the Contractor shall not be entitled to recover, or be paid any sum for any work thereto actually performed by him under this contract unless and until the Dy. General Manager and Ex. Engr. (Drainage) shall have certified in writing the performance of such work and the amount payable to him in respect thereof, and he shall only be entitled to be paid the amount so certified.

for any work thereto actually performed by him under this contract unless and until the Dy. General Manager and Ex. Engr. (Drainage) shall have certified in writing the performance of such work and the amount payable to him in respect thereof, and he shall only be entitled to be paid the amount so certified.

Clause 4:
If the progress of any particular portion of the work is unsatisfactory the Chairman, SSCDL shall notwithstanding that the general progress of the work is satisfactory in accordance with Clause 2, be entitled to take action under Clause 3 [b] after giving the Contractor 10 days notice in writing and the Contractor will have no claim for compensation for any loss sustained by him owing to such action.

Clause 5.
In any case in which any of the powers conferred upon the Chairman, SSCDL by clause 3 and 4 hereof shall have become exercisable and the same shall not have been exercised the non-exercise thereof shall not constitute a waiver of any of the conditions hereof such powers shall notwithstanding be exercisable in any future case default by the Contractor for which by any clause or clauses hereof he is declared liable to pay compensation amounting to the whole of his security deposit and the liability of the Contractor for past and future compensation shall remain unaffected.

In the event of the Chairman, SSCDL taking action under the sub-clause (a) or (c) of clause 3, he may, be he so desires to take possession of all or any tools; plant materials and stores in or upon the works, or the site thereof or belonging to the Contractor, or procured by him and intended to be used for the execution of the work of any part there of, paying or allowing for the same in account at the contract rates, or in the case of contract rates not being applicable at current market rates, to be certified by the Dy. General Manager and Ex. Engr. (Drainage) whose certificate thereof shall be final. In the alternative the Chairman, SSCDL may, by notice in writing to the Contractor or his clerk of the works, foremen or other authorized agent require him to remove such tools, plant, materials, or stores from the premises within a time to be specified in such notice; and in the event of the Contractor failing to comply with any such requisition, the Chairman, SSCDL may remove them at the Contractor's expense or sell them by auction or private sale at the risk and account of the Contractor in all respects and certificate of the Dy. General Manager and Ex. Engr. (Drainage) as to the expense of any such removal, and the amount of the proceeds and expense of any sale shall be final and conclusive against the Contractor.

Clause 6.
If the Contractor shall desire an extension of the time for completion of the work on the ground of his having been unavoidably hindered in its execution or on any other ground, he shall apply in writing to the Chairman, SSCDL within 30 days from the date on which he was hindered as aforesaid or on which the cause for asking for extension occurred and the Chairman, SSCDL may, if in his opinion, there are reasonable grounds for granting an extension, grant such extension as he thinks necessary or proper. The decision of the Chairman, SSCDL in this matter shall be final.

Clause 7.
On the completion of the work the Contractor shall be furnished with a certificate by the Dy. General Manager and Ex. Engr. (Drainage) [hereinafter called the Engineer-in-charge] of

such completion, but no such certificate shall be given nor shall the work be considered to complete until the Contractor shall have removed from the premises on which the work shall have been executed all scaffolding, surplus materials and rubbish, and shall have cleaned of the dirt from all woodwork, doors, windows, walls, floors or other parts of any building, in or upon which the work has been executed, or of which he may have had possession for the purpose of executing the work, nor until the work shall have been measured by the Engineer-in-charge or where the measurement have been taken by his subordinates until they have received the approval of the Engineer-in-charge, the said measurement being binding and conclusive against the Contractor.

If the Contractor shall fail to comply with the requirements of this clause as to the removal of scaffolding, surplus materials and rubbish, and cleaning off dirt on or before the date fixed for the completion of the work, the Engineer-in-charge may, at the expense of the Contractor remove such scaffolding surplus materials and rubbish, and dispose off the same as he thinks fit and clean off such dirt as aforesaid; and the Contractor shall forthwith pay the amount of all expenses so incurred, but shall have no claim in respect of any such scaffolding or surplus materials as aforesaid except for any sum actually realised by the sale thereof.

Clause 8.

No payment shall be made for any work, estimated to cost less than Rupees one thousand, till after the whole of the said work shall have been completed and a certificate of completion given. But in the case of works estimated to cost more than rupees one thousand, the Contractor shall, on submitting a monthly bill therefore be entitled to receive payment proportionate to the percentage shown in the attached Memorandum of the part of the work than approved and passed by the Engineer-in-charge, whose certificate of such approval and passing of the sum so payable shall be final and conclusive against the Contractor.

All such intermediate payments shall be regarded as payments by way or advance against the final payments only and not as payments for work actually done and completed and shall not preclude the Engineer-in-charge from requiring bad, unsound imperfect of unskillful work to be removed and taken away and reconstructed, or re- erected, nor shall any such payments be considered as an admission of the due performance of the contract or any part thereof in such respect of the accruing of and claim; nor shall it conclude, determine or affect in any way the Powers of the Engineer-in-charge as to the final settlement and adjustment of the accounts or otherwise, or in any other way vary or affect the contract. The final bill shall be submitted by the Contractor within one month of the date fixed for the completion of the work, otherwise the Engineer-in- charge's certificate to the measurement and of the total amount payable for the work shall be final and binding on all parties.

Clause 9.

The rates for several items of the work agreed to within, shall be valid only when the item concerned is accepted as having been completed fully in accordance with the sanctioned specifications. In cases where the items of works are not accepted and so completed the Engineer-in-charge may make payment on account of such items at such reduced rates as he may consider reasonable in the preparation of final or on account bills.

Clause 10.

A bill may be submitted by the Contractor once in each month on or before the date fixed by the Engineer-in-charge for all works executed in the previous months, and the Engineer-in-charge shall take or cause to be taken the requisite measurement for the purpose of having the same verified, and the claim, so far as it is admissible shall be adjusted if possible within fifteen days from the presentation of the bill. If the Contractor does not submit the bill within the time fixed as aforesaid, the Engineer-in-charge may depute a subordinate to measure up the said work in the presence of the Contractor or his duly authorised agent whose counter signature to the measurement list shall be sufficient warrant, and the Engineer-in-charge may prepare a bill from

such list which shall be binding on the Contractor in all respects.

Clause 11.
The Contractor shall submit all bills on the printed forms to be hand on application at the office of the Engineer-in-charge. The charges to be made in the bills shall always be entered at the rates specified in the tender or in the case of any extra work ordered in pursuance of these conditions, and not mentioned or provided for in the tender at the rates hereinafter provided for such work.

Clause 12.
If the specification or estimate of the work provides for the use of any special description of materials to be supplied from the S.M.C. Store or if it is required that the Contractor shall use certain stores to be provided by the Engineer-in-charge (such materials and stores and the prices to be charged thereof as hereinafter mentioned being so fare as practicable for the convenience of the Contractor but not so as in any way to control the meaning or effect of the contract specified in the schedule or memorandum hereto annexed) the Contractor shall be supplied with such materials and stores as may be required from time to time to be used by him for the purpose of the Contract only and the value of the full quantity of materials and stores so supplied shall be set off deducted from any sums then due, or thereafter to become due to the Contractor under the contract, or otherwise from the security deposit or the proceeds of sale thereof shall be held in Government securities; the same or a sufficient portion thereof shall in that case be sold for the purpose. All material supplied to the Contractor shall remain the absolute property of the Surat Smart City Development Limited, and shall on no account be removed from the site of the work, and shall at all times be opened to inspection by the Engineer-in-charge. Any such materials unused and in perfectly good condition at the time of completion or determination of the contract shall be returned to the SSCDL store, if the Engineer-in-charge so requires by a notice in writing given under his hand, but the Contractor shall not be entitled to return any such materials except with such consent and he shall have no claim for compensation on account of any such materials supplied to him as aforesaid but remaining unused by him or for any wastage in or damage thereto.

Clause 13.
The Contractor shall execute the whole and every part of the work in the most substantial and workmanlike manner, and both as regards materials and in every other respect in strict accordance with the specifications. The Contractor shall also conform exactly, fully and faithfully to designs, drawings and instructions in writing relating to the work signed by the Engineer-in-charge and lodged in his office and to which the Contractor shall be entitled to have access for the purpose of inspection at such office, or on the site of the work during office hours, and the Contractor shall, if he so requires, be entitled at his own expenses to make or cause to be made copies of the specifications and of all such designs, drawings and instructions on aforesaid.

Clause 14.
The Engineer-in-charge shall have power to make any alterations in, or additions to the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work, and the Contractor shall be bound to carry out the work in accordance with any instructions in this connection which may be given to him in writing signed by the Engineer-in-charge and such alteration shall not invalidate the contract, and any additional work which the Contractor may be directed to do in the manner above specified as part of the work shall be carried out by the Contractor on the same conditions in all respect on which he agreed to do the main work and at the same rates as are specified in the tender for the main work. And if the additional and altered work includes any class of work for which on rates is specified in this contract, then such class of work shall be carried out at the rates entered in the

schedule of rates of the Surat Smart City Development Limited or at the rates mutually agreed upon between the Engineer-in-charge and the Contractor whichever are lower if the additional or altered work for which no rate is entered in the schedule of rates of the Surat Smart City Development Limited is ordered to be carried out before the rates are agreed upon then the Contractor shall, within seven days of the date of the receipt by him of the order to carry out the work, inform the Engineer-in-charge of the rate which it is his intention to charge for such class of work and if the Engineer-in-charge does not agree to this rate he shall be notice in writing be at liberty to cancel his order to carry out such class of work, and arrange to carry it out in such manner as he may consider advisable provided always that if the Contractor shall commence the work or incur any expenditure in regards thereto before the rates shall have been determined as lastly herein before mentioned, then in such a case he shall only be entitled to be paid in respect of the work carried out or expenditure incurred by him prior to the date of the determination of the rate as aforesaid according to such rate or rates as shall be fixed by the Engineer-in-charge. In the event of a dispute, the decision of the Chairman, SSCDL will be final.

Where, however, the work shall have to be executed according to the designs, drawings and specifications recommended by the Contractor and accepted by the competent authority the alteration above referred to shall within the scope of such designs drawings and specification appended to the tender.

The time limit for the completion of work shall be extended in the proportion that the increase in its cost occasioned by alterations or additions the cost of the original contract work, and the certificate of the Engineer-in-charge as to such proportion shall be conclusive.

Clause 15 A

A. If at any time after the execution of the contract documents, the Engineer-in-charge shall for any reason whatsoever, require the whole or any part of the work as specified in the tender, to be stopped for any period or shall not require the whole or part of the work to be carried out at all or to be carried out by the Contractor, he shall give notice in writing of the fact to the Contractor who shall thereupon suspend or stop, the work totally or partially, as the case may be. In any such case, except as provided herein under, the Contractor shall have no claim to any payment or compensation whatsoever on account of any profit or advantage which he might have derived from the execution of the work in full but which he did not so derive in consequence of the full amount of the work nor having been carried out, or on account of any loss that he may be put to on account of materials purchased or agreed to be purchased, or for unemployment of labour recruited by him. He shall not also have any claim for compensation by reason of any alteration having been made in the original specifications, drawings, designs and instructions may involve any curtailment of the work as originals contemplated. Where which however, materials have already been purchased or agreed to be purchased by the Contractor, before receipt by him of the said notice, the Contractor shall be paid for such materials at the rate determined by the Engineer-in-charge, whose decision shall be final. If the Contractor suffers any loss on account of his having to pay labour charges during the period during which to stoppage of work has been ordered under this clause the Contractor shall on application be entitled to such compensation on account of labour charges as the Engineer-in-charge, the labour could have been employed by the Contractor elsewhere for the whole or part of the period during which the stoppage of the work has been ordered as aforesaid.

Clause 15 B.

The Contractor shall not be entitled to claim any compensation from the Surat Smart City Development Limited for the loss suffered by him on account of delay by the Surat Smart City Development Limited in the supply of materials entered in schedule A where such delay is caused by ---

i Difficulties relating to the supply of railway wagons and availability of Government controlled materials.

ii Force Majored.

iii Act of God.

iv Act of the Nation's enemies or any other reasonable cause beyond the control of the Surat Smart City Development Limited.

In the cause of such delay in the supply of materials the Surat Smart City Development Limited shall grant such extension of time for the completion of the work as shall appear to the Chairman, SSCDL to be reasonable in accordance with the circum stances of the case. The decision of the Chairman, SSCDL as to the extension of item shall be accepted as final by the Contractor.

Clause 16.
The Contractor is to set out and Levi the work and will be responsible for the accuracy of the same. He is to provide and maintain measuring and surveying instruments including steel tapes, theodolite and dumpy level at all times for proper carrying of the work and for the use of the Dy. General Manager and Ex. Engr. (Drainage) and his representatives including skilled attendance.

Clause 17.
The Contractor is to cover up and protect the works from the weather, and is to suspend all wet operations during such weather which, in the Dy. General Manager and Ex. Engr. (Drainage) opinion, will be detrimental to the work.

Clause 18.
Samples of each class of material and workmanship shall be submitted by the Contractor for the approval of the Dy. General Manager and Ex. Engr. (Drainage) and after such approval these samples shall be deposited at any place the Dy. General Manager and Ex. Engr. (Drainage) may appoint and the Contractor shall be required to perform all the works of this contract in accordance with the samples.

Clause 19.
On completion, all work must be cleaned down; rubbish removed and the works and land cleaned of rubbish; surplus materials and other accumulations, and everything left in a clean and ordinary condition.

Clause 20.
The Contractor shall provide, erect and maintain proper sheds and temporary buildings for the storage and protection of materials and goods and for the execution of work which may be fabricated or brought on the site.

Clause 21.
The Contractor is to set out and level the works and will be responsible for the accuracy of the same. He shall also be responsible for the correctness of the positions, levels, dimensions and alignment of all parts of the structure as shown in the drawings supplied to him. If at any time any error shall appear during the progress of any part of the work, the Contractor shall at his own expense rectify such error if called upon to the satisfaction of the Dy. General Manager and Ex. Engr. (Drainage).

Clause 22.
The Contractor shall permit the execution of the work not provided for in the tender by artists; tradesman, or others engaged by the Surat Smart City Development Limited. The

Contractor shall allow all reasonable facilities and the use of his scaffolding and water for the execution of such work, but is not required to provide any special scaffolding for the execution of such work except by special arrangement with the Surat Smart City Development Limited.

Clause 23.
Under no circumstances whatsoever shall the Contractor be entitled to any compensation from the Surat Smart City Development Limited on any account unless the Contractor shall have submitted a claim in writing to the Engineer-in-charge within one month of cause of such claim occurring.

Clause 24.
If at any time before the security deposit is refunded to the Contractor, it shall appear to the Engineer-in- charge or his subordinate in charge of the work that any work has been executed with unsound imperfect, or unskillful workmanship or with materials of inferior quality; or that any materials or articles provided by him for the execution of the work are unsound, or of a quality inferior to that contracted for, or otherwise not in accordance with the contract, it shall be lawful for the Engineer-in-charge to intimate this fact in writing to the Contractor and then notwithstanding the fact that the work, materials or articles complained of may have been inadvertently passed, certified and paid for, the Contractor shall be bound forthwith to rectify, or remove and reconstruct the work so specified in whole or in part as the case may require, or if so required, shall remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost; and in the event of his failing to do so within a period to be specified by the Engineer-in-charge in the written intimation aforesaid, the Contractor shall be liable to pay compensation at the rate of one percent on the amount of the estimate for every day not exceeding ten days, during which the failure so continues and in the event of any such failure as aforesaid the Engineer-in-charge may rectify or remove and re-execute the work or remove and replace the materials or articles complained or as the case may be at the risk and expense in all respects of the contractor, should the Engineer-in-charge consider that any such inferior work or materials as described above may be accepted or made use of it; shall be within his discretion to accept the same at such reduced rates along with the appropriate penalty as the Chairman, SSCDL may deem fit. The period to be counted from that date of final completion and handing over of the work to the Surat Smart City Development Limited during which the Contractor is so liable for any defects in the work shall be the Defects Liability Period shown in the attached Memorandum.

Clause 25.
All works under in cause of execution or executed in pursuance of the contract shall at all time be open to the inspection and supervision of the Engineer-in- charge and his subordinates, and the Contractor shall at all times during the usual working hours, and at all other times at which reasonable notice of the intention of the Engineer - in - charge or his subordinate to visit the work shall have been given to the Contractor, either himself be present to receive orders and instructions, or have a responsible agent duly accredited in writing present for that purpose, Orders given to the Contractor's duly authorised agent shall be considered to have the same force and effect as if they had been given to the Contractor himself.

Clause 26.
The Contractor shall give not less than five day's notice in writing to the Engineer-in-charge or his subordinate in charge of the work before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured; and correct dimensions thereof taken before the same is so covered up or placed beyond the reach of measurement any work without the consent in writing of the Engineer-in-charge or his subordinate in charge of the work, and if any work shall be covered up or placed beyond the reach of measurement without such notice having been given or consent obtained, the same shall be uncovered at the contractor's expense, and in default thereof no payment or allowance shall be made for such work or for the materials with which the same was executed.

Clause 27.
If the Contractor or his workmen; or servants shall break, deface injure or destroy any part of a building in which they may be working, or any building, road, fence enclosure or grass land or cultivated ground continuous to the premises on which the work of any part thereof is being executed, or if any damage shall be done to the work for any cause whatever while it is in progress of if any imperfection becomes apparent in it within the Defect liability period mentioned above by the Engineer-in-charge the Contractor shall make good the same at his own expense, or in default the Engineer-in-charge may cause the same to be made good by other workmen and deduct the expenses [of which certificate of the Engineer-in-charge shall be final] from any sum that may be due or thereafter become due to the Contractor, or from his security deposit or the proceeds of sale thereof or of a sufficient portion thereof.

Clause 28.
The Contractor shall supply at his own cost all materials [except such special materials, if any, as may be supplied from the S.M.C. Stores in accordance with the contract]. Plant tools, appliance implements, ladders, cordage, tackle, scaffolding and any temporary works which may be required for the proper execution of the work, in the original; altered or substituted from, and whether included in these specification or, other documents forming part of the contract or referred to in these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage there for, to and from the work, the Contractor shall also supply without charge the requisite number of persons with the means and materials necessary for the purpose of setting out works and counting, weighing, and assisting in the measurement of examination at any time and from time to time of the work or materials, failing this the same may be provided by the Engineer-in-charge at the expense of the Contractor and the expense may be deducted from any money due to the Contractor under the contract, or from his security deposit or the proceeds of sale there for of sufficient portion thereof. The Contractor shall provide all necessary fencing and lights required to protect the public from accident; and shall also be bound to bear the expenses of every suit, action or other legal proceedings, at law, that may be brought by any person for injury sustained owing to negligence of the above precautions, and to pay damages and costs which may be awarded in any such suit, action or proceedings, to any such person, or which may with the consent of the Contractor be paid in compromising any claim by any such person.

Clause 29.
The Contractor shall make his own arrangements for drinking water for the labour employed by him.

Clause 30.
Compensation for all damage done intentionally or unintentionally or by the contractor's laborers whether in or beyond the limits of the Municipal property shall be estimated by the Engineer-in-charge or such other office as he may appoint and estimates of the Engineer-in-charge subject to the decision of the Chairman, SSCDL on appeal be final and the Contractor shall be bound to pay the amount of the assessed compensation on demand failing which the same will be recovered from the Contractor as damage from the security deposit or deducted by the Engineer-in-charge from any sum that may be due or become due from the Surat Smart City Development Limited to the Contractor under this contract or otherwise.

The Contractor shall bear the expenses of defending any action or other legal proceedings that may be brought by any person from injury sustained by him owing to negligence of precautions to prevent the spread of fire and he shall also pay any damages and cost that may be awarded by the court in consequence.

Clause 31.

No work shall be done on Sunday/Holidays without the sanction in writing of the Engineer-in-charge.

Clause 32.
The contract shall not be assigned or sublet without the written approval of the Engineer-in-charge, and if the Contractor shall assign or sublet his contract or attempt to do so, or become insolvent or commence any proceedings to be adjudicated an insolvent or make any composition with his creditors, or attempts or attempt to do the Engineer-in-charge may, by notice in writing rescind the contract. Also if any bribe, gratuity gift, load, perquisite, reward or advantage, pecuniary or otherwise, shall either directly or indirectly be given, promised, or offered by the Contractor, or any of his servants or agents to any public officer or person in the employ of the Surat Smart City Development Limited in any way relating to his office or employment, or if any such officer or person shall become in any way directly or indirectly interested in the contract the Engineer-in-charge may by notice in writing rescind the contract. In the event of contract being rescinded, the security deposit of the Contractor shall thereupon stand forfeited and be absolutely at the deposit of the Surat Smart City Development Limited and the same consequences shall ensue as if the contract had been rescinded under clause 3 hereof and in addition the Contractor shall not be entitled to recover or be paid for any work thereto for, actually performed under the contract.

Clause 33.
All sums payable by a Contractor by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied to the use of the Surat Smart City Development Limited without reference to the actual loss or damage sustained and whether any damage has or has not been sustained.

Clause 34.
In the case of a tender by partners any change in the constitution of a firm shall be forthwith notified by the Contractor to the Engineer-in-charge for his information.

Clause 35.
All works to be executed under the contract shall be executed under the directions and subject to the approval in all respects of the Dy. General Manager and Ex. Engr. (Drainage) who shall be entitled to direct at what point or points and in what manner they are to be commenced, and from time to time carried on.

Clause 36.
Except where otherwise specified in the contract the decision of the Chairman, SSCDL shall be final, conclusive and binding on all parties to the contract upon all questions relating to the meaning of the specifications, drawings, designs and instructions hereinbefore mentioned and as to the quality of workmanship, or materials used on the work, or as to any other question, claim, right, matter, or thing whatsoever in any way arising aloof, or relating to the contract, designs, drawings, specifications, estimates, instructions, orders or these conditions, or otherwise concerning the works or the execution or failure to execute the same, whether arising, during the progress of the work or after the completion or abandonment thereof.

Clause 37.
When the estimate on which a tender is made includes lump sums in respect of parts of the work the Contractor shall be entitled to payment in respect of the items of work involved or the part of the work in question at the same rates as are payable under this contract or such items or if the part of the work in question is not in the opinion of the

Engineer-in-charge capable of measurement the Engineer-in-charge may at his discretion pay the lump sum amount entered in the estimate, and the certificate in writing of the Engineer-in-charge shall be final and conclusive under the provisions of the clause.

Clause 38.
In the case of any class of work for which there are no such specifications as are mentioned in Rule 1 such work shall be carried out in accordance with the Municipal or Gujarat Government P.W.D. specifications, and in the event of there being no Municipal or Government P.W.D. specifications, then in such a case the work shall be carried out in all respects in accordance with the instructions and requirements of the Engineer-in-charge.

Clause 39.
The expression "works" or "work' where used in these conditions shall, unless there be something in the subject or context repugnant to such construction be construed to mean the work or works the contracted to be executed under or in virtue of the contract, whether temporary or permanent, and whether original, altered, substituted or additional.

Clause 40.
All quarry fees and royalties shall be paid by the Contractor. All octroi, taxes shall also be paid by the Contractor according to the Municipal rules in force at the time and no refund shall be given.

Clause 41.
The Contractor shall be responsible for and shall pay any compensation to his workmen payable under the Workmen's Compensation Act 1923 [VIII of 1923] or any statutory modification thereof for injuries caused to workmen. The Workmen Compensation policy and all the insurances pertaining to Plant and Equipment, fire, burglary shall be in the Contractors scope. However, the events such as earthquake and flood shall be considered as a Force Majored and relevant clauses of the tender shall apply for the same

Clause 42.
Quantities shown in the tender are approximate and no claim shall be entertained for quantities of work executed being either more or less then those entered in the tender of estimate.

Clause 43.
No compensation shall be allowed for any delay caused in the starting of the work on account of any acquisition of land in the case of clearance work, for any delay in accordance to estimate.

Clause 44.
No compensation shall be allowed for any delay in execution of the work on account of water standing in borrow pits or compartments. The rates are inclusive for hard or cracked soil, excavation in mud, sub-soil water or water standing in borrow pits, and no claim for an extra rate shall be entertained, unless otherwise expressly specified.

Clause 45.
The Contractor shall not enter upon or commence any portion of work except with the written authority and instructions of the Engineer-in-charge or of his subordinate in charge of the work failing such authority the Contractor shall have no claim to ask for measurements of or payment for work.

Clause 46.
No Contractor shall employ any person who is under the age of 18 years. If any contractor found employing person or persons under the age of 18 years, during course of the

construction at any stage, legal actions shall be taken against him as stipulated in Child Labour (Prohibition & Regulation) Act 1986 and also, a penalty of Rs.20,000/-(Rupees Twenty thousand) shall be imposed which shall be deposited with District Collector in Child Labour Rehabilitation cum Welfare Fund.

No Contractor shall employ donkeys or other animals with breeching of string or thin rope. The breeching must be at least three inches wide and should be of tape [Nawar].

No animals suffering from sores, lameness or emaciation or which is immature shall be employed on the work.

The Engineer-in-charge or his agent is authorised to remove from work any person or animal found working which does not satisfy these conditions and no responsibility shall be accepted by the Surat Smart City Development Limited for any delay caused in the completion of the work by such removal.

The Contractor shall pay fair and reasonable wages to the workmen employed by him in the contract undertaken by him in the event of any 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 Dy. General Manager and Ex. Engr. (Drainage) who shall decide the same.

The decision of the Dy. General Manager and Ex. Engr. (Drainage) shall be conclusive and binding on the Contractor but such decisions shall not in any way affect the condition in the contract regarding the payment to be made by the Surat Smart City Development Limited at the sanctioned tender rates.

Clause 47.
Payment to the Contractors shall be made by cheque drawn on any bank in Surat, provided the amount exceeds Rs. 10. Amounts not exceeding Rs. 10 will be paid in cash.

Clause 48.
Any Contractor who does not accept these conditions shall not be allowed to tender for works.

Clause-49
The work contract tax shall not be paid to the contractor.

Clause-50.
Disputes if any, shall be discussed and mutually settled and in case of disagreement the same shall be referred to Chairman, SSCDL. After referring to Chairman, SSCDL if the said dispute is not solved, the same shall be referred to the court subject to Surat Jurisdiction only.

Clause-51
The following condition are being included in this tender and shall be considered as a part of tender document.

In case the total amount of work done is 5% less than the contract value, prorate S.D. to that extent may be refunded to the contractor while releasing the payment of final bill. In short, the S.D. to be retained by the Surat Smart City Development Limited after payment of final bill shall be equal to 2% of the amount of final bill as per the prevailing norms or as per the norms decided from time to time.

If there is increase in amount of work more than 5% of the Contract value. The Additional S.D. shall be recovered from the running bill. When the total of any of work done by the Contractor upto

running bills under consideration is more than 5% of the contract value. However, such S.D. shall be recovered in the round figure of Rs. 1000/- i.e. the amount of work done when it exceeds 5% of the contract value it shall be rounded of to the nearest multiple of Rs.25000/- such additional S.D. shall be recovered for the works amount to Rs. 5 Lacs or more at the rate of 4% of the additional amount.

In many cases, the contractors are stopping the work half-way due to number of reason and when the department has to take actions in accordance to clause 3(a) or (b) or (c) of the contract the remaining work has to be carried out by advertising the tender for the remaining work and the whole administrative process right from inviting tenders to finalizing the tender etc.

In such cases a fixed amount of Rs. 1000/- should be recovered from the original contract towards the cost of advertisement and other administrative charges incurred by the department in finalizing the contract for the remaining work.

In case a separate advertisement is issued for a single work actual cost of advertisement shall be recovered such recovery shall be in addition to the recovery to be made under clause-3 or such other relevant clauses.

Clause 52.
The tender is sent to you with one set of conditions of contract, technical specification and one set of Schedule-B with one set of drawings, please return the same duly filled in along with all the set in a sealed cover. The mode of submission of tender shall be as indicated in tender notice

The Tender submission shall be by Registered Post A.D./Speed post/online.

Clause 53.
A sum of Rs. 2,45,60,000.00 on account of Earnest Money should be paid in pay order or demand draft only to the Surat Smart City Development Limited. Earnest Money in the form of cheque will not be accepted. The amount will be forfeited in case after his quotation is accepted, the contractor does not complete the contract documents and pay the amount of Security Deposit of 2% of tender amount within the specified time as mentioned in clause 1 of condition of contract, otherwise it will be refunded. The work is to be completed within 24 (Twenty Four) months incluidng testing, trial run and commissioning [Including monsoon] from the date of written order to commence the work. The Insurance Company's bond will not be accepted against the Security Deposit.

Note:- The contractor are also allowed to pay the 50% amount of earnest money in pay order or demand draft of any Nationalised Bank payable at Surat in favor of the Surat Smart City Development Limited only and rest of 50% in form of Bank guarantee of any Nationalised Bank located at surat.

Clause 54.
The contractor will quote item rate, both in words and figures. The final total as per the item-rates quoted above shall also be given both in words and figures.

Clause 55.
No alteration in the form of quotation and in schedule of quantities and no additions in the shape of special stipulation will be permitted. Quotation which do not fulfill all or any of the above conditions or are incomplete in any respect are liable to be rejected.

Clause 56.
The tenderer must obtain for himself on his own responsibility and at his own expense all the information which may be necessary for the purpose of filling this tender and for entering into a contract for the execution of the same from the office of the Dy. General

Manager and Ex. Engr. (Drainage), Surat Smart City Development Limited, Surat, during the office hours between 11:00 A.M. to 6:00 P.M. on weekdays except Sunday & Holidays and must examine the drawings and
inspect site of the work and acquaint himself with all local conditions and matters pertaining thereto before submitting the tender.

Clause 57.

Each of the pages (having reference for signature of the contractor) of the tender documents is required to be signed by the person or persons submitting the tender in token of his/their having acquainted himself/themselves with General Conditions etc., as laid down. Any tender with any of the documents not so signed which will be rejected.

Clause 58. (DELETED)

~~The tender form must be filled in English and all entries must be made by hand written in ink, if any of the documents is missing or unsigned, the tender shall be considered invalid.~~

Clause 59.

The rates quoted by the contractor shall include all eventualities such as heavy rain, sudden floods, etc. which may cause damage to the executed work or which may totally wash out the work. Until the completion certificate is issued to the contractors, S.M.C. shall not be responsible for such damage or wash out to the construction work.

Clause 60.

Time is the essence of the contract. The work should be completed within 24 (Twenty Four) months incluidng testing, trial run and commissioning [Including monsoon] from the date of the work order issued to the contractor to commence the work. The successful contractor will have to give a schedule of the various items of work to be done so that the work is completed within the stipulated time.

Clause 61.

Rate for extra items, as far as possible will be derived from the quoted tender items where it is not possible to do so, the same shall be carried out in following sequence.

(i) From GWSSB S.O.R.2014-2015
(ii) If rates are not available, as described under (i), then from RNB - Surat S.O.R. 2015-2016
(iii) If rates are not available in either of (i) or (ii), then it shall be arrived at by adding 15% towards overhead and profits on the actual cost of labour, material and plant and machinery input as approved by the Engineer-in-charge.

Clause 62.

In case of delay in execution of work the penalty at the rate of 0.2% of contract value per day subject to the maximum of 10% of the contract value, shall be payable by the contractor to the Surat Smart City Development Limited towards compensation.

Clause 64.

No claim for any extra or compensation for damage will be entertained on account of such variation, except where the quantity is increased by more than 30%. No claim for any extra or compensation for damages will be entertained on account of such variation where the quantity is decreased to any percentage or where the item is totally deleted.

Clause 65.

It should be noted that the contractor shall have to complete the work in stipulated time of 24 (Twenty Four) months incluidng testing, trial run and commissioning [Including monsoon] as per the terms of the contract. The Contractor shall submit complete CPM/PERT chart and get it approved within one month of the award of the work.

Clause 66.
The Contractor shall also arrange to obtain the license from the competent Authority under the contract labour (regulation and abolition) Act 1970.

Clause 67. (DELETED)
~~Before payment of final bill on completion of the work, total amount of that work done at sanctioned rate shall be considered with the total amount of work done, had it been executed at the rate of second tenderer. While comparing total amount, quantity to be taken into consideration will be the quantity executed and not the quantity put to tender and will also include variation of quantity within the limits of quantity executed ie 30% of the estimated quantity. In case the latter is less than the total amount of work done at sanctioned rate; than the amount of difference the two shall be deducted from the final bill before making payment. In other words the work when executed shall not exceed as compared to the rate of second lowest tenderer. It may be noted that extra items shall not be included in comparing the rates with the second lowest tenderer.~~

Clause 68.
The following additional information shall be forwarded by the tenderer along with the submission of the tender:

a A list of works of comparable nature executed, along with their value and time of completion.

b A list of works in hand showing the cost of the work to be completed against each with the certificate from the Head of the office concerned.

c A list of machinery in their possession and which they will bring for the proposed work.

d Solvency certificate without which such tenders are liable to be rejected. The Solvency certificate should be for the amount equal to 20% of the tender value of the work.

e Every contractor shall furnish along with the tender, information regarding income-tax the circle of the district in which he is assessed for income-tax the reference No. and year of assessment.

Clause 69.
Acceptance of quotation will rest with the competent authority who does not bind himself to accept the lowest and reserves the right to reject any or all quotations/tenders and no reasons will be given for acceptance or rejection thereof. The tenderers whose quotation is accepted will have to enter into a regular contract and abide by all rules and regulations embodied in the tender.

Clause 70.
The tender will be liable to be rejected outright, if while submitting it ---

a The tenderer proposes any alteration in the work specified in the tender or in the time limit allowed for carrying out the work or any other condition.

b Any of the pages of the tender are removed or replaced.

c In the case of item rate tender, the rates are not entered in ink in figures and words and the total of each item and grand total are not struck by the tenderer in ink in the last column of Schedule `B' under his signature.

d Any errors are made by him in the tender.

e All corrections and additions or pasted slips are not initiated by tenderers.

f The tenderer or in the case of a firm each partner thereof does not sign or the signature/signatures is/are not attested by a witness on page of the tender in the space provided for the purpose.

g The tenderers which do not fulfill any of the conditions of those in the printed form and those tenders which are incomplete.

Clause 71.
The contractor has to make all arrangements for procuring the materials required on his own work.

Clause 72.
in case of any discrepancy with tender document the contractor may contact the Dy. General Manager and Ex. Engr. (Drainage), Surat Smart City Development Limited, Surat.

Clause 73.
In view of the difficult position regarding the availability of foreign exchange, no foreign exchange would be released by the SMC for the purchase of plant and machinery required for the execution of the work contracted

Clause 74.
The contractor will have to construct shed for storing valuable materials at works site having locking arrangement. The material will be taken for use in the presence of the SMC person. No materials will be allowed to be removed from the site of works.

Clause 75.
Tender once accepted shall be binding on the contractor even if the formal agreement is not signed.

Clause 76.
Tender once offered can not be withdrawn except with the express permission of the Surat Smart City Development Limited.

Clause 77.

The successful tenderer may be required to furnish surety of 10% of the contract value on stamp paper if so desired by the Chairman, SSCDL.

Clause 78.

The tenderers are requested to give complete specification of prices quoted.

Clause79.

For all R.C.C. works such as Footings, Columns, Beams, Slabs, Chhajjas, Pardis, Lintels, etc., a 15 cm x 15 cm x 15cm sizes test cube as per the P.W.D. Standard will have to be taken by the contractor and as per instructions and directions of the Engineer-in-charge. These test cubes will be for 7 days and 28 days respectively. After 7 days, 28 days these test cubes will be tested in the Government approved laboratory by the contractor at his own expense and results will be submitted directly to the respective head of the SMC.

Clause 80.

This tender document contains 592 pages (Technical Bid), which should be furnished along with earnest money deposit, duly filled in and signed. No pages can be removed from the conditions of contract, specifications of drawings, otherwise it will be considered as an intentional fault and the tender will be liable for rejection and the amount of earnest money deposit forfeited.

Clause-81.

If the work executed is found to be of inferior quality OR of any substandard quality not conforming to the specifications at any point of time during the inspection of by Engineer-in-charge or any Higher Authority, the contract shall be terminated without assigning any reasons there off and no payment shall be made towards the probable damages or loss caused to the contractor and materials purchased by him for this work and no compensation whatsoever either shall be paid to contract by Surat Smart City Development Limited.

Clause-82.

The Successful contractor shall take "all contract risk insurance policy" for the tendered cost of the work. "Work's man compensation policy" for all workers and labour of contractor and clients working at site and "Third party insurance policy" to fully cover all third party type risk for the whole contract i.e. Construction, supply, installation, testing and commissioning and Operation & maintenance of sewage treatment plant. The insurance policy so taken by the contractor for such purpose shall be in the joint name of the contractor and the client and the policy shall be deposited with the clients.

Clause-83.
The Contractor should note that the conditional tenders shall be out rightly rejected.

Clause-84.
Out of the amount payable/creditable to contractor's account, the Central Government/State Government tax/taxes shall be deducted at source in accordance with the relevant laws/rules from time to time prevailing.

Clause-85.
Now no octroi is to be paid as the same is exempted and therefore the question of reimbursement does not arise. The contractors shall quote their rates considering this aspect of exemption of octroi.

Clause-86.
Surat Surat Smart City Development Limited shall not provide `C' or 'D' Form for tax purposes.

Clause-87
Price variation or escalation shall be paid to the contractor as detailed in the tender.

Clause-88

While preparing final bill on completion of the work, the total amount of work done as sanctioned shall be compared with the total amount of work done, had it been executed at the rate of second lowest tenderer and if the later is less than the total amount of work executed by the successful contractor at sanctioned rates, than the amount of difference between the two, shall be deducted before making final payment. In short, the work when executed, shall not cost more to the Surat Smart City Development Limited, if compared with the rates of the second lowest tenderer.

Clause-89
The final bill shall be paid only after the successful commissioning of the total plant.

Clause-90
Special Clause regarding EPF act 1952 and payroll and muster roll.

All the applicant contractors are required to have their own employer code number under EPF Act, 1952 and are required to comply the applicable provisions of said statute regularly and totally.

Further the contractors for services are required to produce the certified copies of paid challans in respect of employees/workers employed by said contractor in respect of work allotted by Surat Smart City Development Limited, along with copies of Pay Roll and Muster Roll. If the same are not produced, the bills will not be released.

Signature Of The Contractor

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

12. SCHEDULE - A

CEMENT AND STEEL :
Surat Smart City Development Limited shall not issue cement and reinforcement steel to be used for this work. The cement and reinforcement steel required for the above said work shall be procured by contractor at its own cost.

The brands for cement – OPC shall be Ambuja, Ultratech, Sanghi and J. K. Laxmi confirming to IS 12269/87 (with its latest amendments) of 53 grade (for OPC cement) only.

Approved make of CRS – Fe 415 reinforcement steel :- TATA, SAIL, Rastriya Ispat, Electrotherm (India) ltd. and J.S.W. Steel ltd. If Steel purchased from Electrotherm (India) ltd. and J.S.W. Steel ltd. than purchase bill / testing certificate of the that product shall be obtained from company itself and the name of the contractor /work shall be appeared on the bill /testing report.

Any of the above mentioned brands of Cement and Reinforcement steel shall only be used by the contractor at the time of execution.

The minimum cement content and maximum W/C ratio shall be as per table below.

Concrete Grade	Minimum (Kg/M^3)	Max. W/C Ratio
M 20	350	0.55
M 25	375	0.50
M 30	415	0.45
M 35	425	0.45

For concrete with volumetric / nominal mix and other items with use of cement the same shall be as per prevailing Surat Smart City Development Limited standards. The contractor shall not be allowed to use Fly Ash in Cement Concrete.

MINIMUM CONSUMPTION OF CEMENT AND REINFORCEMENT STEEL :
The allowable actual minimum consumption than the theoretical consumption, for cement and steel shall not be more than 5% of theoretical consumption.

TESTING OF CEMENT AND STEEL :
It should be specifically noted that the cement and steel brought by the contractor at site of work shall be used only after the same is tested at the approved laboratory as per the direction of the Engineer-in-charge. Such approved laboratory may be located at Surat, Baroda, Ahmedabad or Mumbai.

All the charge for the transport and testing of the samples shall have to be borne by the contractor. The frequency of testing such material shall be in accordance to the relevant Indian Standards as directed by Engineer-in-charge.

Star Rate formula for Cement and Reinforcement Steel

The amount payable to the contractor for the work done shall be adjusted for increase or decrease in the rates of cement & steel as under :

Price variation for cement and TOR steel brought by the contractor

The star rates for cement and TOR steel to be brought by the contractor shall be considered at site as per RBI indices

Cement	Rs. 235/- per bag of 50 Kg.
CRS steel	Rs. 40500/- per MT

(The above star rates shall be linked with Whole Sale price Index to be obtain from Office of economic Adviser Govt. of India. price index for steel/HYSD (STEEL:- LONG) and cement (Grey Cement) and HTS (Iron and steel wires) for the month in which the Tender Documents shall be received).

The fluctuations in rates of cement /steel shall be adjusted in the bills payable to the contractors as under:

A = B x (CI/C0-1) x D

A	=	Amount payable or recoverable
B	=	Basic rate of steel / cement as mentioned in the tender.
CI	=	The (monthly) average corresponding index for steel, cement for the month in which goods are received at site(date of delivery Challan). Index as published on website of Office of Economic Adviser (OEA).
C0	=	Price index of cement/steel for the month in which the tender documents are received, (as published on website of Office of Economic Adviser (OEA)).
D	=	Quantity of cement/steel actually brought by the contractor on site of work for bonafied use

The above formula shall be applicable for variation in prices of cement and steel only.

1. No ceiling for escalation for difference of steel and cement will be applicable.

2. This clause shall be operative from the date of issue of work order and up to the expiry of original and extended time limit.

3. This formula shall be used individually for individual item for cement and steel for calculating adjustment.

4. If during the progress of work or at the time of completion of work, it is noticed that any material brought at site is in excess of requirement (actual Consumption, then amount of escalation if paid earlier on such excess quantity of material shall be recovered on the basis of cost indices as applied at the time of payment of escalation or as prevailing at the time of effecting recovery, whichever is higher.

5. The cement and steel brought by the contractor on site of work shall be used only after the same is tested by the Department at the cost of contractor or after production of test certificate by Manufacturer as desired by the authority.

6. If such materials are not found as per the IS specification, the same shall be removed by the contractor for which no claim shall be entertained.

CEMENT AND STEEL

Contractor shall procure cement and steel required for this work. Contractor shall consider basic rate of cement at Rs. 235/- per bag of 50 Kg. The rate of CRS-Fe-415 steel at Rs. 40500/- per MT and in Surat for the purpose of quoting. Any difference in rates of cement and steel in Surat shall be adjusted in the bills payable to the contractor as per star rate formula as above. Contractor will not be paid for any transport, handling and storage expenses separately and he should quote for the works accordingly. Price variation for cement and steel shall not be applicable to RCC/Steel pipe, perforated Jali's/Grill and PVC steps, binding wires, MH frames with cover, Structural steel etc.

Signature of Contractor

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

13. SCHEDULE - B

AS PER SEPARATE PRICE BID uploaded

Note :

1. All works shall be carried out as per Government of Gujarat's P.W.D. Handbook and our specifications contained in this document and as directed.

2. All the columns in the Schedule-B for the quotation as a turn key tender should be filled on line.

3. Rates quoted include clearance of site (prior to commencement of work and at its close before handing over) in all respects and hold good for work under all conditions, site, moisture, weather etc.

4. Rate for each job and the total amount of work shall be filled .

Signature Of The Contractor.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

14. IMPORTANT INSTRUCTION TO TENDERER

1.

Affix latest passport size photo of tenderer

_____

Specimen Signature of the Contractor

2.

1	2	3	4
AFFIX LATEST PASSPORT SIZE PHOTOGRAPH OF ALL PARTNERS IN CASE OF PARTNERSHIP AGENCY			

Specimen signature of all partners incase of partnership agency.

i. _____
ii. _____
iii. _____
iv. _____

Submission of Registered Agreement is compulsory in case of partnership agency.

3. Submission of income tax clearance certificate of last three years is compulsory for tenderer submitting agency.
4. Submission of sale tax certificate, with proof of residence is compulsory for tenderer.
5. In case of Government royalty applicable to tenderer, it is compulsory to submit a receipt of royalty payment with tender.
6. The Photograph and specimen signature of contractor will be cross checked, whenever contractor receives payment in account section of SMC.
7. The specimen signature of contractor will be cross checked by Account Department of SMC, in case of representative of Contractor along with letter of authority of a person who signed an agreement, receives payment.
8. All partners of tenderer should put their specimen signature at the relevant places in the tender. A Passport size photograph of all partners who have signed the tender shall be affixed in the tender.

The successful tenderer shall be required to execute necessary agreement where in the same partners shall put on their signatures.

Signature of the Contractor

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

.

15. MEMORANDUM

I / We _____ the undersigned do hereby tender for carrying-out the work described in the schedule subject to the conditions annexed in Schedules attached herewith in tender documents.

1. General Description of work : Design , Construction , Erection , Testing and commissioning of (i) Augmentation of existing Sewage Pumping Station, (ii) Augmentation of existing 66 MLD up to 167 MLD Capacity STP (iii) 40 MLD net Output TSTP to generate Industrial grade Water including operation and maintenance of all the above (i), (ii) and (iii) for 10 Years Period, Under SMART CITY , Surat

2. Earnest Money Deposit : Rs. 2,45,60,000.00

3. Security Deposit:

No.	Details	Agreement	Security Deposit
1	Capital Work and O&M during augmentation / upgradation	For Capital Work and O&M during augmentation / upgradation	Payable as under for only Capital Work amount
2	O&M after completion of capital work on commissioning	For O&M work only	Payable as under for only O&M Work amount of 10 years

i Pay order or F.D.R.or D.D.of any Nationalised Bank. :- -

ii In form of Bank guarantee of any Nationalised Bank:- 2% of Tender Amount (Shall be released at the time of final bill)

iii To be deducted from Running Bill in form of Retention Money:- 2% (Shall be released after defect liability period)

4. Time Limit : 24 (Twenty Four) months incluidng testing, trial run and commissioning [Including monsoon]

5. Penalty for delay : 0.2% (Zero point two percent) of the contract price per day maximum upto 10% (Ten Percent) of the Tender Amount.

6. The progress of work should confirm to : 1/4 of the work in 1/4 of the time.
1/2 of the work in 1/2 of the time.
3/4 of the work in 3/4 of the time.

7. Percentage to be retained from running account bills:- Additional 5% (Shall be released at the time of final bill)

8. Defect Liability Period : 12 Months (Twelve Months)

9. Water Charges
a. Water charges shall have to be paid by the Contractor at the rate of 3% of the amount of work done and shall be deducted from the running account bill, if water supplied by SMC.

b. Exemption shall be granted if the contractor makes its own arrangement of water supply and inform SMC within one month of commencement of work.

Signature of the contractor.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

16. SPECIAL CONDITIONS OF CONTRACT

1.1 General

The present tender covers the work of **Design , Construction , Erection , Testing and commissioning of (i) Augmentation of existing Sewage Pumping Station, (ii) Augmentation of existing 66 MLD up to 167 MLD Capacity STP (iii) 40 MLD net Output TSTP to generate Industrial grade Water including operation and maintenance of all the above (i), (ii) and (iii) for 10 Years Period, Under SMART CITY , Surat** The operation and maintenance contract under this tender covers work of the operation and maintenance of existing STP with SCADA/PLC/Instrumentation system.

The clauses given under these special conditions shall be read in conjuction with conditions of the contract and in case of any conflict the provisions of special conditions will over ride the provisions of general conditions of contract.

For any descripancy in interpretation of tender specifications, terms, conditions, general note, instructions, the decision of General Manager will be final and binding to the Contractor.

The scope of work and specification cover all the items/equipments/materials required for commissioning the augmented Sewage Treatment Plant (STP). However, if in the opinion of contractor/ bidder any item/ equipment/ material is missing the same should be included in the scope of work and provided accordingly. No separate payment shall be made towards it.

The tenderer shall acquaint himself with the access to site, availability of local facilities such as transport, materials, labour and shall price his tender accordingly. The tenderer's lumpsum price shall take into account all the above in this regard for the entire period of the contract.

The tenderer shall have to quote his lumpsum price for **Integration of existing units and new units with necessary modification, addition and alteration including design, construction, erection, testing and commissioning and successive operation and maintenance for the period of 10 years** as described in Clause 1.2 here below.

The tenderers shall be deemed to visit the site and familiarised themselves throughly with the site conditions before submitting the tender. Non familiarity with the site conditions to assess the scope and nature of work will not be considered as a reason either for extra claims or for not carrying out works in strict confirmity with the detailed drawings and specifications. The tenderer shall have to study the details of existing land/plot area available and surroundings.

1.2 NOTE: THE BIDDERS ARE ADVISED TO READ THIS CLAUSE CAREFULLY BEFORE QUOTING THE PRICE FOR THIS TENDER.

Turn-key price of the tender is asked for the proposed augmentation of sewage treatment plant. The bidder is required to go through the details of the given treatment process in the Chpater on “Description of the Project” and then looking to the given raw sewage data, existing STP unit and equipment details, process requirements and required secondary treated sewage parameters as per the tender requirements the tenderer has to submit the data sheet as provided in the Annexures and submitted along with the “PART-B : TECHNICAL BID” with

supporting drawings/details etc. For this, the bidder is required to quote his Lump-sum price in the online Price-Bid.

It should be clearly noted here that the process/design proposed by the bidders should be related to the total 167 MLD capacity sewage treatment plant only, with the object of getting desired treated sewage (effluent) quality standards from the available quality of raw sewage, as given in the tender.

1.3 The place of the proposed project is situated at Dindoli.

1.4 The general scope of work for the proposed Sewage Treatment Plant and Tertiary Sewage Treatment Plant under present tender includes Design, Construction, Erection, Testing and Commissioning including the cost of all the labour, materials, chemicals, equipments, instruments, tools required for civil, electrical, mechanical, instrumentation, piping etc. & all other types of works for the total completion of the project on turn-key basis. The detailed scope of work, specifications etc. are described in this tender elsewhere.

Cost of all types of materials/ equipments/ machineries/ tools/ items including cement, steel (reinforcement as well as structural) all types of pipes etc. & all types of labor required for the completion of the project is included in the estimated amount for the proposed work. Their purchase as per approved vender list given in the tender and construction/ erection/ installation/ laying will be in the contractor's scope.

1.5 The proposed Sewage Treatment Plant and Tertiary Sewage Treatment Plant will have to be designed & constructed considering the HFL as 11.50 Mtr. R.L. The H.F.L. at the site shall be 11.50 mt. R.L. The plinth of all units including MCC / Panel room (excluding sludge pump houses – water / sludge tanks) shall be minimum 300 mm above HFL. The average Ground level at the site varies between 10.0 mtr. to 11.0 mtr. R.L.

1.6 The tentative location for layout for the proposed STP and TSTP is shown in the tender drawing. Tenderers shall have to carry out necessary soil test to arrive at foundation type and details. The contractor shall have to adopt Pile foundation, if required.

1.7 All the drawings enclosed with this tender like-layout plan, Hydraulic flow are of existing STP facility only.

The bidder shall submit his proposed layout plan & hydraulic flow diagram as per the proposed design / data sheet with the Technical-Bid of the tender. Alternative offer shall not be accepted and in such case the tender will be rejected.

Before starting of any construction activities including excavation etc., layout plan, hydraulic flow diagram, P&I diagram & G.A. drawings of all the units of the plant with design calculations shall have to be prepared and submitted by the contractor for approval to SMC. After getting the approval for the same from SMC, the contractor shall submit structural (RCC/steel) drawings with design calculations for approval to SMC

SMC may appoint a process / structural consultant for this work, to whom all the structural drawings with design calculations will be forwarded by SMC as submitted by the contractor. SMC may approve the structural drawings or give remarks for showing necessary corrections in the drawings as per the opinion given by the structural consultant appointed by SMC Any drawing can be released for construction only after getting final approval in writing from SMC.

1.8 SMC's engineer or his authorised inspecting agency reserves the right to inspect the work of the contractor/subcontractors and satisfy himself about the quality of materials used for the work.

1.9 Safety :

All the safety and factory rules shall be strictly followed. The contractor is fully responsible for the safety of his staff and workmen and must equip them with safety appliances and tools.

1.9.1 The Contractor shall be responsible for provision of safety arrangements & protective clothing for all persons/employees on the site whether or not engaged in actual operation or supervision.The Contractor shall also be responsible for safety arrangements of all equipment used for construction and shall employ trained workmen conversent with safety regulation. The contractor shall use only tested equipment and tools and shall periodically renew tests to the satisfaction of the Engineer. All test certificates shall be made available to the Engineer at the site of the work. If at any time, in the opinion of the Engineer, this provision is not complied with, the contractor shall forthwith replace such equipment and tools.

1.9.2 The contractor shall display notices and arrange proper fancing at such places where hazardous work is being carried out. The contractor shall provide at his own expense on the works to the satisfaction of the Engineer at such places, proper and sufficient fire fighting, first aid appliances etc. which shall at all times be available for use.

1.10 Time Schedule :

The work shall be executed strictly as per the time schedule/bar chart submitted and as agreed upon alongwith price-bid offer.The entire job/project has to be completed within a period of **24 (Twenty Four) months incluidng testing, trial run and commissioning [Including monsoon]** from the date of placement of order. The time limit includes the time required for testing, rectification, if any, retesting and completion in all respect to the entire satisfaction of the Engineer-in-charge. The timely completion of this project is very very important for the citizen of Surat City, and hence weightage will be given on strict compliance of work as per the sanctioned schedule of work/bar chart.The time limit of this project is **24 (Twenty Four) months incluidng testing, trial run and commissioning [Including monsoon]** inclusive of trial run period. The time period of completion shall be reckoned from the date of notification of award of work. The bidder shall have to submit a detailed PERT/BAR chart network, with the time frame consisting adequate number of contractual activities covering key

phases of the works such as design, drawing, approval procurement, manufacturing, testing, construction and field erection activities.

The contractor shall have to finish its detailed process design, civil GA drawing and drawings of electro-mechanical equipments within first two months of award of work invariabley.

Monthly construction programme, progress and financial target achieved shall be drawn up and submitted at every first of calender month. The tenderer shall strictly adhere to the schedule of work by deploying adaquate personnel.

1.11 Penalty for delay :

The Contractor is bound to do the work as per the sanctioned schedule of work/bar chart. The contractor shall have to submit the progress report with physical and financial achievement at every first of calender month. The Engineer-in-charge will review the same and if the contractor fails to achieve the target set as per the sanctioned bar chart, he shall pay penalty for delay, at one fifth of one percent of financial target set of respective month.

If the contractor fails to complete the work within the stipulated completion date for the work, he shall pay **penalty for delay** at 0.2% (Zero point two percent) of contract value per day of delay in completion and handing over the work or part thereof as the case may be to The Surat Smart City Development Limited. The amount of **penalty for delay** shall, however, is subjected to a maximum of 10% (ten percent) of the contract value. Delays in excess of one hundred days will be a cause for termination of the contract and forfeiture of all security for performance.

1.12 Scope of Supply of Material :

a] **Supply of Material** :

All materials,testing appliances,tools, tackles & spares etc. necessary for the successful execution & completion and till plant handing over to SMC shall be procured and provided by the tenderer. **No material will be supplied to the contractor, either free of cost or at issue rate by the Surat Smart City Development Limited, for this complete work.**

b] **Water :**

The contractor shall be allowed to make arrangement for necessary construction water in two ways.

(a) The contractor can make its own arrangement of water supply through private boreholes or through tankers. However, the contractor shall be required to inform Surat Smart City Development Limited within 30 days of staring of work and shall have to produce necessary test certificate that conform the construction water grade as per relevant IS. Otherwise, water charge shall be recovered at rate of 3% of the work done amount from contractor's bill.

(b) If contractor wishes to use the municipal water for construction purpose, he/she shall have to apply to get the water connection through license plumber from relevant zone office. He shall have to bear all the cost towards getting water connection. The contractor shall be liable to pay all the charges as per the prevailing rules and regulation of Surat Smart City Development Limited for making use of water. Further, the contractor shall have to produce the copy of payment of water charge bill to the undersigned, otherwise the water charges shall be deducted from his running bills.

Where, the water supply network is not available, the contractor may borrow the tanker from any of the municipal water distribution centre on the payment of necessary water charges, as per the prevailing rules and regulations.

Most importantly, the contractor shall be responsible for disconnecting the water connection on completion of work and shall have to inform the department accordingly.

If Municipal mains are not available nearby the contractor shall have to make his own arrangements at his cost for water required for construction purpose.

For all the purposes connected with the work, the contractors shall be allowed the use of water from the Municipal mains wherever available at prevailing rates. The contractors, however, will have to make their own arrangements to get at their cost necessary water connections from the Municipal mains. If the water is, in the opinion of the Engineer, used improperly or wasted, the Engineer may cause the supply of water to be discontinued or the water will be supplied to the Contractors at double the prevailing rate of water for the quantity of water used. In order to prevent the misuse or wastage of water by the Contractors, the Engineer shall be at the liberty to engage a Mucadam at the cost of the Contractors on wages not exceeding Rs.300/- [Rupees Three Hundred Only] per day [exclusive of other charges leviable by the Surat Smart City Development Limited under rules such as dearness allowance and supervision etc.] for supervising and controlling the use of water by the contractors men.

c] **Power** :

Power required for the construction, erection and other allied job shall be arranged by the contractor at his own cost.

The Contractor shall have to make his own arrangement for getting electric power. The SMC will issue only recommendation letter to the contractor if required. No compensation shall be paid for delay in getting power supply.All the rest formalities for getting the power supply, connection charges, deposits, monthly energy bills etc. shall be done and borne by the contractor.

d] **Cement** :

Cement required for the construction, erection works shall be procured by the contractor at his own cost. All the cement to be used for the proposed work for any civil engineering activity shall be Portland Pozzolana Cement (Fly Ash based), confirming to IS: 1489, Part-I (Latest Edition) and from the specified vendors/manufacturers only.

e] **Steel** :

All reinforcement and structural steel required for construction, erection and other allied job shall be procured by the contractor at his own cost. All the reinforcement steel to be used for the RCC work for the proposed Sewage Treatment Plant and Tertiary Sewage Treatment Plant at all levels, shall be CRS (Corrosion Resistant Steel) type of Fe 415 Grade confirming to IS:1786 and from the specified vendors/manufacturers only.

f] **Chemical and Consumables** :

Only necessary electrical power will be supplied free of charge by SMC during testing, commissioning and O & M till handing over the system to SMC All other

consumable items including chemicals and all other arrangements shall have to be made by the contractor at his own cost.

1.13 Construction of Stores and Site Office :

Suitable areas will be allocated by the SMC to the Contractor to build storages for storing his equipments, plant, materials etc. and also to build his site offices. He will be solely responsible for watching and guarding of his stores, offices etc.

The contractor shall cover all his equipments and materials at site with requisite insurance against theft, larceny, decoity, fire tempest, flood, earthquake etc. It will the contractor's responsibility till handing over the plant after satisfactory completion of trial run and Operation-maintenance contract. Even though part/full payment is released against supply/ installation/ commissioning.

On completion of the works undertaken by the contractor, he shall remove all temporary works erected by him and have the site cleaned as directed by the Engineer. The SMC reserves the right to ask the contractor any time during the pendency of the Contract to vacate the land by giving 7 day's notice on security reasons or on national interest or otherwise.

1.14 Labour and Supervisory Camps :

No land will be provided by the SMC to the Contractor for constructing his labour and supervisory camps and other service facility. Contractor shall make his own arrangements outside the plant boundary.

1.15 Construction Equipment :

The Contractor shall make his own arrangement to procure all constructional plant and equipments for his own. He shall also state the type and number of different equipments with their capacities in good working conditions which he will use on the site to ensure completion of the work in the specified time.

All materials, construction plants and equipments once brought by the contractor to the site are not to be removed from there without the written permission of the Engineer--in-charge. Also,the Contractor shall have adequate stock of spare parts for the equipment on the site and work shall not be delayed on this account. Similarly all temporary works built by the Contractor for the main construction undertaken by him, are not to be dismantled and removed without the written authority of the Engineer-in-charge.

1.16 Signing Of The Contract

The successful tenderer shall be required to execute an agreement in the proforma attached with the tender documents within ten days of the receipt by him of the notification of acceptance of tender. In the event of failure on the part of the successful tenderer to sign the agreement within the above stipulated period, the acceptance of the tender shall be considered as cancelled and Earnest Money Deposit amount will be forfeited.

1.17 Interpretation Of Contract Documents

Except if and to the extent otherwise provided by the contract, the provisions of the General Conditions of Contract and special conditions shall prevail over those of any other documents forming part of the contract. Several documents forming the contract are to be taken as mutually explanatory, should there be any discrepancies, inconsistencies, errors or commissions in the contracts or any of them, the matter may be referred to the Engineer-in-charge who shall give his decisions and issue to the contractor instructions directing in what manner the work is to be carried out. The decision of the Engineer-in-charge shall be final and conclusive and the contractor shall carry out the work in accordance with this decision.

Works shown upon the drawings but not mentioned in the specifications or described in the specifications without being shown on the drawings shall nevertheless be held to be included in the same manner as if they had been specifically shown upon the drawings and described in the specifications.

The various documents forming the contract are the essential parts of the contracts and a requirement occurring in one is as binding as though occurring in all, they are intended to be mutually explanatory and complementary and to describe and provide for a complete work.

In the event of any discrepancies, the various documents forming the contract or in any one document, the following order of precedence should apply

a] Dimensions & quantities ---
   i Drawings.
   ii Schedule `B' of the tender form.
   On drawings, figures, dimensions, unless obviously incorrect will be followed in preference to shown dimensions

b] Description ---
   i Schedule `B' of the tender form
   ii Drawings
   iii Specifications

In case of defective description or ambiguity, the Engineer-in-charge should issue further instructions/ directions in what manner the work is to be carried out, it being understood that the best modern practice is to be followed. The contractor should forthwith comply with such instructions

The contractor should take no advantage of any apparent error or commission in drawings or specifications and the Engineer-in-charge shall make such corrections and interpretations as necessary to fulfill the intent of the plans and specifications.

1.18 Force Majeure

Any delays in or failure of the performance of either part hereto shall not constitute default hereunder or give rise to claims for damages, if any, to the extent such delays or failure of performance is caused by occurrences such as Acts of God or the public enemy; expropriation or confiscation of facilities by Government authorities, compliance with any order or request of any Governmental authorities, acts of war,

rebelling or sabotage or fires, floods, explosions, riots or illegal strikes. The contractor shall keep records of the circumstances referred to above and bring these to the notice of the Engineer-in-charge in writing immediately on such occurrences.

1.19 Forfieture Of Retention Money

Whenever any claim against the contractor for the payment of a sum of money arises out of or under the contract, the S.M.C. shall be entitled to recover such sum by appropriating in part or whole of the retention money of the contractor. In case, the retention money is insufficient or if no retention money has been taken from the contractor, then the balance or the total sum recoverable, as the case may be, be deducted from any sum then due or which at any time thereafter may become due to the contractor. The contractor shall pay on demand any balance remaining due.

1.20 No Compensation For Alteration In Or Restriction Of Work

If at any time after the commencement of the work, the Surat Smart City Development Limited shall for any reason whatsoever not require the whole or part thereof as specified in the tender to be carried out, the Engineer-in-charge shall give notice in writing of the fact to the contractor, who shall have no claim to any payment or compensation whatsoever on account of any profit or advantage which he might have derived from the execution of the work in full, but which he did not derive in consequence of the full amount of the work not having been by reason of any alterations having been made in the original specifications, drawings, designs and instruction which shall not involve any curtailment of the works as originally contemplated.

1.21 Right Of The Surat Smart City Development Limited To Determine/Terminate Contract

i The Surat Smart City Development Limited shall, at any time, be entitled to determine and terminate the contract, if in the opinion of the Surat Smart City Development Limited the cessation of the work becomes necessary owing to paucity of funds or for any other cause whatsoever, in which case the cost of approved materials at the site as verified and approved by the Engineer-in-charge and of the value of the work done to date by the contractor shall be paid for in full at the rate specified in the contract. A notice in writing from the Surat Smart City Development Limited to the Contractor of such determination and the reason, thereof shall be the conclusive proof of the fact that the contract has been so determined and terminated by the Surat Smart City Development Limited.

ii Should the contract be determined under sub-clause (i) of this clause and the contractor claims payments to compensate expenditure incurred by him in the expectation of completing the whole of the work, the Surat Smart City Development Limited shall consider and admit such claims as are deemed fair and reasonable and are supported by vouchers to the satisfaction of the Engineer-in-charge. The decision of the Chairman, SSCDL on the necessity and propriety of any such expenditure shall be final and conclusive and binding on the contractor.

1.22 Co-operation with other Contractors :

The contractor shall execute his work in phased manner as directed by the Engineer from time to time so as not to obstruct or retard the work being executed simultaneously by other agencies.

1.23 Coverage of Contract:

The Contract for the work is a complete one for labour, material and workmanship with contractor's overhead and profit including all temporary works and the provision anduse of all construction equipments, tools, tackles, etc. The contractor shall make his own arrangements for all the materials and equipments required for the due performance of the contract.

Except where it is explicitly provided that the cost will be borne by SMC, the various obligations of the contractor under contract shall be at the cost of the contractor.

The lump sum price quoted by the contractor for the turnkey project of the proposed Sewage Treatment Plant and Tertiary Sewage Treatment Plant shall be deemed to have included any octroi charges or any other local taxes, sales tax, VAT etc. imposed or to be imposed by Local body and/or State/ Central Government during the project period for the all the goods, items, raw materials, finished goods, machineries, equipments, valves, pipes, instruments, cables or any other materials to be used for the proposed work.

In the Operation & Maintenance Contract of Ten years for Proposed Sewage Treatment Plant and Tertiary Sewage Treatment Plant, only electricity as per the requirement will be supplied from SMC. Rest all the expenses pertaining to the operation & maintenance of the augmented STP and new TSTP as described in detail in Chapter on Operation and Maintenance in this tender, as per the given specifications & required quantity and cost of all the major/minor spares and chemicals required for any type of repairing or replacement during the period of Ten years shall be borne by the contractor.

1.24 Collection Of Data Tenderers' Responsibility

The tenderer shall visit the site and acquaint himself fully of the site and no claims whatsoever will be entertained on the plea of ignorance or difficulties involved in execution of work or carriage of materials.

1.25 Setting Out Works

The Engineer-in-charge shall furnish the contractor with only the four corners of the work site and a level bench mark and the contractor shall set out the works and shall provide an efficient staff for the purpose and shall be solely responsible for the accuracy of such setting out.

1.26 Responsibility For Level & Alignment

The contractor shall be entirely and exclusively responsible for the horizontal and vertical alignment, the level and correctness of every part of the work and shall rectify any errors or imperfections therein. Such rectifications shall be carried out by the contractor at his own cost, when instructions are issued to that effect by the Engineer-in-charge.

1.27 Discrepancies Between Instructions

Should any discrepancy occur between the various instructions furnished to the contractor, his agents or staff, or any doubt arises as to the meaning of any such instruction or, should there be an misunderstanding between the contractor's staff and the Engineer-in-charge's staff, the Contractor shall immediately report the matter in writing to the Engineer-in-charge whose decision thereon shall be final and conclusive and no claim for losses alleged to have been caused by such discrepancies between instructions, doubts or misunderstanding shall in any event be admissible.

1.28 Plant Guarantee/Warantee :

The contractor shall guarantee the performance of the complete sewage treatment plant as per the scheme shown in Hydraulic flow diagram & layout. The equipments supplied under this tender shall be guaranteed for a period of 12 months from the date of succesful completion of one months trial run, commissioning and performance test, against defects in civil, mechanical, electrical & instrumentation with regard to design, materials and workmanship. Any defects found within the guarantee period shall be made good by the Contractor at his cost immediately on receipt of intimation from SMC in writing.

1.29 Mechanical Guarantee :

Mechanical Guarantee for the entire equipment part shall be for the period as stipulated above.

a] In the event of failure of any particular part of the equipment [excluding fast wearing parts.] more than two times during the guarantee period, it shall not be repaired but the complete part shall be replaced by the tenderer and the guarantee for the particular part shall be extended by one year from the date of last replacement.

b] In case it is found that above mentioned failure is due to some connected part of the equipment, that part shall also be rectified or replaced by the tenderer to avoid such failure in future and similar guarantee shall be offered by the tenderer for this also.

c] In the event of failure of any particular equipment which fails more than two times during the guarantee period,the tenderer shall have to replace this equipment with another equivalent make as approved by the SMC and manufacturer's guarantee shall be kept valid.

1.30 Performance Guarantee :

The tenderer shall give a guarantee for a period of one year from the date of sucessful completion of commissioning of one months trial run period. Any defects found in the workmanship or materials used supplied by the tenderer will be rectified by the contractor at his own expenses, within the time specified by the Engineer-in- charge.

The tenderer shall start and commission the plant and prove that it is giving satisfactory service and desired characteristics of treated effluent continuously for three months before handing over the plant to owner at his own cost. During this start up and commissioning period, the tenderer shall also have to give guarantee for the standard

quality of the treated effluent to meet all the applicable requirements given in the tender documents.

1.31 Inspection :

The necessaly all the expences towards inspection shall have to be borne by the contractor, including transportation, lodging, boarding, inspection cost etc. for maximum two representatives of SMC.

a) The equipments as per approved QAP shall be subjected to inspection and tests inline with the relevant standards at the manufacturer's works before despatch. Tenderer shall give notice of two weeks to the Engineer- in- charge. who may depute his representatives at his option to witness such tests.It shall however,be the tenderer's responsibility to supply all materials as per specifications,standards mentioned herein and inspection by the clients does not relieve the contractor from his all obligations.

b) All tests as required by the Engineer-in-charge either at site or at outside laboratories concerning the execution of the work and supply of materials shall be carried out by the tenderer at his own cost.

c) Tenderer shall ensure that all facilities are extended for inspection of works by the Engineer-in-charge or his representatives at any time during the period of execution of the works. The tenderer shall carry out all instructions given by the Engineer-in-charge or his representative to the entire satisfaction of the Engineer-in-charge.

d) All materials to be used by the tenderer shall be of approved quality and make.The tenderer shall submit the list and makes of materials he intends to use, unless otherwise specified and obtain the prior approval of the Engineer-in-charge.Any material found to be of inferior quality/make other than approved make or unsuitable for the purpose will be rejected by the Engineer-in-charge and the tenderer shall replace at his own cost, the decision of Engineer-in-charge in such event shall be final and binding.

e) Inspection and acceptance by the Engineer-in-charge shall not relieve the tenderer from any of the responsibilities/obligations under the contract.

The equipments as per approved QAP thereof shall be inspected and tested at manufacturer's site in presence of representative of SMC & TPI (Third party Inspection) before shipment and/or dispatch for the site. In addition, if felt necessary, certain critical equipments thereof shall be subjected to shop inspection and testing at manufacturer's site by the SMC & TPI or its authorized representative before shipment/dispatch to ensure conformity with the accepted laid down specifications. The contractor is responsible for providing all tools, instruments and other requirements for conducting such inspection and testing by the Surat Smart City Development Limited or its representative. However, the shop floor inspection of equipment by the SMC or its authorized representative before shipment shall not prejudice the SMC's right for rejection of the equipments on the final inspection at site and also does not relieve the Contractor from the responsibility that all the equipments provided shall be free from defects and suited in all respects for the purpose intended to. Testing charges and other

relevant costs shall be borne by the contractor and this matter is elaborate elsewhere in the tender document. Contractors have to arrange for railway ticket minimum two tiers AC for indigenous equipments for travelling time less than 14 hours and economy class Air fare for imported equipments as well as travelling time is more than 14 hours. All the testing charges of equipment/machineries and the transportation, lodging, boarding and any other relevant expense of the team of Surat Smart City Development Limited (including TPI) which may consist maximum 2 personals shall be born by the contractor.

Only routine tests as per relevant B.I.S./IEC/ specifications for the various items of equipment shall be performed at the Contractor's works/equipment manufacture's site in the presence of Engineer-in-Charge and test certificates furnished. Where the bought out items/equipment are such that it forms part of a system which is to be inspected, inspection shall be carried out at Contractor's works/ manufacture's site as per the stipulation laid down in B.I.S./IEC specification. However, where independent equipment is so involved that it does not concern the assembly testing and can be directly dispatched to site, the test certificates shall be produced by the contractor/subcontractor and inspection shall be carried out at SMC site. However, during inspection if any defect found, the contractor at his risk & cost shall replace the same and cost within specified time limit. In this case no time limit extension will be given in the execution of overall plant.

Acceptance of any material or equipment shall in no way relieve the Contractor of his responsibility for meeting the requirements of the specifications, relevant standards and successful testing and commissioning at site

All test equipment, operating personnel and consumables, testing charges, etc., required for carrying out tests at manufacture's work and at site shall be supplied by the Contractor at his own cost.

If required by the Surat Smart City Development Limited the equipment shall be sent to recognized test lab for ascertaining the guaranteed parameters. The Contractor should agree to the same. The test results so obtained shall be binding to the Surat Smart City Development Limited and to the contractor. If the results are found meeting test standards/certificates, the test charges shall be borne by the Surat Smart City Development Limited otherwise the test charges shall be borne by the Contractor. But at the first instance the contractor to the concern institute/laboratory shall pay the charges.

1.32 Testing and Commissioning :

a) After testing the individual equipment, the tenderer shall commission and run the whole plant for atlest three months as directed by the Engineer-in-charge. Any defects found in design. workmanship or in any of the equipment supplied by the tenderer shall be rectified by the tenderer at his own cost within a reasonable time to be decided by the Engineer-in-charge. Beyond this period suitable penalty shall be levied and the plant shall be tested again for faultless running of three months to the entire satisfaction of the Engineer-in-charge. All the skilled/ unskilled labour, oil, grease, spares and all other consumable items and other arrangement shall have to arranged by the Contractor at his cost during the testing, commissioning and till handing over the system to SMC Only necessary power will be supplied free of charge by SMC.

b) During the period of testing and commissioning the tenderer shall make available at site experienced personnel including chemist for operating the treatment system. They shall impart adequate training to the staff deputed by SMC so as to enable them to efficiently handle the operation and maintenance of the system. Ten copies of operation manual detailing the function of all the civil, mechanical, electrical, units and instruments, operation, routine maintenance, and preventative maintenance shall be supplied before trial run of the sewage treatment plant.

1.33 Royalties :

Royalties for the consturction materials i.e. Sand, Stone, aggregates,Rubble, murrum, gravel as specified from time to time by the State Government shall be paid by the contractor. All ruling regulations have to be strictly adhered to.

1.34 Instruction Manual for Operation & Maintanance:

After the total completion and before the commissioning of the plant, the contractor shall submit the 10 (Ten) copies of the operation & maintenance manual for the proposed augmented STP and new TSTP.

The contractor shall submit in duplicate (soft copy and hard copy each in duplicate) operational and maintenance manual for all the process units including for equipments and instruments. The manual shall include details such as objectives, precommissioning instructions as well as detailed operational aspects and instructions on start up, normal operation and shut down procedure for treatment plant units including analytical methods to be adopted at various stages of monitoring treatment plant to achieve desired results. The detailed characteristics of various supplied equipments shall be part of manual. The necessary detailed drawings such as plant layout, hydraulic flow diagram and P & I diaagram shall be also enclosed.

The approved Operation & Maintenance manual shall be finally submitted in Ten sets in proper binding giving various above details also incorporating all details and comments given by SMC.

1.35 All the reinforcement steel to be used for the RCC work for the proposed Sewage Treatment Plant and Tertiary Sewage Treatment Plant at all levels, shall be CRS type of Fe 415 Grade confirming to IS:1786 and from the specified vendors/manufacturers only. Test certificates indicating steel confirming to required IS, must accompany before delivery of each & every lot of reinforcement steel to be supplied & used for the proposed work. After delivery of such reinforcement steel at site, testing of steel shall be carried out as per the relevant IS codes, as per the sampling procedure given in the same.

1.36 All the cement to be used for the proposed work for any civil engineering activity like-PCC, RCC, inside & outside plastering, IPS & flooring etc., shall be Portland Pozzolana Cement (Fly Ash based), confirming to IS: 1489, Part-I (Latest Edition) and of the specified vendors/manufacturers only.

1.37 All the concreting work for the proposed Sewage Treatment Plant and Tertiary Sewage Treatment Plant shall be carried out by automatic digital type weigh-batching plant &

concrete mixer installed at the site for the proposed work, as per the specifications given in this tender. Volumetric batching of concrete ingredients shall not be allowed in any case.

1.38 Photography/Videography of all the major constructional activities, trial run & commissioning period of the proposed Sewage Treatment Plant and Tertiary Sewage Treatment Plant shall be carried out by the contractor, cost of which shall be deemed to have been included in the lump sum price given by the contractor for the proposed work. Minimum 300 numbers of photographs shall be taken & provided in two copies in 4"X6" size in matt finish with album. Videography shall be provided in CD format in two copies.

1.39 The Contractor shall have to get approval from factory inspector as per factory act and should submit the certificate of approval to SMC The required drawings to be submitted to factory inspector shall be supplied by the Contractor and approved drawings shall be handed over to SMC All necessary drawings/liasons work etc. will be done by the contractor. SMC will assist only in submission of the application forms.

1.40 The contractor shall be required to give test report and submit the same to Electrical Inspector for complete Electrical works done by the Contractor. The approved drawing / test reports shall be handed over to SMC

1.41 Insurance / responsibility of all the materials / equipments / plants shall be the Contractor's responsibility till handing over the plant to SMC, even if part payment is released.

1.42 Payment terms will be as follows:

[a] Civil works:
(i) 100% to be paid for respective civil works completed.

[b] Mechanical/electrical/instrumentation/piping work:
(i) 15% to be paid on equipment / instrumentation / pipe purchase order.
(ii) 70% to be paid as and when the complete plant / equipment (alongwith specified spares) is received at site.
(iii) 10% to be paid as the plant/equipment is installed.
(iv) 5% to be paid after one month satisfactory trial run of the plant.

[c] In all above payments vide Runnig Bills for [a] and [b] above, 2% S.D. and 5% Retention money shall be retained and released as described under Memorendum

1.43 Guidelines to be followed at work site :

[a] All the items occuring in the work and as found necessary during actual execution shall be carried out in the best engineering manner/practice as per specifications and as directed by the Engineer-in-charge.

[b] Rate for extra items, as far as possible will be derived from the quoted tender items where it is not possible to do so, the same shall be carried out in following sequence.

(i) From GWSSB S.O.R.2014-2015
(ii) If rates are not available, as described under (i), then from RNB - Surat S.O.R. 2015-2016
(iii) If rates are not available in either of (i) or (ii), then it shall be arrived at by adding 15% towards

overhead and profits on the actual cost of labour, material and plant and machinery input as approved by the Engineer-in-charge.

[c] The Contractor shall engage qualified Engineer for the execution of work who will remain present for all the times on site and will receive instructions and orders from the Engineer- in-charge or his authorised representatives. The instructions and orders given to the contractor's representative on site shall be considered as if given to the contractor himself.

[d] A work order book as prescribed shall be maintained on the site of the work by the contractor and the contractor shall sign the orders given by the insepcting officers and shall carry them out promptly.

[e] Figured dimensions of drawings shall supercede measurements by scale. Special dimensions or directions in the specifications shall supercede all other dimensions.

[f] All levels on drawings are for general guidance and the contractor shall be responsible to take regularly levels at the site before actually starting the work. The level shall be connected to the G.T.S. levels and shall be got approved from the Engineer-in-charge.

[g] If the arrangement for temporary drainage is required to be made during any work of this contract, this shall be made by the contractor without claiming any extra cost.

[h] As the proposed work is to be carried out near the villages outside city llimits, the cleanliness should be preserved in & surrounding the work space.

[i] The contractor shall issue identification cards to all his labourers/ workers/ supervisors etc., employed/engaged for the proposed work, with the their passport size photographs pasted on it, with seal & signature of the contractor on it.

1.44 Following must be specifically noted;

[a] No advance payment terms are accepted.

[b] No `D' or `C' Form or Octroi exemption certificate will be furnished by the Surat Smart City Development Limited.

[c] The plant is located within the SMC Limit.

[d] Rates quoted must be inclusive of all taxes, octroi, work contract tax, as applicable as on date of bidding and no dispute at later date will be entertained. However, if any new taxes levied by government during the period of contract (Capital and O & M), the same shall be reimbursed on submission of documentary proof of its payment. **In case, GST is applicable during the course of execution as well as O&M, the same shall be reimbursed / recovered against the existing applicable taxes (i.e. Excise duty, Sales tax, VAT, etc.) on submission of documentary proof of its payment**

However, for getting the benefit of the exemption in the excise duty and / or custom duty as per the prevailing policy of the Central Government for the construction of new water treatment plants / Tertiary Sewage Treatment Plant / Wastewater Recycling Plant and transferring the same benefit of reduced costs to Surat Smart City Development Limited, the bidders should quote their lump-sump price in price bid after taking in to consideration of excise duty and / or custom duty for the items/equipments suggested as per that policy. Surat Smart City Development Limited will give a supporting letter to the contractor to obtain the necessary certificate/letter for exemption of excise duty and / or custom duty for

those items / equipments required for the proposed work from the respective authority after sanctioning & award of work..

[e] Applicable sale tax/income tax and surcharge as per Rules, will be deducted from all the payments made to the contractor as a TDS.

[f] Completion period will remain 24 (Twenty Four) months incluidng testing, trial run and commissioning [Including monsoon]. Extension in completion period is not accepted. Further, it is ensured that comments will be offered on the drawings submitted for approval within 15 days of submission of drawing.

[g] EMD & SD shall be furnished as per tender terms and conditions only

[h] Bidder to specifically note that he has to select the vendors from the Vendors List only given in the tender documents. However,for any of the items for which no vender is mentioned, he must seek prior consent from SMC while selecting the particular vendor out of Vendor List.

[i] The defect liability period of 12 (Twelve) months shall be considered only after the successful completion of one month trial run of the plant i.e. from the date of handing over the plant to Surat Smart City Development Limited.

[j] It is to note that, it is the responsibility of contractor to watch and ward and make keep security arrangement.

1.38 Price Escalation shall be paid to the contractor by the Surat Smart City Development Limited as per the provisions made under Chapter 19 in this tender.

1.39 All the applicable taxes as per the Government Rules and Regulations shall have to borne by the Contractor only, no compensation shall be paid on this account.

1.40 Interest of any kind what so ever shall never be paid/entertained in any case including delayed payment of Running bills or final bill or any such or all dues with Surat Smart City Development Limited.

1.41 The Surat Smart City Development Limited May Do Part Of The Work

Upon failure of the Contractor to comply with any instructions given in accordance with the provisions of this contract, the Surat Smart City Development Limited has the alternative right, instead of assuming charge of entire work, to place additional labour force, tools, equipments and materials on such parts of the works, as the Surat Smart City Development Limited may designate or also engage another Contractor to carry out the work. In such cases, the Surat Smart City Development Limited shall deduct from the amount which otherwise becomes due to the Contractor, the cost of such work and materials with 10% added to overall departmental charges and should the total amount thereof exceed the amount due to the Contractor, the Contractor shall pay the difference to the Surat Smart City Development Limited.

1.42 Contractor to note that SMC shall appoint Project Management Agency /Third Party Agency for the supervision / inspection of the work and contractors are obliged to work under them. However decision of SMC shall be final.

1.43 SMC has conceived this project duly considering the benefits that can be availed through CDM (Clean Development Mechanism). The contractor shall have to provide all necessary technical support in this regard and shall not be paid any extra cost towards the technical support to avail CDM benefits.

1.44 Unless otherwise specified anywhere in the tender, No arbitration regarding any or all the issues in this tender shall be allowed whatsoever.

1.45 All the matter pertaining to this tender shall be subjected to Surat Jurisdiction only.

Signature Of The Contractor.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

17. SCOPE OF WORK, DESCRIPTION OF THE PROJECT AND DESIGN SPECIFICATION

Design , Construction , Erection , Testing and commissioning of (i) Augmentation of existing Sewage Pumping Station, (ii) Augmentation of existing 66 MLD up to 167 MLD Capacity STP (iii) 40 MLD net Output TSTP to generate Industrial grade Water including operation and maintenance of all the above (i), (ii) and (iii) for 10 Years Period, Under SMART CITY , Surat

(A) GENERAL:

1.1 Introduction

Surat ranks among the fastest growing cities in India and is managed under the jurisdiction of Surat Smart City Development Limited (SMC). Surat Smart City Development Limited spans an area of 326 sq.km with population of 4.5 million as per census 2011.

The sewerage network in Surat is presently served through ten drainage schemes, namely Anjana, Bhesan, Bhatar, Karanj, Singanpore, Bamroli, Variav-Kosad, Dindoli, Vesu and Asarama drainage schemes. There are ten sewage treatment plants catering to the needs of all the zones of the city and which have a total capacity of treating 930 MLD of sewage.

Surat Smart City Development Limited (SMC) plans to execute a project to augment existing Sewage Treatment Plant (STP) at Dindoli up to 167 MLD capacity of to treat the raw sewage from New East and New South East Drainage Zone. It is proposed in this tender to augment the existing STP with integration of new treatment units to achieve BNR standards to dispose as per the latest GPCB norms for treated sewage disposal and to construct tertiary sewage treatment plant to generate industrial grade water.

The operation maintenance period of the complete existing 66 MLD STP, 101 MLD new STP (Total combined capacity of 167 MLD STP facility shall be design for BNR System) and proposed 40 MLD net output capacity TSTP will be 10 years. This would enable SMC to reduce pressure on ground water resources in the city and free up potable water, which could be further used to supply the drinking water to the newly merged area in the city. This would also minimize the breakage of roads since, the transportation of water tanker would be turn down in the area.

Surat Smart City Development Limited has invited this tender for the following scope of works for the proposed work as part A and Part B in this tender as under.

(A-I) Design & Drawings, Construction/ Fabrication/ Erection, Testing & Commissioning of proposed capacity of 167 MLD including upgradation of existing STP with new STP based on BNR System, including all the works related to Civil/Electrical/Mechanical/ Instrumentation or any other field of Engineering, all inter-connecting piping, Supply of equipments etc., including all the required materials

& labour etc., including two (2) months of erection and one (1) month of commissioning and trial run of the proposed plant, on turn-key basis., complete as per terms & conditions, and specifications of this tender.

For this part, the tenderer shall quote a Lump-sum price at the specified place in Volume-II (Price-Bid) of the tender.

The tenderer shall have to also submit the details on the electricity consumption for the entire system i.e. for all the project componenets in this tender. The tenderer shall have to submit the performance guaranteed in the table furnished hereunder in this tender for evaluation purpose. It shall be reviewed in future for actual electricity consumption also.

Performance Guranteed Statement

Details	**As per Tender**	**To be guaranteed by Contractor**
Flow	167 MLD	
Power Consumption (Excluding Power generation from Biogas power plant)	To be filled in by Contractor in KWH/day	
Treated Sewage Parameters		
BOD	< 10 mg/l	
COD	< 50 mg/l	
Suspended Solids	< 10 mg/l	
pH	7-8.5	
Ammonical Nitrogen	< 5 mg/l	
TN	< 10 mg/l	
Dissolved P	< 2 mg/l	
Residual Chlorine	0.5 mg/l	
Fecal Coliform	<100 MPN / 100 ml	

(A-II) Operation & Maintenance of all the project componenet as described under (A-I), after successful commissioning & completion of two (2) months of erection and one (1) month of commissioning and trial run period of the plant, for Ten years, as per terms & conditions of the tender.

For this part, the tenderer shall have to quote price, at the specified places in Volume-II (Price-Bid) of the tender, for all the 10 years period of O&M contract. The contractor shall be paid price escallaiton for the O&M contract based on RBI price index (prevailing at particular time during O&M contract). The price escalation formula for O&M contract is provided in this tender hereunder.

(B-I) Design & Drawings, Construction/ Fabrication/ Erection, Testing & Commissioning of proposed Tertiary Sewage Treatment Plant with reject water

treatment, including all the works related to Civil/Electrical/Mechanical/ Instrumentation or any other field of Engineering, all inter-connecting piping, Supply of equipments etc., including all the required materials & labour etc., including two (2) months of erection and one (1) month of commissioning and trial run of the proposed plant, on turn-key basis., complete as per terms & conditions, and specifications of this tender.

For this part, the tenderer shall quote a Lump-sum price at the specified place in Volume-II (Price-Bid) of the tender.

The tenderer shall have to also submit the details on the electricity consumption for the entire system i.e. for all the project componenets in this tender. The tenderer shall have to submit the performance guaranteed in the table furnished hereunder in this tender for evaluation purpose. It shall be reviewed in future for actual electricity consumption also.

Performance Guranteed Statement

Details		**As per Tender**	**To be guaranteed by Contractor**
Flow (Nett output)		40 MLD	
Power Consumption for TTP		To be filled in by Contractor in KWH/day	
Final Tertiary Treated Effluent Parameters			
Sr. No.	Parameter	Unit	Tertiary Treated – Industrial Grade Water
1	2	3	8
1	True Colour (Hazen Units) max.	Hazen Units	< 5
2	Turbidity	NTU	< 5
3	pH	-	6.0 – 7.5
4	Total Hardness as CaCO3	mg/l	< 300
5	Iron as Fe	mg/l	< 0.25
6	Manganese as Mn.	mg/l	< 0.10
7	TDS	mg/l	< 500
8	BOD_5	mg/l	< 5
9	COD	mg/l	< 50
10	Total Suspended Solids	mg/l	< 2
11	Total Nitrogen as N	mg/l	< 10
12	Total Phosphorus	mg/l	6 -10

(B-II) Operation & Maintenance of all the project componenet as described under (B-I), after successful commissioning & completion of two (2) months of erection and

one (1) month of commissioning and trial run period of the plant, for Ten years, as per terms & conditions of the tender. **However, the time limit of one (1) month for commissioning and trial run for TSTP shall commence after successful commissioning of STP.**

For this part, the tenderer shall have to quote price, at the specified places in Volume-II (Price-Bid) of the tender, for all the 10 years period of O&M contract. The contractor shall be paid price escallaiton for the O&M contract based on RBI price index (prevailing at particular time during O&M contract). The price escalation formula for O&M contract is provided in this tender hereunder.

There will be separate head for fixed cost and variable cost. The fixed cost will contribute to labor/manpower cost, routine maintenance cost and major and minor spare part cost, membrane replacement cost whereas the variable cost will contribute to the consumables chemical and chlorine cost etc., wherein the tenderer shall have to quote their prices for each head, as explained in above para.

For Operation and Maintenance, "Scope of work for Operation & Maintenance" of proposed plants and "Terms & Conditions" for the same are described in relevant Chapter of this Tender document.

Price Escalation formula for Capital Work

For (a) Labour, (b) Materials,(c) P.O.L(Purchase of Oil & Lubricant)

The amount to be paid / recoverable to the contractor for the work done shall be adjusted for increase or decrease in the rates for labour and materials excepting the cost of those materials supplied by Surat Smart City Development Limited or the cost of those materials on which price escalation / star rate difference is being paid separately.

(a) LABOUR

Increase or decrease in the cost due to labour shall be calculated quarterly in accordance with the following formula.

$Vi. = 0.85 \times (pl/100) \times Rp((L - L0)/ L0)$

Vi = increase or decrease in the cost of work done during the quarter under consideration due to change in rates for labour.

Rp = Value of net work done in rupee during the quarter under consideration after deducting the cost of material on which price escalation / variations or star rate difference is being paid separately and deducting the cost of extra items, whose rates are derived by rate analysis based on market rates and the cost of those materials which are being supplied by Surat Smart City Development Limited and full assed value of secure advance or any advance payment

Lo = The average consumer Price index (Whole sale prices) for industrial workers for the quarter in which tenders are received as applicable to Ahmadabad as published by the Reserve Bank of India for consumer price Index Numbers for Industrial workers.

L = The average consumer Price index (whole sale prices) for industrial workers for the quarter under consideration as above.

pl = Percentage of labour components of the item = 25

(b) MATERIAL

The increase or decrease in the cost of materials shall be calculated quarterly in accordance with the following formula.

Vm = 0.85 x(Pm/100)x Rp((I – Io)/ Io)

Vm= Increase or decrease in the cost of work during the quarter under consideration due to change in rates for material.

Rp = Value of net work done in rupee during the quarter under consideration after deducting the cost of material on which price escalation / variations or star rate difference is being paid separately and deducting the cost of extra items, whose rates are derived by rate analysis based on market rates the cost of those materials which are being supplied by Surat Smart City Development Limited and full assed value of secure advance or any advance payment.

Io = The average whole sale price index (all commodities) as published on website of Office of Economic Adviser (OEA).RBI for the quarter in which Tenders are received.

I = The average Whole sale price index (All commodities) as published on website of Office of Economic Adviser (OEA).RBI for the quarter under consideration as above.

Pm = Percentage of material components = 75

(C) FUEL

Vd. = 0.85 xPd/100x RP(D – Do)/Do

Vd = Increase or decrease in the cost of work done during the quarter under consideration due to change in the rates of petrol, oil and Lubricants(P.O.L.)

Pd = Percentage of P.O.L., component of the item. = 0 (ZERO).

Rp = Value of net work done in rupee during the quarter under consideration after deducting the cost of material on which price escalation / variations or star rate difference is being paid separately and deducting the cost of extra items, whose

rates are derived by rate analysis based on market rates the cost of those materials which are being supplied by Surat Smart City Development Limited.

D = The average price of high speed diesel for Surat from either IOCL or BPCL or HPCL in the quarter.

Do = The average price of high speed diesel for Surat from IOCL or BPCL or HPCL for the quarter under consideration as above.

Notes: Following clauses shall be applicable to capital works only.

1) The Price escalation shall be paid on the work done after one year till the extension of time limit from the date of commencement of the work
2) Price escalation clause shall be applicable for the work that is carried out within the stipulated time or approved extension thereof, No claim for price adjustment other than those provided here in shall be entertained.
3) The percentage of Material, Labour and Fuel for the entire work will be as under:
   a) Material M: 75% (b) Labour L: 25% (c) POL: 0%(ZERO)

4) "Ceiling limit in respect of percentage for escalation shall be up to 7.5% of the sanctioned tender amount or Total Amount of work done under this tender whichever is less
   In short, no payment shall be made beyond the ceiling limits in any case.
5) Cost of the materials issued by Surat Smart City Development Limited to be deducted from "Rp".
6) Star Rate difference on cement and reinforcement are paid separately, therefore to derive "Rp", amount deduction shall be done based on basic rate multiply by Quantity of cement /Steel used. Basic Rate for Cement is Rs. 260/- per Bag of 50 Kg. and Steel/Reinforcement is Rs 33000/- per M.T
7) Quarter shall be considered as per the Calendar quarter i.e. from Jan. to March, from April to June and so on.
8) If liquidated damage /work delay penalty to be imposed than price escalation for that period shall not be payable.

Price Escalation Formula for Operation and Maintenance work

After successful commissioning of the entire TTP project under this tender, the operation & maintenance contract will start. As instructed above, the tenderer shall have to quote the price for all the 10 (ten) year period of O&M contract considering the base year as 1st year of O&M (1st year). However, the payment of O&M after 1st year shall be subjecte d to an annual indexation to reflect the annual increase in the O&M. Such indexation will become applicable and coincide with 31st March every year, following the first financial year post commissioning as per the formula mentioned below.

$P_n = P_v \times (WPI_n/WPI_1) + P_f \times (CPI_n/CPI_1)$

Where,

P_n = Total Price of O&M at n^{th} year of contract.

P_1 = O&M Price of the 1st year, which shall be quoted by the tenderer without considering any escalation, i.e. as per the base year – 1st year

P_v = Rates quoted under variable price for the nth year against the total O&M price of nth year

P_f = Rates quoted under fixed price for the nth year against the total O&M price of nth year

WPIn = Wholesale price index as of 31st march of the year the revision is being made

WPI1 = Wholesale price index as on 31st march of the year of commissioning

CPIn = Consumer price index as of 31st march of the year the revision is being made

CPI1 = Consumer price index as on 31st march of the year of commissioning

Star Rate formula for Membrane Replacement during O&M

The amount payable to the contractor for the work done shall be adjusted for increase or decrease in the rates US dollar as under :

Price variation for Membrane Replacement by the contractor

This clause shall be applicable only if the UF and RO membranes are imported. The contractor shall hve to submit an authentic proof of delivery of membrane at any Indian port. The star rates for UF and RO Membrane to be brought by the contractor shall be considered as

UF Membrane	Rs. 167400/- per nos.
RO Membrane	Rs. 52500/- per nos.

The fluctuations in rates of US dollar shall be adjusted in the bills payable to the contractors as under:

$$A = B \times (\$_n/\$_0 - 1) \times C$$

A = Amount payable or recoverable

B = Basic rate of UF / RO membrane as mentioned in the tender.

$\$_n$ = Closing Rate of US $ declared by RBI, as on previous day of delivery of Membrane at any Indian Port.

$\$_0$ = Closing Rate of US $ declared by RBI, as on previous day of tender submission.

C = Quantity of UF / RO membrane actually brought by the contractor on site of work for bonafied use.

The above formula shall be applicable for variation in US dollar rates for UF and RO Membranes only.

1. No ceiling for escalation for difference of UF and RO Membrane will be applicable.
2. This clause shall be operative from the date of issue of work order and up to the expiry of original and extended time limit.
3. This formula shall be used individually for individual item for UF and RO Membrane only for calculating adjustment.
4. If during the progress of work or at the time of completion of contract, it is noticed that any membrane brought at site is in excess of requirement (actual Consumption, then amount of escalation if paid earlier on such excess quantity of membrane shall

be recovered on the basis of cost indices as applied at the time of payment of escalation or as prevailing at the time of effecting recovery, whichever is higher.

5. If such materials are not found as per the tender specification, the same shall be removed by the contractor for which no claim shall be entertained.

1.2 General :-

The tentative area for layout and Hydraulic flow diagram of proposed treatment plant at Dindoli site are provided in this tender. However, bidders shall have to prepare & submit their layout plan and hydraulic flow diagram etc. alongwith the tender.

The scope of work will be in general but not limited to civil, mechanical, electrical, instrumentation interconnecting pipes works and the design, construction, testing, trial runs, commissioning and guaranteeing and operation and maintenance (including spares and consumables) of proposed augmented sewage treatment plant as per the tender.

1.3 Terminal Points: (PLEASE READ CAREFULLY)

The treated sewage from the proposed SBR system shall be taken to the Inlet of TSTP. The contractor shall have to operate and maintain the proposed TSTP as per the ternder terms and conditions. The contractor has to carry out the work so that the plant should run satisfactorily to achieve desired tertiary treatment efficiency – characteristics values mentioned in this tender elsewhere. The final treated effluent, in addition to the reject water from the STP, shall be disposed off having quality as per the norms specified in this tender, into the nearby creek, through disposal line. The laying of disposal line is not in the scope of contractor under this tender.

1.4 Submission by Contractor ;

The successful Contractor shall be required to submit the following for approval of SMC.

a] Planning (General layout to the scale) of proposed STP and TSTP considering the ease in construction and economical aspects.

b] Hydraulic flow diagram.

c] Hydraulic design calculation.

d] Detailed progress bar chart and report showing physical and financial achievement at every first of calender month.

e] Detailed planning of all units.

f] Detailed Design Calculation, structural detailed drawings, working drawings etc. for all plant and pumping units.

g] Detail piping and instrument or engineering flow diagram for process and utility showing all equipments, machinery piping and instrumentation. All piping should be indicated with diameter material of construction, pipe class, pipe number and fluid flowing through it.

h] Detail installation drawing for mechanical equipments and other instruments.

i] Light fitting layout and wiring diagrams, drawings for panels, earthing layout etc.

j] Data and guaranteed power and chemicals consumption for the STP and TSTP.

k] Equipment data sheet.

l] Detailed bill of material as per the requirement of the SMC.

m] Any other drawing / data / details required by the owner, consultant appointed by owner or his authorized person

n] Details of plant interconnecting pipe network alongwith supports etc.

o] During commissioning of the plant the contractor shall submit draft copies of Instruction manual for operation and maintenance of the various STP and TSTP units giving analytical procedures for various parameters, technical literature, leaflet, wiring diagram etc. On approval and ammending the same as per plant conditions, the contractor shall submit ten copies of final Instruction Manual in proper binding, giving details of plant also.

p] Singal line power diagram and power flow.

q] Cable Layout and Cable Sehdule.

1.5 Plant Capacity :

The capacity of existing STP is 66 MLD and proposed STP is 101 MLD. The total combined capacity of 167 MLD STP shall be designed and constructed for BNR process. The inlet flow to proposed TTP shall be of 60 MLD capacity and taken from proposed STP. The tertiary sewage treatment plant shall be designed and constructed for 40 MLD net output capacity. All Civil and Mechanical/ electrical/ instrumentation works are to be checked for above requirement and considering losses. All the design shall be carried out duly considering the peak flow.

1.6 Extent of capital works:

a] The capital work shall consist of two parts viz. Part-I Civil Works and Part – II Electro-Mechanical equipments.

Part-I shall consist of all the Civil Works of the STP and TSTP units, as described in the data sheets with all channels, interconnecting pipings etc.and shall include all R.C.C., C.C.,. Brick masonary, wood works and iron works etc. completed pertaining to the structure.

Part-II shall include the delivery at site and erection of all mechanical and electrical equipments including pipes, valves, electrical units, motors switches, control gears, and other instruments etc. so as to make the plant self contained in all respects.

Part-I & II shall be executed as one contract and tenders received for only Civil works or for only Mechanical works shall not be considered.

b] All internal wiring for power and lighting for the plant and buildings shall be provided by the contractor as per prevailing Indian Electricity Rules/Act and as per the rules of Gujarat Electricity Board/Surat Electricity Company. The MCC shall be provided for taking power for various units of the plant and for lighting in the various pump house. Main switch board, meters, fuses, switches etc.shall be provided by the contractor and all further cables, wires suitable for each equipment shall be provided and fixed by the Contractor. The contractor shall specify the connected H.P. each of his power consumption units and shall also give the total power required to run the plant including lighting arrangements to all structures.

All the skilled and unskilled labour oil, grease, spares, chemicals and other consumable items etc. including chemicals etc. required to be incurred during trial run period of 1 Month from the date of completion in all respect shall be

borne by the Contractor but only electricity will be supplied free of charge by SMC during testing, commissioning and Operation & Maintenance period, till handing over system to SMC The contractor shall also train the Deptt. staff to get the training so that on the expiry of the trial run period the plant can be run indpendently by those persons. The Department shall also bear the electrical charges for power and lighting of the plant during the trial run period.

e] For the period of twelve months of defect liability period, after certified date of succesful completion of one month trial run, the contractor shall have to give guarantee for smooth running of the plant. During guarantee period if any component or components of mechanical equipment, or electricial, or electronic instruments and or measuring equipments or valves or pipes or specials etc. gets out of order or found to be malfunctioning the same shall have to be replaced by the contractor at his cost and for the replaced article, the guarantee period shall be twelve months from the date of re-commissioning.

1.7 Terms of Payment :

Terms of Paument shall be strictly as defined in Volume-B (Price-Bid.). Various recoveries as per tender conditions shall also be made from contractor's R.A. Bills. The R.A. bills shall be paid every month to the contractor for the complete contract, as per the tender terms and conditions, specified at various places.

(B) SCOPE OF WORK:

Details, datasheet, specifications, terms etc are described elsewhere in this tender document. (Technical Bid). However, a brief overview of scope of work for the capital works is outlined here below. Scope of work for Operation and maintenance is described in detail in another specific chapter on it in this tender. The scope of work described below is in general and the bidder has to refer the sewage flow and its parameters as mentioned in the data sheets and in the annexure with this tender.

1.1 Extent of Scope of Work:

The scope of work under this Single Responsibility Contract includes construction of all works as described in subsequent paras to achieve the objective to treat the secondary treated sewage as per the criteria defined in the tender elsewhere as per stipulated discharge standards by Gujarat Pollution Control Board and to dispose off the treated sewage into the creek as per good and acceptable engineering practices.

The scope of work will be in general but not limited to Design & Detailed Engineering, Procurement, Civil, Mechanical, Electrical, Instrumentation, and Interconnecting Pipe works including erection, testing, trail runs, commissioning, guaranteeing and operation and maintenance (including major and minor spares) for the period of 10 years, of 167 MLD STP with 40 MLD net output capacity tertiary sewage treatment plant as per detailed technical specifications and data sheet. The scope also includes geotechnical survey of plot to derive soil bearing capacity, strata classification and details of water table etc.

The scope shall also include internal roads, storm water drains, development of lawns, landscaping, and plantation along the periphery of the site proposed for construction of STP including maintenance of all during entitre O&M period.

Trial and run of tertiary sewage treatment plant with allied works for a period of one month and operation and maintenance for the period of 10 years after successful completion of trial run, commissioning and acceptance of the system by SMC. Only secondary treated sewage and electricity shall be supplied free by SMC during trial run and O&M period and rest all expenses including chemicals, consumables, spares, manpower, etc. shall be borne by the successful bidder.

Wherever reference is made of the employers design, drawings, or concept, it may be understood that these are concepts of the employer and the responsibility for correctness of designs, drawings and safety of equipment/structure shall rest on the contractor. Bidders are advised to inspect the site for further clarifications and to understand the scope of work. It is the bidder's responsibility to carry out all the works required to complete the scheme under this project whether it has been mentioned or not.

(C) PROCESS DESIGN CRITERIA FOR STP:

The guide lines for process design criteria for augmented 167 MLD capacity Sewage Treatment Plant unless otherwise specified shall be as under. The process data sheet of existing 66 MLD capacity STP is also an integral part of proposed datasheet here under for the reference to the contractor, so that the contractor can design the whole STP with augmented capacity of 167 MLD to achieve BNR (Biological Nutrient Removal) Process. The specified sizing and quantities mentioned are minimum and not limited to and contractor shall provide adequately higher sizing / quantities if required and any additional items for satisfactory fulfillment of the specified tender conditions and to meet final treated sewage quality.

Table: - Raw and Treated Sewage Characteristics

Sr. No.	Parameter	Unit	Raw Sewage (90%tile)	Secondary treated sewage
1	2	3	4	6
1	True Colour (Hazen Units) max.	Hazen Units	90	50
2	Turbidity	NTU	-	-
3	pH	-	6.5 – 7.5	7 – 8.5
4	Total Hardness as CaCO3	mg/l	900	-
5	Iron as Fe	mg/l	0.72	-
6	Manganese as Mn.	mg/l	0.4	-
7	TDS	mg/l	1400	1400
8	BOD5	mg/l	250	≤ 10
9	COD	mg/l	600	≤ 50
10	Total Suspended Solids	mg/l	300	≤ 10
11	TKN	mg/l	40	-
12	Ammonical Nitrogen	mg/l	25	-

13	Total Nitrogen as N	mg/l	42	≤ 10
14	Total phosphorus	mg/l	7	≤ 2 (as dissolved -P)
15	Fecal Coliform Count	MPN/100 ml	1×10^5	<100

(A) Augmentation of existing 17 MLD SPS up to 39 MLD

1.0 Sewage Pumping Station – New Pumps

No.of Unit	:	One No.
Flow	:	39 MLD (Avg.) 87.75 MLD (peak)
No.of Pumps	:	6 Nos. (3 W + 3 S)
Type of Pump	:	Non-clog Sewage Submersible Pumps
Capacity of each pump	:	340 LPS.
Total Head	:	17 M
Sp.gravity of sewage	:	1.05
Material of construction		
Impeller	:	SS : ASTM A 743 CF8M
Shaft	:	SS : BS:970 Gr 410

2.0 New Rising Main

Dia. Of rising main	:	1000 mm
Length	:	@ 800 mtr.
MOC	:	MS pipe – inside solvent free liquid epoxy lining – 406 micron and outside 3LPE coating

(B) Upgradation of existing 66 MLD STP

1.0 Inlet Chamber (Existing)

	Average Sewage Flow	:	66 MLD
	Peak factor ‘f’	:	2.25
	Peak Sewage Flow	:	148.50 MLD
	No. of Unit	:	One
	Detention Period	:	45 Seconds at Peak Flow
	Size of inlet chamber	:	5.0m x 7.5m x 2.5m LD
	Free Board	:	0.5 m
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	By-pass arrangement from Inlet Chamber with necessary Bypass Gate	:	RCC pipe is connected to by pass.

2.0 Screen Channels – Fine Bar Screen with belt conveyor system (Existing)

	No. of Units	:	Two (1W + 1S)
	Capacity	:	148.50 MLD peak flow through each screen
	Type of screen	:	Step type screen
	Clear spacing between the screen flat	:	6 mm
	Angle of inclination	:	40º to Horizontal
	Velocity through screen at peak flow	:	1.2 m/sec (max.)
	Head loss through screen	:	225 mm (max.)
	Flats of screen	:	2 mm thick.
	Drop in bed of screen	:	Minimum 150 mm
	Size of Screen Channel	:	2.0 m wide x 1.5m LD
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	Free board above TWL	:	500 mm
	Belt Conveyor	:	Provided

3.0 Grit Chambers (Existing)

	No. of Units	:	2 nos. (1W + 1S)
	Capacity	:	111.375 MLD peak flow through each grit mechanism
	Surface loading rate at 15º C	:	1300 $m^3/d/m^2$ (at peak flow)
	Detention period	:	60 sec
	Assumed size of grit particle	:	0.15 mm and above
	Specific gravity of particle	:	2.65
	Settling Velocity	:	1.50 cm/sec
	Depth	:	1.0 m
	Organic matter in washed grit		
	not to exceed	:	3%
	Size of Grit Chamber	:	10.2 m x 10.2m x 1.0m LD
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	Free Board	:	500 mm

4.0 Parshall Flume (Existing)

	No. of Units	:	1 No.
	Average Sewage Flow	:	66 MLD
	Peak Sewage Flow	:	148.50 MLD

	Size of Parshall Flume	:	3.0 m wide x 15m long
	Liquid depth	:	1.2 m LD
	Free board	:	0.50 m.
	Flow meter	:	Ultrasonic type

5.0 Primary Clarifiers (Existing)

	Average Flow	:	66 MLD
	No. of Units	:	2 Nos.
	Detention time	:	2 – 2.5 hrs.
	Surface loading rate at average flow	:	35 $m^3/d/m^2$ (max.)
	Floor slope	:	1 in 12
	Size of Primary Clarifier	:	35.00 m dia.
	Side water depth (upto top weir)	:	3.2 m
	BOD 5 days, 20ºC removal	:	30%
	Suspended solids removal	:	60%
	Solid concentration in primary sludge	:	3 to 4%
	Specific gravity of primary sludge	:	1.03
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	Free Board	:	500 mm

Note :
1. All piping/channels and launders of primary clarifier is designed for peak flow.
   Free fall in peripheral launder/through with respect to weir crest is between 0.10 to 0.15 m.
2. One no. of PST shall be utilized as Anaerobic Tank as a part of BNR process.

6.1 Aeration Tanks With Diffused Aeration System (To be modified)

Anaerobic Tank ahead of Existing Aeration Tank for 66 MLD

	Average Flow	:	66 MLD
	No. of Units	:	1 No. of existing primary clarifier shall be utilized
	Inlet BOD (5 days at 20ºC)	:	187.5 mg/l
	Inlet TSS	:	213 mg/l
	Inlet TKN	:	34 mg/l
	Inlet TP	:	6 mg/l
	Detention Time	:	1 Hours (min)
	Submersible Mixer	:	To be provided as per design requirements

	Return sludge	:	100 %
	Required Volume of tank	:	2750 Cu.mt.
	Size of existing PST	:	35 m dia x 2.3 m SWD
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	Free board	:	0.6 m

6.2 Aeration Tanks With IFAS

	No of Existing Aeration Tank	:	3 Nos. (Existing)
	Size of each Tank	:	49 m x 24 m x 4.7 m SWD
	Fixed Film Details		
	Type	:	Biotextile sheets aligned in cage
	Specific Growth of Surface	:	23 m^2/ $m^2$of textile area
	MOC		
	Biotextile	:	100% Polypropylene yarns
	Bio-textile configuration on cages	:	Discreet parallel textile sheets (no double wrapping of textile sheets allowed)
	Cage	:	SS 304
	Clamps and fixing accessories	:	Water resistant PP
	Standard width / Weight	:	As per manufacturer's recommendation
	Mobility		
	Fixed/Moving	:	Immobile-Fixed
	Installation	:	Biotextile-Parallel to flow direction
	Dimensions		
	Cages Dimensions	:	As per design requirement
	Quantity	:	Minimum 20 cages/Tank
	Specific Aeration Requirements		
	Aeration underneath cages	:	Fine bubble aeration (no coarse bubble aeration allowed)
	Diffuser type – MOC	:	Fine bubble diffusers-strip type-Polyurethane
	Efficiency of diffusers required	:	6% per meter of submergence
	AIR BLOWERS		
	Min. Air required	:	25000 M^3/Hr.
	No of Air Blowers	:	5 Nos.
	Capacity	:	9150 M^3/Hr. each
	Pressure	:	0.6 Kg/cm^2
	Blower RPM	:	As per Design
	Type of Blowers	:	Turbo / Screw type
	Motor HP	:	As per Design
	Motor RPM	:	As per Design
	Diffusers for Aeration Tank	:	

	Type	:	Strip
	Diffuser Membrane		
	Type-self cleaning	:	Yes
	No of diffuser	:	As per design requirement
	Type	:	Polyurethane
	Means of attachment to main header	:	PE Pipe
	Membrane Width x Length	:	W 180 mm X L 4000 mm
	Diffuser Assembly		
	Type	:	Strip
	Length	:	4000 m
	MOC	:	PVC
	MOC		
	Diffuser Tube	:	PVC
	Membrane	:	Polyurethane
	Pipe clamps & Hardware	:	SS/Nylon Plugs / Plastic
	Pipe Grid	:	PE
	Performance		
	SOTE Oxygen transfer rate	:	≥ 6% per meter of submergence

7.0 Secondary Clarifiers With Distribution Chambers (Existing)

	Avg. flow	:	66 MLD+ other flow
	No. of Units	:	3 Nos.
	Detention time	:	2.5 hrs.
	Surface loading rate at average flow	:	20 m^3/m^2/day (max.)
	Floor slope	:	1 in 12
	Size of Secondary Clarifier	:	38.100 m dia.
	Side water depth (upto top of weir)	:	2.5 m
	Solid concentration in secondary sludge	:	1%
	Specific gravity of secondary sludge	:	1.01
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	Free Board	:	500 mm

Note :

All piping/channels and launders of Secondary clarifier is designed for peak flow including any other flows.

Free fall in peripheral launder/trough with respect to weir crest is between 0.10 to 0.15 m.

FRP 'V' notches is provided on periphery of launders.

8.0 Chlorine Contact Tank (Existing)

	Avg. Flow	:	66 MLD
	No. of Unit	:	1 no.

	Retention time	:	25 min.
	Size of Chlorine Contact Tank	:	27.0 m x 20.0 m x2.5 m LD
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	Free Board	:	500 mm
	Dose of chlorine	:	5 ppm (min.) or suitable for 0.5 ppm FRC
	No. of chlorinator	:	3 nos. (2 W + 1 S)
	Type of chlorinator	:	Vaccume type
	Capacity of chlorinator	:	20 Kg/hr each

8A Chlorine Booster Pumps (Existing)

	No. of Unit	:	3 nos. (2 W + 1S)
	Type of pump	:	Inline multistage centrifugal
	Capacity & Head	:	12 m^3/hr, H=50m
	MOC	:	As per mechanical specification

8B Chlorine Tonners (Existing)

	No. of tonners (Storage for 15 days use)	:	6 Nos. (4 Working + 2 Standby)
	Capacity of each tonners	:	900 Kg. or so which may be available in market

Note: Contractor shall supply above specified numbers of Chlorine Tonners along with chlorination system with necessary statutory approval on behalf of SMC at no extra cost.

9.0 Primary Sludge Sump & Pump House (Existing)

	No. of Sump & Pump House	:	1 No.
	Solid concentration	:	3 to 4% (max.)
	Specific gravity of sludge	:	1.03
	Actual pumping hours for sludge		
	Pumping	:	12 hrs/day for average flow
	Minimum diameter of pumping		
	main to avoid clogging	:	150 mm
	Size of sump	:	For 1 hr storage (min.)
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	Size of sludge sump	:	8.5 m x 2.0 m x 2.0 m LD

	Size of pump house	:	6.0 m x 8.5 m
	Free board	:	500 mm (min.)
	No. of Pumps	:	4 nos. (2W + 2S)
	Type of Pump	:	Screw type
	Capacity of Pump	:	20 m^3 /hr
	Head of pump	:	8 m to 10 m
	Material of Construction of Pumps	:	
	Pump Housing		CI
	Rotor/Shaft		SS AISI 410
	Stator		Nitrile Black

10. Return Sludge Sump & Pump Houses (Existing)

	No. of Sump & Pump House	:	1 No.
	Retention time in sump	:	15 minutes of return sludge
	Quantity of return sludge	:	upto 50% of avg. flow (minimum)
	Concentration of solids in return sludge	:	1%
	Min. dia. Of pumping main to avoid clogging	:	200mm
	Size of sludge sump	:	19.0 m x 6.70 m x 2.7 m LD
	Size of pump house	:	19.0 m x 6.5 m
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	Free Board	:	500 mm
	Top of sump	:	300 mm above water level of clarifier

10A Return Sludge Pumps (Existing) & 2 Nos. of new pumps to be installed

	No. of Pumps (Existing)	:	4 nos. (2W + 2S)
	No. of new pumps to be provided	:	2 Nos.
	Type of Pump	:	Horizontal Centrifugal non-clog
	Capacity of pump	:	690.0 m^3 /hr each
	Head	:	8 m to10.0m
	Material of Construction:		
	Casing	:	CI IS 210 Gr FG 260 with 1.5% Ni.
	Impeller	:	SS ASTM A743 Gr CF8M

	Shaft / Shaft Sleeve	:	ASTM A276 SS 431

10B Excess Sludge Pumps (Existing)

	No. of Pumps	:	4 nos. (2W + 2S)
	Capacity	:	25.0 m3 /hr
	Type of Pump	:	Horizontal Centrifugal non-clog
	Head	:	10 m to 12.0 m
	Material of Construction:		
	Casing	:	CI IS 210 Gr FG 260 with 1.5% Ni.
	Impeller	:	SS ASTM A743 Gr CF8M
	Shaft / Shaft Sleeve	:	ASTM A276 SS 431

11. Gravity Sludge Thickener (Existing)

	No. of Units	:	2 no
	Solid loading rate	:	40 kg/d/m^2 (Max.)
	Hydraulic loading rate	:	12 m^3/m^2/day (Min.)
	Floor slope	:	1 in 8
	Size of sludge thickener	:	17.5 m dia
	Side water depth	:	3.5 m
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	Free board	:	500 mm
	Solid concentration in thickened sludge	:	5% (max.)

12.0 Thickened Sludge Sump & Pump House (Existing)

	Solid concentration of inlet Sludge	:	5% (max.)
	Specific gravity of sludge	:	1.05
	Actual pumping hours for sludge		
	Pumping	:	12 hrs/day for average flow
	Minimum diameter of pumping		
	main to avoid clogging	:	150 mm
	Size of sump	:	For 1 hr storage (min.)
	Size of sludge sump	:	8.5 m x 2.2 m x 2.0 m LD
	Size of pump house	:	8.5 m x 6.0 m
	Material of Construction	:	R.C.C. (M-30) with water proof

			plaster
	Free board	:	500 mm (min.)
	No. of Pumps	:	2 nos. (1W + 1S)
	Type of Pump	:	Screw type
	Capacity of Pump	:	35.0 m^3 / hr.
	Head	:	10 m to 12.0 m
	Material of Construction of Pumps	:	
	Pump Housing		CI
	Rotor/Shaft		SS AISI 410
	Stator		Nitrile Black

13.0 Anaerobic Sludge Digesters (Existing)

	No. of Units	:	2 nos
	Material of Construction:		
	Floor, Wall and ring beam	:	RCC M30 epoxy coated
	Dome	:	RCC fixed dome with epoxy coating
	Solids concentration of inlet sludge	:	5% (max)
	Volatile solids	:	70%
	Specific gravity of raw sludge	:	1.05
	Volatile solids destroyed during digestion	:	50%
	Temperature of digestion	:	30ºC
	Digestion period at stated temperature	:	20 days (min.)
	Solid concentration in digested sludge	:	5%
	Specific gravity of digested sludge	:	1.05
	Bottom floor slope	:	1 in 6
	Solids loading	:	1.6 kg of VSS/day/m3
	Size of sludge digester	:	25.7 m dia. x 8.0 m SWD
	Free board	:	0.6 m
	Mixing system	:	Complete homogenous mixing by pumping
	Power level to be maintain	:	5 watts/m3 (min)

14.0 Digester Sludge Mixing Pump House (Existing)

	No. of pumps	:	3 nos. (2 W + 1 S)
	Type of Pump	:	Horizontal Centrifugal non-clog

	Capacity of pump	:	1130 m3 /hr
	Head of pump	:	7.0 m to 9.0 m
	Solid concentration in sludge	:	5%
	Material of Construction:		
	Casing	:	CI IS 210 Gr FG 260 with 1.5% Ni.
	Impeller	:	SS ASTM A743 Gr CF8M
	Shaft / Shaft Sleeve	:	ASTM A276 SS 431
	Minimum diameter of pumping		
	main to avoid clogging	:	200 mm
	Size of pump house	:	10.0 m x 8.0 m

15.0 Centrifuge Feed Sump & Pump House (Existing)

	Solid concentration of inlet sludge	:	5% (max.)
	Specific gravity of sludge	:	1.05
	Actual pumping hours for sludge		
	Pumping	:	12-14 hrs/day for average flow
	Minimum diameter of pumping		
	main to avoid chockage	:	150 mm
	Size of sump	:	For 1 hr storage (min.)
	Size of sludge sump	:	6.0 m x 2.0 m x 2.0 m LD
	Size of pump house	:	6.0m x 6.0 m
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	Free board	:	500 mm (min.)
	No. of Pumps	:	2 nos. (1W + 1S)
	Type of Pump	:	Screw type
	Capacity of Pump	:	20 m3./ hr
	Head	:	12.0 m to 15.0 m
	Material of Construction of Pumps	:	
	Pump Housing		CI
	Rotor/Shaft		SS AISI 410
	Stator		Nitrile Black
	Pump Operation		Through VFD

16.0 Sludge Dewatering System (Existing)

16A Centrifuge

	No. of Units	:	2 nos. (1 W + 1 S)
	Capacity	:	20 m^3/hr
	Specific gravity of influent sludge	:	1.05
	Solid concentration at inlet	:	5 % by wt.
	Solid concentration of dewatered cake	:	20 % by wt. min. dry solid basis

16B Polyelectrolyte Dosing Tank, Mixer & Pumps

	No. of Dosing Tanks	:	2 nos.
	Capacity	:	10 hrs. dosing requirement
	Solution strength	:	0.1% (max.)
	Material of Construction of Tank	:	RCC epoxy lined
	No. of Agitator	:	1 no./tank
	Type of Agitator	:	Turbine type
	MOC of Agitator	:	SS 304
	Agitator Speed	:	60 – 100 RPM
	No. of Dosing Pump	:	2 nos. (1W + 1S)
	Capacity	:	2000 LPH
	Type of Pump	:	Diaphragm
	Pressure	:	2 kg/cm2
	MOC:		
	Wetted parts	:	SS304/Tefion
	Diaphragm	:	Teflon
	Gland	:	PTFE
	Base plate	:	MSEP

17.0 Dilution Water Sump & Pump House (Existing)

	Retention time in sump	:	15 minutes of dilution water
	Min. dia. Of pumping main to avoid cogging	:	200mm
	Size of sump	:	6.0 m x 5.0m x 2.0 m LD
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	No. of Pumps	:	2 nos. (1W + 1S)
	Type of Pump	:	Submersible
	Capacity of pump	:	205 m^3/hr

	Head of pump	:	10 m to 12.0 m
	Material of Construction		
	Impeller		SS CF 8m
	Casing		CI FG 200 with 1.5 to 2% Ni.
	Shaft		SS410

18.0 Supernatant Sump (Existing)

	Retention time in sump	:	15 minutes of Supernatant
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	Size of sump	:	6.0 m x 6.0 m x 2.0 m LD
	Free Board	:	500mm
	Material of Construction	:	R.C.C. (M-30) with water proof plaster
	No. of Pumps	:	2 nos. (1W + 1S)
	Type of Pump	:	Submersible
	Capacity of pump	:	250.0 m^3/hr
	Head of pump	:	12 m to 15.0 m
	Material of Construction		
	Impeller		SS CF 8m
	Casing		CI FG 200 with 1.5 to 2% Ni.
	Shaft		SS410

19.0 BIO GAS BASED POWER GENERATION PLANT (Existing)

The bio-gas generated in the sewage treatment plant is utilized for the generation of the electricity with the help of Bio gas engine. The typical details of sewage gas are as under.

Sewage Gas Flow Rate (total of two digester)	120 M^3/Hr to 140 M^3/Hr
CH_4	60 – 75 %
CO_2	25 – 40 %
H_2S	< 1 %
Moisture	2 - 6 %
Temperature	25 - 40 °C
Calorific Value	4700 – 6200 KCal/NM^3
Gas Pressure	2 mmwc to 150 mmwc

The sewage gas having characteristics as mentioned above is used to generate the electricity with the help of Internal Combustion SI Engine.

This power plant will consists following major components.

Sewage Gas Pipe lines
Sewage Gas collection blowers
H_2S Scrubber
Modification in Sewage Gas Flaring System
Sewage Gas Holder for Sewage gas
Sewage Gas blowers for Sewage Gas Engine
Sewage Gas Engine generator set and Control Panel
Instrumentation & SCADA System
Power and Control Cables

The Bidder will examine entire existing Biogas generation plant with respect to life of each of the item installed and will repair / replace / modify as per Manufacturer's recommendation the individual item after verifications to make the entire system operational for ten years period of operation & maintenance.

The contractor shall provide the sludge pipeline from proposed centrifuge feed sump of new STP based on SBR system to existing anaerobic sludge digesters to achieve designed output of electricity from existing biogas engine system. The pump head required for proposed centrifuge feed shall be designed accordingly with isolation knife gate valve arrangement considering operational flexibility of biological sludge handling of proposed STP.

(C) New 101 MLD STP based on SBR System

1.	**INLET CHAMBER**		
	Average Sewage Flow	:	101 MLD
	Peak factor	:	2
	Peak Sewage Flow	:	202 MLD
	No. of Unit	:	One
	Detention Period	:	60 Seconds at Peak Flow
	Liquid Depth	:	3.0 mt.LD
	Plan area of Inlet Chamber	:	46.76 sq.mt.
	Size of inlet chamber	:	7.0 m x 7.0 m x 3.0 m LD
	Free Board	:	0.5m
	Material of Construction	:	R.C.C.(M-30)with water proof plaster
	By-pass arrangement from Inlet Chamber with necessary Bypass Gate	:	RCC pipe of suitable size to be connected to bypass.
2.	**FINE BAR SCREEN**		
	No. of Units	:	5 (4 W + 1 S)
	Capacity	:	50.5 MLD peak flow through
	Type of screen	:	Multirake fine screen
	Clear spacing between the screen flat	:	6 mm
	Angle of inclination	:	40º to Horizontal
	Velocity through screen at peak flow	:	1.2 m/sec (max.)

	Head loss through screen	:	225 mm (max.)
	Flats of screen	:	2 mm thick.
	Drop in bed of screen	:	Minimum 150 mm
	Size of Screen Channel	:	1.20 m wide x 1.2 m LD
	Material of Construction	:	R.C.C. (M-30) with water proof
	Free board above TWL	:	500 mm
	Belt Conveyor		As per requirement
	Details of Belt Conveyor System		
	Belt Conveyor Unit	:	1 Set
	Width of Conveyor	:	0.6 M
	Length	:	Min. 10 M or As per Site Req.
	Motor HP/RPM	:	2HP/1440 RPM
3.	**GRIT REMOVAL SYSTEM**		
	No. of Unit	:	Two (working)
	Design Flow	:	50.5 MLD each
	Size of the unit	:	11.0 M X 11.0 M X 1.5 M SWD
	Settling Velocity	:	< 0.02 M/Sec.
	Surface Load	:	1000 M3/M2/Day
	Specific Gravity of Grit Particle	:	2.65
	Diameter of the smallest particle to be removed	:	0.2 mm
	Details of Grit Mechanism:		
	a. Degrit Mechanism:		
	No. of Units	:	2 Nos.
	Type	:	Central Driven Type
	No. of Scraper per unit	:	3 Nos. (min.)
	Motor HP/RPM	:	3 HP / 1440 RPM
	b. Classifier Mechanism:		
	No.of Units	:	2 Nos.
	Type	:	Reciprocating Type
	Drive	:	2 HP / 1440 RPM
4.	**PARSHALLFLUME**		
	No. of Units	:	1No.
	Average Sewage Flow	:	101 MLD
	Peak Sewage Flow	:	202 MLD
	Free board	:	0.50 m.(minimum)
	Flow meter	:	Ultrasonic type
5.	**SEQUENTIAL BATCH REACTOR TANKS WITH**		

	DIFFUSED AERATION SYSTEM		
	Design Flow (Average Flow)	:	101 MLD
	No. of tanks /basins	:	6 Nos.
	Size. of each SBR Basin	:	43.0 mL x 43.0 mW x 5.5 m SWD
	Area of Selector zone in each SBR Basin (For Anaerobic and Anoxic Processes)	:	43.0 mL x 6.5 mW
	HRT	:	14.5 hrs
	MLSS	:	3000 to 5000 mg/1
	F/M Ratio	:	0.1to 0.18
	SWD	:	Min. 5.5 m
	Field transfer rate of Oxygen correction factor	:	0.65
	Excess sludge	:	0.5 to 1.2 kg / kg of BOD removed
	Material of Construction	:	R.C.C. (M30)
	Oxygen transfer of Diffusers at Std. conditions	:	Minimum 5% per meter depth of sub mergence
	Basin DO Concentration		2.0 mg/l
	Free board	:	0.5m
	Diffuser		
	Type of aeration	:	Fixed Type Fine bubble diffused
	Type of diffusers	:	Tubular type
	Diffuser material		Polyurethane
	No. of diffuser	:	As per process design
	SOTE Oxygen transfer rate	:	Minimum 5% per meter depth of submergence
	Decanter		
	Nos.	:	6 Nos.–one for each basin
	Type	:	Auto Control Moving Weir Arm Type
	Decanter travel rate	:	60 mm/minute (max.)
	Decanter Operation	:	VFD operated
	Level Transmitter	:	Required for each tank,
	On-line DO Transmitter cum Temperature Transmitter	:	Provided
	SBR Inlet Gates	:	Required, motorized gate with integral starter
	Auto Valves for sub header to facilitate switch over of Aeration Cycle from one Basin to other by PLC & selector zone valve	:	Motorized valves with integral Starter
	Air Blowers		
	Type of Blower	:	Turbo / Screw type

	Capacity of Each Blower	:	Min. 6700 Nm³/hr or higher as per process design requirement.
	Blower pressure	:	0.65 Kg/cm2 or as per design
	No. of Units	:	9 Nos.
	Motor Rating	:	As per design requirement
	Blower Operation		All Air Blowers shall operate via VFD
	Return Activated Sludge (RAS) Pumps (New)		
	No. of Pumps	:	7 nos. (6W + 1 Store Standby), one per SBR basin
	Type of Pump	:	Submersible Non-clog
	Capacity of pump	:	350 m^3/ hr or as per process requirement
	Head	:	As per hydraulic design
	Fluid handled	:	Bio-sludge of 0.8–1% solids consistency
	Specific Gravity	:	1.03
	Solid Size Handling capacity	:	Min.100 mm
	Pump Speed	:	1000 rpm(max.)
	Efficiency	:	More than 50%
	Accessories	:	Guide rail, chain, auto coupling, duck foot bend
	Material of Construction:		
	Casing	:	CIIS 210 Gr FG 260 with 1.5% Ni.
	Impeller	:	SS ASTM A743 Gr CF 8M
	Shaft/Shaft Sleeve	:	ASTM A276 SS 410
	Excess Sludge Pumps (SAS Pumps)		
	No. of Pumps	:	7 nos. (6W + 1 Store Standby), one per SBR basin
	Type of Pump	:	Submersible Non-clog
	Capacity	:	275 m^3/hr or as suitable for wasting excess sludge
	Head	:	10 m
	Fluid handled	:	Bio-sludge of 0.8–1% solids consistency
	Specific Gravity	:	1.03
	Solid Size Handling capacity	:	Min.100 mm
	Speed	:	1000 rpm (max.)
	Efficiency	:	More than 50%
	Min. dia. Of pumping main to avoid clogging	:	150 mm
	Material of Construction:		
	Casing	:	CI IS 210 Gr FG 260 with 1.5%
	Impeller	:	SS ASTM A743 Gr CF 8M
	Shaft / Shaft Sleeve	:	ASTM A276 SS 410

6.	**CHLORINE CONTACT TANK**		
	Design Flow	:	101 MLD
	No. of Unit	:	1 no.
	Retention time	:	25 – 30 min.
	Size of Chlorine Contact Tank	:	28 m x 28 m x 3 m LD
	Material of Construction	:	R.C.C. (M-30) with water proof
	Free Board	:	500 mm
	Dose of chlorine	:	5 ppm (min.) at avg. flow or suitable for 0.5 ppm FRC
	Chlorination cum Tonner Room	:	18.5 M x 6M (minimum)
	No. of chlorinator	:	3 nos. (2W+1S)
	Type of chlorinator	:	Vacuum type
	Capacity of chlorinator	:	Min. 15 Kg/hr capacity.
	Chlorine Booster Pumps		
	No. of Unit	:	3 nos.(2W+1S)
	Type of pump	:	In line multi stage centrifugal
	Capacity & Head	:	As per manufacturer
	MOC	:	As per mechanical specification
	Chlorine Tonners		
	No. of tonners (Storage for 15 days	:	10 Nos.
	Capacity of each tonners		928Kg.or so which may be available in market
7.a	**Centrifuge Feed Sump**		
	No. of unit	:	1 No.
	HRT	:	4 Hrs (min)
	Minimum Volume	:	550 m^3
	SWD	:	2.5 m
	Size of Sump	:	16.8 m dia
	MOC	:	RCC (M30) with water proof plaster
	Nos. of Feed Pump	:	4 nos.
	Capacity of pump	:	20 m3/hr or As per Design Req.
	Free board	:	0.6 m
b.	Air Blower for Mixing		
	No. of unit	:	2 Nos.
	Capacity	:	700 m3/hr each
	Discharge Pressure	:	0.35 kg/.cm^2
	Type	:	Roots type, Twin Lobe, Air Cooled

8.	**MECHANICAL SLUDGE DEWATERING SYSTEM–CENTRIFUGE**		
	No. of Units	:	4 Nos. (3W+1S)
	Type	:	Solid Bowl Centrifuge
	Capacity	:	40 m3/hr or As per design requirement.
	Operating Hours	:	20 hrs. per day max.
	Specific gravity of influent sludge	:	1.03 – 1.05
	Solid concentration at inlet (max.)	:	Biological sludge of 0.8-3% solids
	Solid concentration of dewatered cake	:	20 % by wt. min. dry solid basis
	MOC–Wetted Parts	:	SS-304
9.	**POLYELECTROLYTE DOSING TANK, MIXER & PUMPS**		
	POLYELECROLYTE DOSING		
	No. of Tank	:	4 Nos.
	Capacity	:	20 hrs. dosing requirement
	Solution Strength	:	0.1% (max.)
	Size	:	2.5 M x 2.5 M x 2.0 m SWD each
	Free Board	:	0.5 M
	MOC of tank	:	RCC with inside Epoxy Lining
	POLY ELECTROLYTE DOSING		
	No. of Unit	:	5 Nos. (3 W + 2 S)
	Model	:	WD-3000/100
	Type	:	Simplex Hydraulically Flexed
	Capacity	:	800 LPH
	Motor HP/RPM	:	2 HP/1440 RPM
	Discharge Pressure	:	2.0 kg/cm2
	Speed (Stroke/Min)	:	100 SPM
	Stroke Control	:	Manual
	Sp. Gravity	:	1.16
	Material of Construction		
	-Wetted parts	:	SS 316*
	- Diaphragm	:	Teflon
	- Gland	:	PTFE
	- Relief Valve	:	In hydraulic oil chamber
	- Base Plate	:	MS Epoxy Painted
	DOSING TANK AGITATORS		
	No. of Mixer	:	4 Nos.
	Size of Tank	:	2.5 M × 2.5 M
	Liquid Depth	:	2.0 M LD
	Free Board	:	0.5 M
	Agitator RPM	:	60-100 RPM

	Motor HP / RPM	:	2 HP/1500 RPM
	MOC		
	Contact Parts	:	SS-304
	Impeller Type	:	3 Bladed Hydrofoil type Turbine
10.	**AIR BLOWER ROOM**		
	No. of Units	:	One
	Size	:	23M x 8M (minimum)
	Height	:	5 M
	MOC	:	RCC frame structure (M30) with Brick Masonry
11.	**HT ROOM / TRANSFORMER YARD / L.T. ROOM / MCC**		
	(a)H. T. Room		
	No. of Units	:	One
	Size	:	As per design requirement
	Height	:	4M
	MOC	:	RCC frame structure (M25) with Brick Masonry
	(b)Transformer Yard		
	Size	:	as per electrical specifications with chain link fencing etc.
	(c) L. T. Room /MCC Rooms		
	No. of Units	:	One
	Size	:	As per design requirement
	Height	:	4M
	MOC	:	RCC frame structure (M25) with Brick Masonry

Note:

1. **The details of existing STP is provided here above for reference to the tenderer only. However, the tenderer is required to visit the site before quoting the tender and shall have to incorporate all the necessary changes / modification / alteration , he desires for 100% smooth running of the plant, to achieve the desired treated sewage parameters as specified above, under this tender.**
2. **All the pump heads indicated above are indicative & for guidelines. Any increase in head during detailed engineering shall be provided by contractor without any price implication.**
3. **All the motors for above shall be <1000 RPM, S1 duty and TEFC type only, except for Process Air Blowers**

Indicative Process Flow Diagram, and land allocation layout drawings for the proposed STP are attached at the end of this technical specifications of Volume–II. These Drawings are indicative and for tendering purpose only. Bidders need to develop their own drawings based on his design and site conditions, conforming to the specifications given in the Tender documents.

The processes selected above are well-established process for treatment of sewage. The Bidders are to adopt the same nomenclature used for various Treatment Units in their design documents as used in the Tender documents.

(D) UNITWISE SPECIFICATION OF STP:

The scope work under this tender incorporates the new construction and modification / repairing / alteration / augmentation of existing 66 MLD capacity STP upto 167 MLD capacity facilities. The various unitwise specification are provided hereunder are for general guidance only and not limited to as specified thereof. The tenderer shall have to carry out all the new construction and alteration / modification / repairing / augmentation of existing STP as per the specification provided under this tender for specific unit hereunder. Hence, the tenderer is required to visit the site before quoting the tender and shall have to incorporate all the new construction and necessary changes / modification / alteration / augmentation of existing STP, he desires for 100% smooth running of the complete 167 MLD augmented plant, to achieve the desired treated sewage parametes as specified above, under this tender.

1.1 GENERAL :

The Scope of work under each sub head shall consist of Design, construction of Civil Engineering works, supply, installation and testing/commissioning of all instrumentation, electrical/mechanical equipments alongwith piping works and other essentially required ancillary work etc. complete for each unit mentioned here under.

The process and hydraulic as well as structural design calculations for each of the following units / channel / pipelines etc., as required alongwith Civil G.A. drawings and G.A. drawings for mechanical/electrical/instrument equipment along with design calculations as applicable, with complete details shall have to be submitted by the contractor for approval of the client before starting execution of each work/ procurement of any equipment.

The scope work under this tender incorporates the new construction and modification / repairing / alteration / augmentation of existing 66 MLD capacity STP upto 167 MLD capacity facilities. The various unitwise specification are provided hereunder are for general guidance only and not limited to as specified thereof. The tenderer shall have to carry out all the new construction and alteration / modification / repairing / augmentation of existing STP as per the specification provided under this tender for specific unit hereunder. Hence, the tenderer is required to visit the site before quoting the tender and shall have to incorporate all the new construction and necessary changes / modification / alteration / augmentation of existing STP, he desires for 100% smooth running of the complete 167 MLD augmented plant, to achieve the desired treated sewage parametes as specified above, under this tender.

1.2 INLET CHAMBER

Inlet chamber of suitable size built in RCC M30 shall be constructed at the location shown in the tentative layout plan. The inlet chamber shall be designed to take peak flow of sewage. The inlet chamber shall have required number of puddle collars and necessary Alluminium penstock gates of suitable size for flow control.

The inlet chamber shall receive flow from Sewage Pumping Stations and the chamber shall have to be designed having adequate depth and free board above top water level to avoid splashing. Necessary hydraulic test to check water tightness of the inlet chamber shall be performed. Drain arrangement shall be provided with necessary Valve. The drain pipe shall be connected to the plant bypass pipeline / chamber.

RCC slab/platform with hand railing shall be provided on three sides at the top of inlet chamber for access and operation of the gates. Access to the top of inlet chamber shall be by means of 1m wide RCC staircase with hand rails. Polypropline foot rests of standard size shall be fixed inside the inlet chamber. The inside surface of the inlet chamber shall be provided with 20 mm thick water proof plaster in Cement mortar 1:3. The bottom of the chamber shall be provided with 40 mm thick IPS screeding. The outside surface shall be provided with 20 mm thick double coat Sand faced plaster in cement mortar 1:3 with exterior emulsion as per Civil specification.

1.3 SCREEN CHANNEL – FINE BAR SCREEN

Fine Screen Chamber – Mechanical Fine Screen – The Fine Screen shall be provided for total 167 MLD capacity STP. The existing Fine Screen is of 66 MLD and new fine screen to be provided for 101 MLD average flow. The detailed scope of work of fine screen chamber and mechanical fine sceen shall be be as under :

The suitable dimensions of the chamber shall be provided in order to maintain a velocity of 1.2 m/sec during peak flow across the screen. Flow into screen channel shall be received from main inlet chamber through a channel of adequate length and width. A free board of 500 mm shall be provided in this structure. The Step type fine bar mechanical screen of 6 mm clear opening shall be provided for removal of floating material in the screen channel as per mechanical specification.. RCC platform of at least 1.2 m width shall be provided over the screen chamber on upstream side with adequate opening for tilt /swivel of screen and removal without obstruction. Similarly RCC platform of atleast 2.5m width shall be provided on downstream side for placing belt conveyor, hydraulic unit / screen panel and providing at least 1m clear width for operation and maintenance. The platform shall be provided with railing to facilitate inspection and maintenance of screen. RCC staircase of 1.0 m wide shall be provided at suitable position in order to have access to the RCC top slab. Polyproplene rests shall be fixed inside the chamber on both, upstream and downstream side. Necessary drain pipe and valve shall be provided to empty out the screen chamber. The drain pipe shall be connected to the plant bypass pipeline / chamber.

The Screen mechanism shall be mounted on a platform at a suitable height. The screening lifted by the mechanism shall be delivered to the belt conveyor which in turn shall carry and drop the screening with the help of chute and drop directly into the wheel barrow kept standing at ground level on cement concrete platform. The screen

shall be provided with such an arrangement that the falling stock of the screening is arrested.

2 Nos. Alluminium pen-stock gates shall be provided both at inlet and outlet of each screen channel to facilitate isolation and maintenance.

The complete structure shall consist of RCC work with suitable RCC foundation. Necessary hydraulic testing shall be provided for screen channel. The inside surface of the screen channel shall be provided with 20 mm thick water proof plaster in Cement mortar 1:3. The bottom of the channel shall be provided with 50 mm thick screeding. The outside surface shall be provided with 20 mm thick double coat Sand faced plaster in cement mortar 1:3 with exterior emulsion as per Civil specification. The details of equipment and requirement shall be specified separately under the electrical-mechanical work.

Contractor shall supply a total of 3 nos. of wheel operated hand pulled trolleys along with necessary HDPE or MS Drums/Bins for collection of screenings falling off belt conveyor.

The screening falling off the belt conveyor shall be guided to screening collection drums by providing GI (2mm) chute of adequate opening. Chute shall be extended upto 2m above ground level or as directed by engineer-in-charge during execution. The opening between chute and drum shall be enveloped with suitable cloth cover to prevent dispersal of screenings in the plant due to wind or other conditions.

The belt conveyors shall be provided with suitable guard covers to prevent the dispersal of screening in the plant.

1.4 GRIT CHAMBER

The flow from the screen channel shall be allowed into the Grit Chamber for the removal of grit/inorganic matter by means of RCC square tank designed as per relevant IS code of practice. There shall be 4 Nos. Mechanical Gravity type conventional Grit Chamber. Grit chambers shall be designed for peak flow. Mechanical grit chamber shall be capable of removing grit of particle size of 0.15 mm and above and sp. gravity of 2.65. The surface loading rate, settling velocity and other design parameters shall be as stated earlier. The Grit Chamber shall be of RCC M30 grade construction with suitable RCC foundation with necessary water tightness test. The inside surface of the Grit Chamber shall be provided with 20 mm thick water proof plaster in Cement mortar 1:3. The bottom of the Chamber shall be provided with 40 mm thick IPS screeding. The outside surface shall be provided with 20 mm thick double coat Sand faced plaster in cement mortar 1:3 with exterior emulsion as per Civil specification.

The grit be guided to trolleys providing GI (2mm) chute of adequate opening. Chute shall be extended upto 2m above ground level or directed by engineer-in-charge during execution.

1.5 PARSHALL FLUME (FLOW MEASUREMENT)

The Bidder will provide 1 Nos. of new Ultrasonic Flow Meter in the Parshall Flume for total 101 MLD average flow capacity Plant. The required piping modification will be carried out by the Bidder for the same.

The Parshall Flume shall be of RCC M30 grade construction with suitable RCC foundation with necessary water tightness test. The inside surface shall be provided with 20 mm thick water proof plaster in Cement mortar 1:3. The bottom of the Channel shall be provided with 40 mm thick IPS screeding. The outside surface shall be provided with 20 mm thick double coat Sand faced plaster in cement mortar 1:3 with exterior emulsion as per Civil specification.

1.6 MODIFICATION WORK IN EXISTING Primary Clarifier

Necessary modification in 1 no. of PST shall be carried out to convert the same in 1 nos. of Anaerobic Reactor. The flow in to this reactor shall be controlled by means of sluice gates.

Any kind of RCC modification shall be carried out in M-30 grade of concrete. The inside surface of the new construction shall be provided with 20 mm thick water proof plaster in Cement mortar 1:3. The bottom of the new construction shall be provided with 40 mm thick screeding. The outside surface of new construction shall be provided with 20 mm thick double coat Sand faced plaster in cement mortar 1:3 with exterior emulsion as per Civil specification.

The converted clarifier shall take total average flow of 66 MLD and utilized as an anaerobic reactor. Remaining primary clarifier will take 33 MLD average flow and treated outlet from launder shall be diverted to anaerobic tank followed by IFAS system.

1.7 AERATION TANK WITH DIFFUSED AERATION

The existing aeration tank shall be provided with IFAS system with diffused aeration system along with the air blower. The flow to aeration tank shall be as per design requirement. The IFAS system shall be able to carry out necessary nitrification as per tender treated water quality requirement. The contractor shall have to add the cages in the aeration tank as per its design requirement. The necessary recycled sludge pumping shall be carried out by the contractor as per design and process requirements.

All other accessories, whether specified or not, but required for completion of Contract shall form the part of Bidder's Scope.

1.8 SECONDARY SETTLING TANK (Three No.)

The existing secondary settling tank shall be used for the purpose. Any kine of alteration, modification and addition is required, shall be carried out the by the contractor, as per relavant I.S. and tender specification, as directed by Engineer-in-charge.

1.9 SBR UNITS

1.9.1 General

The Sequential Batch Reactor (SBR) Process shall be an advanced activated sludge process which shall utilize a Fill-and-Draw Reactor with complete-mix regime and operating in true-batch mode. The complete process shall be divided into Cycles with each Cycle is of duration of 3 – 4 hours. All the subsequent treatment Steps – Fill/Aeration, Settling and Decanting must take place sequentially and independently without overlapping. During Fill/Aeration phase, the sewage shall be filled into SBR Basins and part of the treated sewage along with activated sludge shall be recycled with the help of Recycle Pumps. Air shall be supplied for aeration with the help of Air Blowers. During Settling phase, the Filling/Aeration shall be stopped and the mixed content shall be allowed to settle under perfect settling conditions. During Decanting phase, the supernatant shall be removed form top with the help of Decanters and excess sludge shall be wasted with the help of Waste Pumps. Inlet of SBR shall be provided with motorised open channel sluice gates.

The Bidder shall provide the most advanced and proven SBR technology being in successful operation and meeting Standards of the Treated Sewage / Effluent Quality as per the requiremnet specified in the tender.

1.9.2 Process Design

- Sequential Batch Reactor (SBR)Units shall be installed and equipped for average flow of 101 MLD.
- The raw sewage enters the Selector Zone, where anoxic-mix conditions shall be maintained. Also a part of the treated effluent along with activated sludge from the Aeration Zone shall be recycled here using Return Activated Sludge (RAS) Pump. As the microorganisms meet high BOD and low DO condition in the Selector Zone, natural selection of predominantly floc-forming microorganisms takes place. This is very effective in containing all of the known low F/M bulking microorganisms, which eliminates problems of sludge bulking and sludge foaming. It ensures excellent settling characteristics of the biological sludge. SVI of treated effluent as less than 120 shall be achieved in all seasons. Also, due to the anoxic conditions in the Selector Zone, De-nitrification and Phosphorous removal occurs, in case Nitrogen and Phosphorous levels are high in the sewage.
- The SBR Process shall have following independent steps without overlapping each other:
    - Fill & Aeration
    - Settling (Sedimentation/Clarification)
    - Decanting (Draw)
- Filling, during Settling or Decanting will not be acceptable.
- The complete biological system shall be designed for handling peak flow.
- 6 (Six) Nos. of SBR Basins with adequate volume shall be provided. In addition, 0.50 m Free Board shallbe provided to each Basin. The Liquid Depth of each Basin shall be 5.50 m.
- The entire construction shall be in M30 grade reinforced cement concrete and as per IS 3370. RCC Platform/Walkway, minimum 1.20 m wide with Hand Railing as per

specifications shall be provided. RCC Staircase, minimum 1.20 m wide with Hand Railing as per specifications shall be provided for access from Finished Ground Level to the top of the Unit & to the Operating Platform/Walkway.Plinth protection along periphery shall be provided as per technical specifications.

- The system should work on a gravity influent condition. No influent / effluent Equalization Tanks or flash filling is accepted.
- The system should be designed for maximum F/M ratio between 0.1 - 0.18 Kg BOD/Kg MLSS day.
- MLSS maintained in the Basin should range from 3000 to 5000 mg/l.
- Cycle times shall be selected adequately by the Bidder considering min. 12 hrs/day Basin of aeration and not exceeding decanting of 1.10 m liquid depth at any time with preferred cycle times containing max. 50% not aerated portion.
- The excess sludge produced shall be fully digested. Sludge production (including percipients) rate shall be about 0.60–1.20 Kg / Kg of BOD removed. A minimum aerated SRT of 10 days shall be maintained to en sure digested sludge.
- A balanced process shall be achieved and regulated by online-measuring of the specific oxygen uptake rate in the basin in such a way that the floc reaction profile allows for nitrification at the peripheral sections and de-nitrification at the inner parts of the floc. Nitrate penetration shall be governed by its rate of diffusion which is of the order of ten times that of dissolved oxygen. Under aerated conditions there is typically no nitrate limitation in the interior zone of the floc. Sufficient carbon provision for de-nitrification shall be achieved through the carbon storage (biosorption) mechanism and the proportional DO demand regulation which minimizes the use of substrate carbon by oxic metabolization. The process shall be regulated such that during the aeration phase there is nitrification and also de-nitrification taking place within the flocs. De-nitrification shall takes place during settling phase. Rising of activated sludge due to nitrogen gas bubbling does not occur as during the relatively short time cycles only low concentrations of nitrate nitrogen have to be denitrified in each cycle.

1.9.3 Decanting Device

- The Decanting Device shall be Moving Weir Arm Device of SS 304 with top mounted Gear Box, Electric Drive, Scum Guard, Downcomers, Collection Pipe, Bearings. The following type of decanter assemblies are not acceptable:
    - Rope Driven Decanters.
    - Floating Decanters.
    - GRP Products.
    - Valve Arrangement.
- The maximum design travel rate shall be 60 mm/min with proven hydraulic discharge capacity of the decanter proportional to the selected Basin area.
- There should be maximum one (1)Decanter per Basin.
- The hydraulic design based on design flow rate as given above shall not exceed flow speed of 1.30 m/s.

- Flexible rubber hose kind of decanter sealing is not acceptable.
- Each Decanter shall be inclusive of local control boxes with manual operation selection and function buttons and communication to main PLC by DH485 or Ethernet.

1.9.4 Aeration System

- The aeration facility shall be installed for 101 MLD average flow.
- Only Fine Bubble Type, PU Membrane Diffusers shall be acceptable with minimum Membrane Diffusers to Floor Coverage Area of 5%. Diffusers shall be submerged, fine bubble / fine pore, high transfer efficiency, low maintenance and non-buoyant type. Diffusers shall be strip / tubular type. In case tubular type Diffusers are used, only top half surface area of the Diffuser shall be considered for supply of air. Material of construction for entire under water system including accessories shall be of non corrosive. Complete Diffuser as a unit shall be assembled at the manufacturing factory level. The grid supports shall of adjustable type made of SS 304.
- The Air Blower Arrangement shall be capable of handling Total Water Level and Bottom Water Level operation conditions controlled by process sensors such as DO, Temperature and Level.
- Each set of Air Blowers shall have dedicated standby. Minimum one working Air Blower in each set shall operate via VFD while others may be operating at a fixed constant speed on soft starter configuration.
- The Air Blowers shall be Turbo / Screw type and head for Air Blowers shall be decided on the basis of S.O.R. of Diffusers and maximum Liquid Depth in Basin duly considering the losses governing point of delivery (Diffusers) and the Air Blowers. Air Blowers shall be complete with Motor and accessories like Base Frame, Anti Vibratory Pad, Reactive Silencer, Non Return Valve, Air Filter etc. as per requirements. Further, Air Blowers shall have acoustic enclosure to ensure that the noise level at 2.00 m from Air Blowers is below 85 db. The Air Blower House shall have Rolling Shutter, Windows, Exhaust Fans, Safety Equipments with sufficient Ventilation, Lighting and Working Space. It shall be equipped with sufficient capacity Electrical Hoist with Travelling Trolley (Min.3 Ton or 1.5 times the weight of Air Blower whichever is more) to facilitate removal of Air Blower/ other Accessory for repairs.
- The operation of Aeration System shall include PLC based control. The operation and speed of Air Blowers shall be automatically adjusted using parameters like Oxygen Uptake Rate, Dissolved Oxygen and Temperature and Liquid Level in the Basin such that the DO is supplied as per demand and power utilisation for operation of Air Blowers is optimised.
- The main Air Header/Ring Main shall be in MS as per relevant IS Code, painted with corrosion resistant paint as per Manufacture's recommendations. The Air Header/Ring Main shall be supported on saddles at suitable intervals or shall be protected against external corrosion in case laid below ground. The Sub-header shall

have Auto Valves to facilitate switch over of Aeration Cycle from one Basin to other by PLC. The Sub-header shall supply air to Diffuser Grids at various locations through vertical Air Supply Pipes. These Air Supply Pipes above water level shall be in MS, painted with corrosion resistant paint and below water shall be in UPVC/PE. All under water Lateral Pipes shall be of UPVC/PE. Junctions between horizontal Sub-header and vertical Air Supply Pipes shall be suitably protected against corrosion due to dissimilar materials.

- After Cooler arrangement shall be provided on Air Header to ensure desired Temperature at the Inlet of Diffusers.
- All other accessories, whether specified or not, but required for completion of Contract shall form the part of Bidder's Scope.

1.9.5 Return Sludge and Excess Sludge Pumps

Dedicated Return Sludge and Excess Sludge Pumps shall be provided in each SBR Basin. The Pumps shall be of submersible / horizontal centrifugal type suitable for handling biological sludge of 0.8 – 2% solids consistency. Capacity and Heads shall be decided based on process requirements. Each Basin shall be provided with suitable lifting arrangements to facilitate lifting of these Pumps if required for maintenance.

a. Return Sludge Pumps

Capacity and Head	:	As per requirements
Type	:	Submersible
Liquid	:	Biological Sludge of 0.8 – 1% solids consistency
Specific gravity	:	1.03
Solid size	:	100mm (Minimum)
Temperature	:	Min. 25° C
Efficiency	:	more than 60%
Quantity	:	6 Nos. (1 No. per Basin) + 1 No. Store Standby

b. Excess Sludge Pumps

Capacity and Head	:	As per requirements
Type	:	Submersible
Liquid	:	Biological Sludge of 0.8 – 1% solids consistency
Specific gravity	:	1.03
Solid size	:	100mm (Minimum)
Temperature	:	Min. 25° C
Efficiency	:	more than 60%
Quantity	:	6 Nos. (1 No. per Basin) + 1 No. Store Standby

1.9.6 Automation and Control

- PLC based Automation System with application software based on Rockwell or equivalent to control SBR System including all Gates, Air Blowers, Pumps, Valves and Decanters as per Bidder's/Technology Provider's own design including I/Os with 20 % Spares and UPS.

- HMI Panel shall comprise latest Personal Computer with 22" LCD Monitor, Multi Media Kit, Printer, Internet Connection, RS-View, RS-Links (Gateway Version), Process and Operator Software with dynamic Flow Charts, Pictures, Screens, Alarms, Historical Trends, Reports etc.
- SACDA based Automation System to monitor the following parameters continuously in each SBR Basins:
    - Fill Volume
    - Discharge Volume
    - Temperature
    - DO Level
    - Oxygen Uptake Rate
    - Air Blower Speed
    - Decanter Speed

1.10 CHLORINE CONTACT TANK (DISINFECTION UNITS)

Treated effluent from SBR System shall be taken to the Chlorine Contact Tank minimum 25 minutes of retention time shall be provided considering decanting flow generated from SBR.

Treated sewage shall be taken to Chlorination Tank by MS / DI Pipe RCC channel and size of Pipe lesser than 1000 mm shall be taken as DI K-7. Gas Chlorine shall be added for disinfection at suitable dosing rate. Baffle walls shall be provided in the Tank to facilitate hydraulic mixing of treated sewage. The entire construction shall be in M30 grade reinforced cement concrete and as per IS 3370.

Chlorine Contact Tank shall be provided with required no. of RCC baffles and Chlorine diffuser to allow the proper mixing of chlorine solution with treated effluent. Dosage of chlorine shall be adjusted such that 0.5 PPM FRC shall be maintained at the outlet of Chlorine Contact Tank.

The inside surface of the Chlorine Contact Tank shall be provided with 20 mm thick water proof plaster in Cement mortar 1:3. The bottom of the tank shall be provided with 40 mm thick IPS screeding. The outside surface shall be provided with 20 mm thick double coat Sand faced plaster in cement mortar 1:3 with exterior emulsion as per Civil specification.

A Chlorinator cum Chlorine Tonner and chlorinator shall be provided as per technical datasheet. The Chlorinators shall be capable of dosing minimum 5 mg/l Chlorine. Minimum capacity of Chlorinators shall be 15 Kg/hr or higher as per design requirements. The Chlorine booster pump and service water pump shall be of the same rating and shall be piped such that the common stand by pump can remain stand by for both services. Chlorinator along with booster pump and service water pump shall be arranged in chlorinator room. One no. of Neutralization tank shall be provided adjacent to chlorinator room for treatment of leaked chlorine tonner. Suitable safety equipment shall be installed in the chlorinator room as per mechanical specifications.

Tonners on line, tonners on standby and full and empty tonners shall be stored separately in the tonner room. Tonner rollers shall be provided for online and standby tonners. Tonners not in use shall be stored on concrete cradles.

The container lifting beam shall be specifically designed for handling chlorine containers and equipped with necessary shackles and hooks. Two lifting beams shall be provided (a duty and a spare) and a one tonner weighing scale to be suspended from the crane hoist.

The system shall comprise a pit located adjacent to or in the tonner storage room. The pit shall be surrounded with removable guard railing. The pit shall be kept full with a neutralizing solution of lime. The pit shall be capable of holding side by side two chlorine tonners. A provision shall be made to drain the pit.

1.11 PUMP HOUSE

(Applicable where new Vertical / Horizontal Centrifugal or Screw Pumps are to be provided and where existing Sump & Pump House cannot be used.)

All pump houses , except Digester Sludge Mixing Pump House, Dilution Water Pump House and Supernatant Sump shall be designed with wet well and dry well arrangement and constructed as per the following specification. The particular specification of each of the pump houses has been presented separately. The pump house building shall consist of three parts (1) the wet well or sump,(2) the dry well and (3) the annexe shall be provided only for primary sludge sump & pump house and sludge recirculation sump & pump house.

The annexe shall be above G.L. with suitable foundation and size for housing the incoming feeder, control panels for the motors and others as per E & M specification in addition to providing office accommodation to the operator.

The sump and dry well portion below the plinth shall be in RCC construction designed as water/earth retaining structure as per relevant IS codes of practice. The sump shall be provided with Polypropylene rests for getting down inside the sump. The floor of the dry well shall be provided with 40 mm thick IPS cement concrete 1:2:4 with 12 mm thick ironite finish. RCC staircase shall be provided on one side to have access to the floor of dry well from plinth level. A 1.5 m wide balcony along with length and width designed for heavy duty loading shall be provided at the plinth level with pipe railing. The floor of annexe shall consist of 40 mm thick IPS cement concrete 1:2:4 with 20 mm thick mosaic finish with suitable skirting as per civil specification. The super structure shall be in RCC frame work consisting of RCC columns, RCC roof beams with brick panels.

A rolling shutter shall be provided in annexe and adequate number of windows and ventilators shall be provided in annexe to ensure proper ventilation and lighting. The roof shall have six courses of water proofing treatment as per specification and rain water downtake pipes. Also Electrical Hoist with Travelling Trolley of minimum 2 Ton capacity or 1.5 times the weight of the single Unit whichever is more to lift the Pump set

The plinth level of the building shall be 600 mm above formation level. The roof of the building shall be about 3.6 m (min.) above plinth level. Ramp of suitable size and slope duly chequered at top for entrance shall be provided. An internal and external surface of walls above ground level shall be plastered with 15 mm thick cement mortar 1:4 C.M. and finished smooth with distemper from inside and with exterior emulsion from outside. The steel work in doors, windows and railing shall be painted suitably to give smooth finish. The paints shall be as approved by engineer.

The architectural drawings of the building shall be got approved by the engineer in charge before execution. The improvements/suggestions intimated by the engineer in charge shall be final and binding on the contractor without any extra cost to the department. The building shall be provided with 1000 mm wide plinth protection of 75 mm thick CC 1:2:4 laid over 150 mm consolidated rubble soling The offer shall include internal electric wiring of the buildings with light & fan fixtures, fitting with light/power points etc, the details of which are given separately in E & M work.

In all the pump houses in the dry well where pumps are to be installed a clear space of at least 1 m to be provided between the pumps for easy access to the pump. A clear space of 1.5 m shall be provided from the end wall. At the suction side there shall be sufficient space provided for the suction lines and the installation of valves as also to accommodate the discharge manifold. In no case this clear space shall be less than 2 m. On the other end there shall be sufficient space for circulation and space provided for maintenance work. A minimum space of 2 m shall be provided.

At one end shall be the sump to take the floor wash where the dewatering pump shall be provided. A channel of suitable size along the periphery of the drywell shall be laid upto the sump with required slope to take floor wash.

The duty and number of pumps shall be computed in such a way so that at least 50% standby at peak flows can be ascertained in all the pumping machineries. The annexe room shall be of sufficient size to accommodate the electric panel, office of pump operators, helpers, maintenance stores for the storage of consumables and common spares.

The offer shall be inclusive of foundation of pumps/motors, electric panels, cable trenches, pipes and trenches for pipe, as per requirement. The specifications for pumps and the DI piping and specials, etc. shall be as given in this document elsewhere. Necessary DI main with valves specials, etc. shall be included in offer. All internal piping shall be supported on RCC pedestals of suitable sizes.

1.12 SLUDGE RECIRCULATION SUMP & PUMP HOUSE (EXISTING SUMP AND PUMP HOUSE TO BE USED WITH NECESSARY MODIFICATION)

The existing Sump and Pump House to be modified / repaired for installation of required new pumps. The scope of work also includes modifications or replacement of existing piping work, valves, electrical works if any to make the system in operation with new pumps. The Bidder will visit site and work out the details for cost estimation purpose. No extra payment will be made for any additional items required on award of

work.

1.13 SLUDGE DEWATERING UNITS

Centrifuge shall be installed as Sludge Dewatering Units and associated equipments. The Centrifuge Shall be installed on the first floor of the building, which has provision to collect dewatered sludge on ground floor. The building shall be generally in line with the other room specification provided in the tender. Howerver, at ground floor, RCC pavement in M25 shall be provided for vehicular movement. The first floor room shall be opened from all side with the provision of hand railing. The poly dosing tank shall be located on the first floor with M30 grade RCC.

1.14 Air Blower Room / HT Panel Room / PMCC Room / MCC Rooms (MCC-1, MCC-3 & MCC-4) or other Rooms as applicable.

The Air Blower room should be structurally sound and aesthetically beautiful and shall merge with the traditional character of the place. The proposed building shall meet the following minimum requirements. The air blowers shall be designed and provided as per the datasheet and detail specification.

The height of ceiling shall be min. 4 m from the floor level or higher to suit lifting of air blowers.

The architectural drawings of the building shall be got approved by the engineer in charge before execution. The improvements/suggestions intimated by the engineer in charge shall be final and binding on the contractor without any extra cost to the department. The RCC work shall be carried out in M25 grade concrete. The building shall be provided with 1000 mm wide plinth protection of 75 mm thick CC 1:2:4 laid over 150 mm consolidated rubble soling The offer shall include internal electric wiring of the buildings with light & fan fixtures, fitting with light/power points etc, the details of which are given separately in E & M work.

1.15 SCHEDULE OF FINISHES

Sr. No.	Unit	Flooring	Doors	Windows / Ventilators
1	Administrative Block (If in the scope of work)	Vetrified Tiles of 24”X24”	Solid Core Flush Door with heavy duty Brass Fittings of approved make	Aluminum of approved make with Grenamite sill glass window with MS Grill – oil painted
1	MCC Room, PLC & Control Room	Polished Kota stone	Solid Core Flush Door with heavy duty Brass Fittings of approved make	Aluminum of approved make with kota stone sill glass window with MS Grill – oil painted

Sr. No.	Unit	Flooring	Doors	Windows / Ventilators
2	Air Blower House, Workshop & Tool Room, Chlorinator cum Chlorine Tonner House, Sludge Pump Houses, Electrical HT Substation,	IPS Flooring with Abrasion Resistant Additives of approved make	MS Rolling Shutter (See Through Type) of approved make and Solid Core Flush Door with heavy duty Brass Fittings of approved make	Aluminum of approved make with kota stone sill glass window with MS Grill – oil painted
3	Centrifuge House	Anti Skid Tile Flooring of approved make	---	---
4	Toilet Blocks	Coloured Glazed Tiles	UPVC of approved make	UPVC of approved make
5	Staircase: Inside Building	Polished Kota stone	---	---

1.16 TREATED SEWAGE DISPOSAL LINE

Treated sewage collected in to the chlorination tank shall be disposed in the in the nearby creek through disposal line. The laying of 1800 mm dia RCC NP3 pipe line of about 100 mtr. is under the scope of this contract. However, necessary GPCB cleareances shall have to be obtained by contractor only. The legal fees towards obtaining clearences shall be borne by SMC.

1.17 LANDSCAPING

Landscaping involves beautification of Sewage Treatment Plant site by cultivating lands, plants and trees of environmental value and suitably modifying the appearance of STP site. It shall add scenic value to the STP site to obtain maximum visual impact. Contractor has to develop proper landscaping in the STP site from professional landscaper. Area for future expansion shall also be considered for landscaping.

Lawns

Lawns should be drained with great care in order to keep it lush with green. The soil should be drained effectively and water should not be allowed to be collected in pools. The ground must be dug up to a depth of 30 - 45 cm to remove stones with weeds and the soil should be exposed to sunlight for proper sterilization. The grass for the lawn should be preferably Cynodon dactyion or Berumda grass. The lawn must be prepared by one of the approved methods seeds, by turfing, by turf - plastering or by dibbling roots. Lawns once should be subjected to regular rolling, moving, watering, and restoration of patches. To keep the lawn in condition it should be seeded once a month with liquid manure by dissolving 45 gm of Ammonium sulphate or 20 gm of Urea in 5 litres of water. Bone meal at the rate of 100 kg per 1000 sq.m is recommended in one year. Neem cake should also be applied once or twice a year at the rate of 200 kg per

10C Raking and scraping for thatch control must be carried out. Weed measures should also be undertaken during the entire O&M period.

Flower beds

Flowerbeds add a special charm to any place. They should be simple in either square, rectangular, circular or oval. The number and size flowerbeds are determined by its extent with type. The tallest growing should be planted at the back of borders or in beds on lawns far away from structures. The medium sized plants should be planted in the central area of the garden and the dwarfish ones should be planted in front. There should be a harmonious blending of colours to create a pleasing appearance. Flowerbeds should be dug up to at least 15-20 days before sowing or bedding out small plants. For most annuals it would be enough as the soil is worked to a 45 cm but for deep rooting plants such as Sweet Peas, Cannas, etc. should be dug up to 60 cm. A basket of 10 kg of manure should be app about 2 sq. metres of flowerbed area. The bed should be levelled in such a way, that it slopes slightly with uniformly from the centre to the edge. A clear 7 to 15 cm should be left unfilled by plants by the edge of the bed.

Shrubs

Shrubs are plants, generally with woody stems, rather smaller than tree bigger than most herbaceous plants. In a typical shrub, there are several stems arising from the same root. Shrubs are either deciduous or evergreen. A well-designed shrub border should consist of a suitable admixture of deciduous with evergreen shrubs. The preferred shrubs are Ixora, Bougainvillae, and Euphorbia leucocephala, Poinsettia, Mussaenda, etc. should be planted by preparing cubic pits of 60 cm, pits about a metre away should be fitter with good soil mixed with 2 to 4 baskets each decomposed manure. The ground should be well prepared in bet digging it about half metre deep with removing all weeks. They should be at suitable distances so that when they mature and reach their maximum growth. They should not be allowed to grow straggly or form clumps by throwing from the base. Manure should be applied to the shrubs at least once a providing plenty of compost materials.

Plantation

Plantations are to be done all along the boundary wall just to provide a barrier. Big trees should be planted 3m apart from each other within a 5m wide. Space adjustment should be done taking the site condition into consideration. Cubical pit of 60cm should be proposed and should be filled with good soil mixed with 2 go 4 baskets of 5 kg each of well decomposed manure. The ground should be well prepared in between by digging it about half metre deep with removing all stones and weeds. The trees should be planted at suitable distances so that when they mature and reach their maximum growth.

1.18 Interconnecting Piping and Valves

All interconnecting Piping, Gates, Valves, Specials and other appurtenances, auxiliaries and accessories required as per Process Design and Scope of Work. In case of Rising Mains, thrust blocks shall be provided wherever required. In case of buried Pipes, warning tapes shall be provided of the appropriate colours. The material of construction for major interconnecting Piping shall be as follows:

Sr. No.	From	To	Material and class
1	Inlet Chamber	Clarifier / A2O Dist. Chamber / A2O / SBR	DI K-7
2	Air Blowers: Delivery Piping	Common Header and sub header	MS Epoxy Painted
3	Air Blowers: Delivery Piping	Vertical Down comers – Aeration / SBR	UPVC / HDPE
5	Air Grid in SBR		UPVC / HDPE
6	SBR / Chlorination Tank	SST / Chloination Tank	DI K-7
7	Chlorination Tank: Outlet Channel / Pipe	Disposal point	RCC Class NP3
8	Internal recirculation Pipe		DI K-9
9	Sludge pipes for pumping operation		DI K-9
10	By pass Piping		RCC NP3 Class pipes
11	Water supply		UPVC/GI pipeline within STP complex
12	Chlorine gas or liquid		flanged or welded carbon steel, CAF flangedjoints
13	Chlorine gas lines below atmospheric pressure		polyvinylidene fluoride (PVDF) with solvent welded or flanged joints
14	Chlorine solution		Class E UPVC in concrete covered dusts outside building. Inside building and in exposed areas, rubber lined carbon steel
15	Polyelectrolyte Dosing		HDPE

Note: All process piping shall be designed by considering the peak flow, as applicable.

1.19 Electrical & Instrumentation Works

It shall be the Contractor's responsibility to obtain adequate incoming HT power from State Electricity Authority based on the maximum demand load. The Employer will pay the charges for obtaining the above connection whereas necessary liasoning for the same shall be done by the Contractor in consultation with Dy. General Manager and Ex. Engr. (Drainage).

The entire new Plant shall be operated on 415 V, 3-Phase, 50 Hz, 4-Wire system. The Contractor's Scope of Work shall include the following:

- Obtaining incoming HT Power from State Electricity Authority including necessary liasonoing, documentation etc. complete.
- HT Cable with Termination Kit from "Source" to the Electrical HT Substation located at the Sewage Treatment Plant.
- HT Substation including 2-Pole Structure, Metering Kiosk, HT Panel, Transformers, PMCC, etc. complete.
- Motor Control Centres.
- Cabling including HT cable, Power, Control and Instrumentation Cables.
- Earthing for Electrical equipments as well as Instruments.
- Internal Lighting in Buildings.
- External Lighting.
- Local Push Button Stations near respective Drives.
- Any other item / accessories required for successful completion of the project.

The Contractor shall design/execute the System as per standard specifications, I.E. Rules and Regulations, requirements of State Electricity Board and other local Authorities and actual site conditions.

Also, the Contractor shall provide adequate automation for fully automatic operation of the entire Sewage Treatment Plant including Primary Treatment Units, Biological Treatment Units, Chlorination Units and Sludge Dewatering Units through a Programmable Logic Centre (PLC) and Supervisory Control and Data Acquisition (SCADA) with Man-Machine Interface (MMI). Provision shall also be made to operate each Unit of the Plant manually, if required.

Bidder shall refer electrical specifications for further requirements / detailed specifications.

1.20 PLC/PC/SCADA BASED AUTOMATION SYSTEM FOR PLANT

The entire new Sewage Treatment Plant including Priliminary Treatment Units, Biological Treatment Units, Disinfection (Chlorination) Units and Sludge Dewatering Units shall be designed for fully automatic operation through a Programmable Logic Centre (PLC) and Supervisory Control and Data Acquisition (SCADA) with Man-Machine Interface (MMI). Provision shall also be made to operate each Unit of the Plant manually, if required.

Salient features of the proposed System shall be as follows:

- Dynamic display of all Units, Equipments and Drives shall be available on SCADA Screen.
- Auto/Manual operation of each Drive shall be made by selecting a Soft Switch on SCADA Screen.
- In Auto mode, each Drive shall operate based on pre set sequence and interlock.
- In Manual mode, each drive shall be operated in Local/Remote mode by selecting a

Soft Switch on SCADA Screen. In Local mode, each Drive shall be operated from the Local Push Button Station (LPBS) located nearby. In Remote mode, operation from LPBS shall be disabled and each Drive shall be operated manually from PLC. Also Working/Standby selection of Drives shall be done by selecting a Soft Switch on SCADA screen.

- Run/Trip indication of all Drives shall be displayed on SCADA screen.
- Annunciation & Alarm facility shall be available in PLC/SCADA. In the event of a Fault, the symbol representing the Equipment/Drive shall continue flashing on SCADA Screen with Equipment/Drive description appearing at bottom of the SCADA Screen and electric Hooter shall continue blowing until the Fault Alarm is acknowledged.
- Data logging of Running Hours of each Drive, Alarm and Historical Trends of monitored Parameters etc shall be envisaged in SCADA.
- The new Automation system must be communicate and Hook up with existing PLC based SCADA System. Each and every thing required to make entire system as a single unit including old system must be incorporated.

Bidder shall refer instrumentation specifications for further requirements / detailed specifications.

1.21 MINIMUM UNIT SIZING

Bidder to note that Minimum Unit Sizing for proposed augemented 167 MLD Capacity STP shall be atleast as provided in (C) Process Design Criteria.

Note:- The sizes of units specifed are the minimum requirement and contractor shall provide the above mentioned minimum or higher sizes units as required during detailed engineering. However, for tanks, sumps and process equipments, contractor may revise the size as per process requirement / detailed engineering subject to maintaining the min. effective volume as worked out from above minimum sizes.

1.3 MAIN WORKS FOR PROPOSED TERTIARY TREATMENT PLANT:

The major works proposed to carry out for 40 MLD net output capacity TSTP (60 MLD Design inflow) comprise of the following as minimum requirement. The list presented below is indicative only, however the necessary addition in the proposed scheme shall have to be carried out by contractor at his own cost so that the complete TSTP shall run to deliver total average net output from TSTP of 40 MLD. The work shall be carried out as defined under this tender. This is minimum requirement and tenderer may provide additional units if required within the quoted price to meet the performance gurantees. Alternative offer shall not be accepted. The bidder shall visit the site and based on the following minimum requirements and in line with the data sheet of various units as specified elsewhere in the tender, prepare and submit the layout and hydraulic of proposed TSTP as per his design.

RAW SEWAGE, SECONDARY TREATED SEWAGE / TTP FEED WATER CHARACTERISTICS AND TTP TREATED – INDUSTRIAL GRADE WATER CHARACTERISTICS

The plant is to be designed to treat the average Secondary treated wastewater flow to obtain nett output of Tertiary Treated Sewage of 40 MLD.

The plant is to be designed to treat the wastewater of characteristics provided in the table below. In the table, the raw sewage characteristics, secondary treated sewage characteristics requirement and the tertirary treated – Industrial Grade Water characteristics requirements are provided. The tenderer shall have to consider all these parameters and its characteristics, while designing tertiary treatment plant. The feed water characteristics that is to be considered for the designing of UF-RO based Sewage recycling plant (TTP), is provided in the table below, duly considering that gurarantee of secondarty treated sewage rests with the tenderer/contractor for the smooth running /operation of UF/RO units, to achieve the desired quality tertiary treated water – Industrial grade water as provided in the table hereafter.

TABLE - A: Source of Treated Sewage domestic at Dindoli Site for proposed 40 MLD net output TTP at Dindoli

Sr. No.	Parameter	Unit	Raw Sewage (90%tile)	Secondary treated sewage	Tertiary Treated – Industrial Grade Water
1	2	3	4	6	8
1	True Colour (Hazen Units) max.	Hazen Units	90	50	< 5
2	Turbidity	NTU	*	*	< 5
3	pH	-	6.5 – 7.5	7 – 8.5	6.0 – 7.5
4	Total Hardness as CaCO3	mg/l	900	*	< 300
5	Iron as Fe	mg/l	0.72	*	< 0.25
6	Manganese as Mn.	mg/l	0.4	*	< 0.10
7	TDS	mg/l	1400	1400	< 500
8	BOD5	mg/l	250	≤ 10	< 5
9	COD	mg/l	600	≤ 50	< 50
10	Total Suspended Solids	mg/l	300	≤ 10	< 2
11	Total Nitrogen as N	mg/l	42	≤ 10	< 10
12	Total phosphorus	mg/l	7	≤ 2 (as dissolved -P)	< 7

MAJOR COMPONENTS TO BE COVERED UNDER THIS TENDER

1.0 INLET ARRANGEMENT:

Inlet Chamber of Disk/cloth media type fine filtration system shall receive flow of secondary treated sewage of 60 MLD from proposed SBR system at Dindoli site.

2.0 COMPONENTS OF PROPOSED 40 MLD TTP

The various components of the Tertiary Treatment Plant to be constructed are as under:

2.1 Civil Components

- Filteration shed
- Shed for entire UF / RO system with Laboratory room
- RCC UF / RO feed water tank with epoxy lining
- Backwash / Reject Collection Tank
- MCC room and transformer yard
- Flash Mixer, Clariflocculator for UF/RO Reject treatment with chemical dosing system
- Foundations for all equipment / Tanks / Pump Houses / Degasser System

2.2 Mechanical Components

- Disk /cloth media type fine filtration
- Manual Strainer (200micron)
- Ultrafiltration(UF) system comprising of membrane modules, backwashing system, Cleaning in Place system (CIP) system, etc.
- Chemical dosing system (Coagulant, pH correction, etc) for UF operation, if required.
- Strainers/ Filters in UF backwash line
- UF backwash-cum- Reverse Osmosis(RO) feed tank
- RO Feed pumps
- Dechlorination facility to RO Feed Water
- Cartridge Filter for RO System
- RO System with membranes modules, cleaning and flushing system
- Chemical dosing system for RO operation and cleaning.
- Sludge Dewatering unit for reject water.
- Degasser Units
- ACF Unit

2.3 The interconnecting piping work including all piping, valves, flanges, fittings and hardwares including pipe support structures between various treatment units as per scope of work with related civil works, valve chambers, etc. complete

2.4 The electrical works for entire TTP including but not limited to HT panel, transformers, MCC panels, APFC panel, PMC, change over system to proposed TTP MCC, HT and LT cables, earthing systems, push buttons, plant and room lighting cable trays and tray supports, related civil work including cable trench etc complete as per scope of work and process requirement.

2.5 The instrument items as specified in the scope of work and process requirement for proposed TTP including instruments, hardwares, cable trays, and tray supports, PLC control system, related civil work.

2.6 Testing, commissioning, trial run of the plant as per scope of work.

3) Clearing the site & setting the layout etc:

The existing trees of any girth and height in the area of plant site shall be cut by the contractor,

including removing the roots, levelling the area and stacking the cut trees away from site of work and carting of logs of cut tress to SMC store, as directed by the Engineer-in-charge. The Contractor shall have to dismantle all the brick work and RCC work of super-structure and foundation of existing boring cabin and remove any structure/pipelines/cables etc. found during excavation and then dispose the debris and deposit the removed pipelines / cables etc., strictly as directed by Engineer-in-charge without claiming extra cost.

The contractor shall then make all arrangements for setting the line out of all the units of the plant on ground level as per the approved drawings and construction of Bench Marks with reference to nearest GTS R.L.

4) Excavation, Carting of excess excavated earth, Dewatering from foundation trenches:
Excavation of all the units/pipeline of the proposed plant up to any depth as per the approved plans and carting / conveying of all the excess (other than required for backfilling in foundation trenches & leveling of nearby land) excavated earth, debris etc. within city limit as directed by Engineer in Charge. Dewatering any quantity of ground water/ rainwater in foundation of any unit of the proposed plant. Refilling the foundation trenches with available excavated earth, after completion of foundation.

5) Disc Filter

The treated sewage from proposed SBR System shall be conveyed to the inlet chamber to the Disc Filter.

- Provision of disc filter of 60 MLD capacity for filtering and obtainting the desired TSS value less than 5 ppm before feeding secondary treated sewage to UF / RO with necessary civil, electrical / mechanical instruments, inter connecting pipe, with necessary arrangements of knife gate valves/ penstock gates and secondary treated sewage pumping arrangement by C.I. recycling pipeline upto UF.

6) UF and RO feed, backwash and reject water sump and pump house

- Provision of UF and RO feed sump (i.e.underground RCC M-30 tank) of required capacity for feeding secondary treated sewage to UF / RO with necessary electrical / mechanical instruments, inter connecting pipe, with necessary arrangements of knife gate valves/ penstock gates and secondary treated sewage pumping arrangement by C.I. recycling pipeline upto UF.

- Provision of UF and RO reject water sump (i.e.underground RCC M-30 tank) of required capacity for collecting UF / RO reject water and then transmitting it to Flash Mixer units with necessary electrical / mechanical instruments, inter connecting pipe. One No. new clariflocculator unit alongwith sludge dewatering system for the reject water to be provided. Moreover, one no. of clariflocculator shall also be provided for existing TTP and the scope of O & M of the said clariflocculator shall be of existing operator.

- Provision of backwash pump shall have to provided for UF backwash facility with necessary electrical / mechanical instruments, inter connecting pipe, with necessary arrangements of knife gate valves/ penstock gates and UF clarified water – backwash pumping arrangement by C.I. recycling pipeline upto UF.

- Material of construction shall be minimum RCC M-30.

- Free board shall be minimum 500 mm, but it should be sufficient for keeping the water drops inside.

- Approach shall be provided with RCC - M-30 staircase having 1.5 mt width with 1.00 m. high G.I. (Class-B) Railing.

- Outside 20 mm thick double coat sand faced plaster in two coats and inside 20 mm thick double coat water proof smooth cement plaster shall be provided as per tender specifications. At bottom 40 mm thick water proof IPS shall be provided

7) UF and RO Shed

- Proposed UF and RO house shall be constructed to house UF and RO membranes and related facilities which shall remove the impurities in the secondary treated sewage and to make it fit for Industrial Grade Water. There shall be separate house for UF and RO. The UF and RO membrane shall be designed and constructed for flow mentioned under the data sheets provided and as filled in by the contractor. UF and RO stream shall be as per the tender specification and as design submitted by the contractor in the date sheet. The shed should also includes the space for Laboratory to carry out necessary analysis from the required laboratory instruments.

- Material of construction shall be minimum RCC M-30 for RCC column, beam, plinth slab, roof /shed of Galvenum sheet of 0.5mm thk., RCC foundations and any other RCC frame member. The peripherial wall shall be of brick masonry upto sill level and of Pre-cast Cement Jali above sill level upto the roof. MS roof structural member shall be epoxy painted.The total effective height of the Shed shall be as per design requirement. The area required for shed shall be decided by bidder as per his own design .

- The membranes from the approved vendor list shall be allowed.

- Location of proposed UF and RO house is shown tenatatively in the layout drawing enclosed with tender. If due to the designed size of the unit it can not be accommodated in the place as shown in the tentative layout drawing enclosed with tender, then its location shall be shifted within plant boundary as suggested by Surat Smart City Development Limited. If due to change of location, length of connecting pipeslines / channels increases it shall not affect the tunkey price quoted by bidder.

- Free board shall be minimum 500 mm, but it should be sufficient for keeping the water drops inside.

- Approach shall be provided with RCC - M-30 staircase having 1.5 mt width with 1.00 m. high G.I. (Class-B) Railing.

- Outside 20 mm thick double coat sand fanced plaster in two coats and inside 20 mm thick double coat water proof smooth cement plaster shall be provided as per tender specifications. At bottom 40 mm thick water proof IPS shall be provided .

- Location of existing UF and RO house is shown in the layout drawing enclosed with tender.

8) Finally Tertiary Treated Product Water Sump and Pump House:The product water sump, pumps and its rising main shall be in the scope of SMC only. **The Bidder will provide treated water pipeline up to blending chamber (UF and RO treated water) having HRT of 60 seconds at the outlet of RO Shed as a terminal point.**

Note:

1) All the interconnecting piping for all the units, bypass piping including fittings and valves for treatment plant, water supply & service water lines shall be provided.
2) UF backwash tank, UF/RO feed water tank and degasser unit shall have acid-alkali tile lining on floor and walls.
3) The reject water treatment shall be carried out
4) All necessary electrical (power & control) and instrumentation (signal, communication, control & power) cabling for HT, LT power distribution, instrumentation & PLC/SCADA system for entire tertiary sewage treatment plant, etc. shall be provided.

The other units required are:

a) The TSTP shall be facilitated with Approach and Internal Roads, Road Kerbs, Storm Water Drains, Plant Pathways, Plinth Protection works and drinking water distribution network. No separate payment shall be made.

b) Bidder shall consider in his scope to provide lawns, plantation and landscaping within the TSTP battery limit (approx. 1000 sq.m. as a minimum or higher as per final approved layout). Plantation shall be provided along the plant roads, plot periphery, open areas and others as directed by engineer in-charge.

   The plantation shall be provided with necessary protection (Jali) and the species selected shall be suitable for the site environment and must be shade giving trees. Contractor shall consider to provide saplings such that minimum 100-120 surviving trees are available.

   Bidder shall submit the Landscaping Design for approval of SMC during detailed engineering and shall carry out the work as per approval and direction of engineer-in-charge.

   Contractor shall commence this work during 1 month perod of trial runs and commissioning and complete the same in all respects within 6 months from the date of works completion i.e. during first 6 months of O&M period, to the satisfaction of engineer-in-charge.

   The maintenance of these lawns, plantation & landscaping works shall be in the scope of contractor during O&M period.

c) Earth filling, leveling and dressing around the treatment unit including cutting of trees, removal of debris, shrubs and solid waste etc. within the premises of treatment plant & filling, to bring the site up to formation level, landscape, tree plantation, shall be included in the scope of work of this contract.

The scope of work shall also include:

- All interconnecting pipes, channels, valves, fixtures, appurtenances.

- Supply, erection, testing, commissioning of various mechanical, piping, electrical & instrumentation equipment required for the smooth working of the tertiary sewage treatment plant, including the Ten years O&M of entire treatment facility.
- Any other item not indicated above but necessary, essential or incidental to the completion of the above works and making them operational / All other accessories, whether specified or not, but required for complete shall form part of contractors scope.
- Preparation of plant layout; process design/unit sizing calculations; hydraulic calculations and flow diagram including pump head calculations; P&I Diagram; civil, mechanical, piping, electrical & instrumentation design, drawings, data sheets, sizing calculations, etc. as applicable including architectural drawings for construction after review and approval and as built drawings.
- Obtaining Power connection for designed power load for running and operation of treatment plant and other units within the project campus area from the power supply company (DGVCL or as applicable) including all required liaisoning. Only the applicable statutory fees shall be borne by SMC.
- Obtaining staturoy approvals for the entire STP facility including GPCB clearance (NOC and Consent), electrical inspector, chlorine tonner storage & filling, etc. Only the applicable statutory fees shall be borne by SMC.
- Preparation and submitting of operation and maintenance manual for plant and equipment in six copies.
- Operation and maintenance of all components of project for the defined period of operation and maintenance after successful trial run for defined period and commissioning.
- Providing training services to SMC's engineers or related departments engineers as per the direction of engineer-in-charge.
- The successful bidder shall make the necessary arrangements to dispose off the sludge at the present landfill site of SMC. (The landfill site for disposing the sludge is about 10 Km from STP and TSTP under this tender)
- Providing inspection and testing of all equipments and materials required for execution of the work at his own cost.

1.4 Completion Period:

The completion period for construction of entire sewage treatment plant as per the scope of work covered under this tender shall be 24 (Twenty Four) months incluidng testing, trial run and commissioning [Including monsoon] commencing from the date of Work Order including Erection, Testing & Trial Run.

1.5 Erection, Commissioning and Trial Run Period:

Erection, Commissioning and Trial run period for sewage treatment plant shall be 3 (three) months after the date of completion of project in all respect. The time period for Erection shall be 2 (two) months and for Trail Run and Commissioning shall be 1 (one) month. The trial run and acceptance of the plant after stipulated guarantee run shall be carried out based on the quantity of sewage made available by SMC at the time of trial and run and commissioning including guarantee run of the plant.

1.6 Tendering Information

Contractor to adopt/adhere to the general engineering specifications and practice given below while designing the STP and TSTP which shall form as part of

specific requirements and shall supersede general requirements specified else where in tender when observed to be in conflict to below requirements:

(a) Design capacity of all the units including inlet/outlet channels/piping, chemical dozing, MCC, control panel etc. of the proposed plant, shall be as per the capacity specified in the datasheets for each plant.

(b) As per the requirements of the tender and post-work order discussion the contractor, he shall prepare and submit layout plan, Hydraulic Flow diagram & P&I diagram for the proposed plant for approval to SMC. He shall also submit General Arrangement (G.A.) drawings of all the units of the proposed plant for approval to SMC.

(c) Layout plan shall be prepared to accommodate all the units of the plant, considering the available space as shown in the tentative plan enclosed with the tender.

(d) If, due to shifting of location of any units as per approved drawing, the length of inlet pipeline or outlet pipeline/channel is increased, no price difference shall be paid to the contractor.

(e) After approval of G.A. drawings submitted by the contractor from SMC, the contractor shall design & prepare the structural drawings of all the units of the plant as per the tender requirements, relevant IS codes and soil investigation report enclosed with the tender and then submit the same with design calculations to SMC for approval.

(f) SMC will in turn get the structural drawings checked from the consultant, appointed by them. If any revisions/ corrections/additions/deletions are required in the drawings submitted by the contractor, as per the views/remarks of the structural consultant appointed by SMC, then the contractor shall prepare and resubmit the revised drawings accordingly for approval again.

(g) Only after the full conformity with all the tender requirements, latest relevant IS codes and views/remarks of the structural consultant appointed by SMC, the structural drawings submitted/resubmitted by the contractor shall be approved by SMC. Only after approval from SMC, the drawings shall be released for construction at site.

(h) During the course of construction also, if in view of SMC and/or structural consultant appointed by SMC, if any changes are required in the already submitted & approved drawings/details etc., then the same shall be redesigned and resubmitted to SMC, showing the revisions made therein, without any extra claim.

(i) After making all the necessary revisions in the drawings and after the total construction, the contractor shall submit the three sets of “As built drawings”& Datasheets along with soft copy in CD format for all Civil,electrical and mechanical units / Equipments of the plant.

(j) All the RCC (Reinforced Cement Concrete)components of water retaining/ water flowing parts / buildings including foundations & super-structure of all the units of the proposed plant shall be of **minimum M-30 grade of concrete** or more as per the requirement of the design, except specificially mentioned for specific item elsewhere in tender. Minimum thickness and concrete grade of PCC (Plain cement concrete) for foundation base/footings of any unit of the proposed treatment plant shall be 100 mm and M-15.

(k) The structural designs of all the units shall have to be carried out as per the latest relevant IS codes, including the codes for wind load, earthquake loads etc.

(l) The necessary formwork and scaffolding for the RCC work shall be made of steel only.

(m) The contactor shall have to make his own arrangement for necessary water for construction and operation-maintenance

(n) **Foundation depth for footing type of foundation for any unit shall not be less than 2.00 meter in any case but up to the good soil for footings to rest. Tenderers shall carry out necessary soil test to arrive at foundation type and details.**

(o) Wherever soil stabilization is required, the minimum requirement shall be as under.

The soil shall have to be stabilized with 3% lime + 12% fly ash. The lime shall have minimum CaO content of 60%. The thickness of soil stabilization shall be minimum 325 mm. After stabilization, the contractor shall have to ascertain the soil bearing capacity that has been adopted in design, by carrying out necessary field tests.

(p) While designing the depth of the foundation for any units, the R.L. of the final disposal point shall be taken into consideration & accordingly the foundation / footing / base of all units shall be designed in structurally stable & sound manner. All relevant best engineering practice & relevant IS code to be followed.

(q) Expansion joints in RCC/brick structure of the proposed plant shall be designed and provided as per the requirement given in the latest relevant IS codes. It shall be provided by construction of double wall/column.

(r) The contractor shall have to take proper care at all the construction joints to prevent any kind of leakage. The contractor may or may not use PVC or rubber type water stopper as per design requirement

(s) The platform and staircase width shall be minimum 1200 mm.

(t) Monorail and chain pulley block (manually operated) shall be provided at all pump houses (both under ground and above ground) for handling of pumps / blowers / others equipments as required and each shall be of adequate capacity (minimum 1.5 times the weight of the equipment / single heaviest component). Monorail / Rail shall be extended to outside pumphouse / building to facilitate loading / unloading of equipment directly on vehicle, for which ramp approach shall be given.

(u) Adequate measure shall be taken to prevent dry running of the pump in all modes of operation i.e. manual as well as auto mode. Low level to trip the pump shall be above the top of pump casing. The sump floor shall slope towards suction pit / channel. Care must taken especially for under ground sludge sumps to provide suction pit of adequate size for emptying the sump for ease of maintenance.

(v) Effective liquid depth of units shall be considered between levels corresponding to lowest level switch and highest level switch. Flooded suction requires that lowest level switch shall not be lower than the elevation of discharge flange of pump. Displacer / Float type Level switches (in addition to level transmitter where specified for auto operation / alarms) shall be provided for dry run protection of pumps to trip the pumps irrespective of auto or manual mode of operation of the pumps.

(w) All pump areas / pedestals shall be provided with kerb walls and suitable arrangement for collection of leakage and connection to the nearest piping/unit,

keeping in mind the process requirement. In dry wells, necessary drain collection pit and dewatering pump of sufficient capacity and head requirement for auto operation with low & high level switches and alarm with high-high level switch shall be provded in all pump houses, especially underground pump house for this purpose.

(x) Vehicular approaches shall be provided to the units for operation and wherever required maintenance .

(y) Flushing connections shall be provided for all sludge handling units and sludge lines.

(z) At all the new units of STP and TTP, the outside plaster shall have to be carried out up to 300 mm below the Ground Level.

(aa) Access to all units / walkways / platforms shall be by RCC stairways except for valve and such operating platforms requiring occasional use where access with ladders shall be accepted.

(bb) The contractor shall have to construct the roads along with the road side kerb and PCC 1:3:6 pavements of 150 mm thick, for the approach of all the units. The road side kerb shall be of size 450 mm deep (total) and 75 mm thick. It shall be constructed in RCC M 20.

(cc) The cattle trap shall be provided at the entrance gate of TTP to restrict the entry of animals in the TTP campus

(dd) The Plinth Protection works to water retaining structures only shall be provided

(ee) At all the new units of STP, the outside plaster of 20 mm thickness sand faced double coat shall have to be carried out from top level of structure to 300 mm below the G.L. The inside plaster of water retaining structure shall be 20 mm double coat water proof plaster. The inside plaster for other structures shall be 12 mm thick smooth plaster.

(ff) Internal surfaces of all water retaining structures shall be white washed (Two Coats) from top level of structure to 500 mm below liquid depth or as specified for particular units in tender elsewhere.

(gg) The contractor shall have to provide storm drainage facility as per requirement. The storm drainage shall be open RCC M20 channel with RCC M20 grating / RCC NP3 class pipe drain with chambers. There should be no water logging in the plant premises.

(hh) The clear distance between adjacent pump / blower pedestal shall be minimum 1000 mm. The clear distance from pedestal to internal face of end walls shall not be less than 1500 mm. The clear distance from pedestal to internal face of walls on suction and motor side of the pumps shall not be less than 2000 mm.

(ii) Minimum clearance of 1000 mm shall be provided around pumps, blowers, equipment pedestal for paving etc.

(jj) Motors of all outdoor equipment shall be covered with canopy.

(kk) All chemical dosing pumps shall be provided with pulsation dampeners. Metering pumps shall have bypass with valves and external pressure safety valves.

(ll) Common delivery header and suction header of pumps (and blowers) shall be provided with a blind flange on one end.

(mm) All motors shall have running (on/off) & fault indication at MCC as well as at SCADA terminal. All starters shall be provided with auto / manual selector switch (with auto mode selection status input to PLC / SCADA) as well as with Local / Remote selector switch. The motors shall operate through PLC in auto mode and in manual mode it shall operate through push buttons at LCS when selected in

remote mode and from push button at MCC when selected for local mode. All stop push buttons shall be mushroom head stay put type with padlocking facility.

(nn) All variable frequency drives and soft starters shall be selected to provide current after suitable derating for 55°C continuous operating temperature equal to or above the rated current of driven motor.

(oo) PCC/PMCC shall be of single front type only. Similarly soft starter cubicles and VFD starter cubicles shall be in single front execution only.

(pp) Clear Distance between two Civil units should not be less than 5 m.

(qq) Knife Gate valves shall be provided for sludge application.

(rr) The reinforcement steel shall be CRS Fe-415 grade.

(ss) Doors, Windows and Ventilators shall be of aluminum glazed type with EZ section.

(tt) Carting of surplus excavated earth shall be within 5 Km radius.

(uu) The plinth level of all the building shall be min. 600 mm above FGL or HFL whichever is higher. The roof of the building (bottom of slab) shall be min. 3.6 m above plinth level or higher as required. It shall be constructed in RCC M 25.

(vv) All the building shall be provided with 1000 mm wide plinth protection of 75 mm thick in M 15 grade concrete laid over 150 mm consolidated rubble soling.

(ww) The gratings at the various units of the plant shall be made of MS FRP coated. All Valve chambers shall be covered with MS chequard plates with FRP coatings.

(xx) All cables within building shall be laid on cable trays or in cable trenches or both and for cables on walls / platforms of various buildings or civil units shall be laid on cable trays and all cables to be laid outside the building / outdoors shall be laid buried in ground. All cables trays shal be of medium duty GI and cable trenches shall be in constructed in RCC.

(yy) Except for pipes / channels for which minimum sizes are specified in tender specifications and in this specific requirement, fluid velocity to be considered in the design of balance pipes / channels / valves / gates shall be as under:

Gravity Flow Pipelines	0.75 m/sec to maximum 1.5 m/sec.
Pumping Suction Pipelines	1.20 m/sec to maximum 2.0 m/sec.
Pumping Discharge Pipelines	1.50 m/sec to maximum 2.5 m/sec.
Air Pipelines	15 m/sec to maximum 21 m/sec.

(zz) Wherever size (diameter) of any type of valve on any pipeline of any unit of the proposed plant is not mentioned in the tender, the same shall be considered as the full diameter of the pipeline proposed to be used.

(aaa) Necessary Drawings/details for Electrical/ Mechanical/ Piping/ Instrumentation/ SCADA shall also be prepared & submitted by the contractor for approval to SMC, prior to starting of work of the concerned discipline.

(bbb) Inter-disciplinary details for proper co-ordination between civil, electrical, mechanical, instrumentation, piping, SCADA etc. shall be clearly shown on the drawings with necessary cut-outs, puddles, insert plates etc., as per the requirement.

(ccc) Wherever, reference to any IS code is made in this tender for any material/equipment etc., it shall be referred for its latest revision.

(ddd) To avoid entry of birds, all windows, ends of girders and other large openings shall be covered with GI wire mesh.

(eee) Plantation in the campus of STP and TTP, including lawn, trees, shrubs, plants etc. shall have to be maintained by the contractor during the Operation and Maintenance period of ten years

(fff) All Civil units as well as electrical-mechanical items, painting work is included in the tender scope as a part of Capital Work, as per the painting work specification mentioned in the tender.

(ggg) **Apart from main energy meter, the contractor shall also install an individual Multi Function Meter for SPS, STP and TSTP. The contractor shall also install an individual digital energy meter at all the PMCC / MCC panels. The contractor shall have to submit the monthly report for energy consumption for SPS, STP and TSTP invariably.**

(hhh) **The contractor shall have to submit the monthly report for energy consumption for STP and TSTP invariably.**

(iii) **All indicative / measuring meters must be Digital type only.**

(jjj) **If any existing equipments/machineries under this contract replaced by new equipments/machineries, then existing equipments/machineries shall be property of contractor. The bidder shall have to quote the rate accordingly.**

(kkk) **All the motors shall be of low RPM, i.e. <1000 RPM, except the motors used for high pressure pumps for UF and RO system and Process Air Blowers. For UF and RO system contractor shall supply motors with <1500 RPM.**

BRIEF PROCESS DESCRIPTION OF UNITS FOR PROPOSED 40 MLD TTP

The treatment plant is designed based on the following basis:

- Final treated water quantity (nett output) : 40 MLD
- UF Recovery attained / designed : ≥ 88%
- UF Flux LMH : ≤35 (Max)
- UF Membranes: Modified /Reinforced PES having good antifouling properties
- RO Recovery attained / designed : ≥ 75 %
- RO Flux LMH : ≤17 (Max)

TTP PROCESS DESIGN

PRE-TREATMENT STAGE:

The pre-treatment stage is to condition the treated sewage as to minimize wear & tear to mechanical equipments in the downstream and reduces the fouling on the reverse osmosis plant, hence will operate with as little downtime for membrane cleaning in place (CIP) process as possible. Pretreatment stage is aimed to removal of suspended solids, colloidal matters, Silica and making treated sewage suitable for feeding into membrane systems for their longer life and expected performance. In practice, this is measured using SDI 15 mins fouling index measurement technique. The feed water to the RO will be designed to achieve an SDI value lower than 3 after the pretreatment processes.

Chlorination Prior to UF:

Continuous chlorination of UF feed water may be applied, if required. However, a suitable de-chlorination provision (SMBS injection) shall be provided at the RO inlet to prevent the RO membranes from exposure to any traces of chlorine.

Provision for shock chlorination (high dose of chlorine for short period of time) shall be

provided prior to the UF Units. Shock chlorination of upto 10 ppm for 30minutes to 1 hour (Max) three times in a week shall be considered.

ULTRAFILTRATION

The ultra-filtration stage is to condition the combined treated waste water so that the reverse osmosis plant will operate with as little downtime for CIP as possible. Expected water quality from the STP is to be of low turbidity, however the fouling nature of this on reverse osmosis membranes is still high and so the ultra-filtration is required to lower the colloidal fouling potential to acceptable levels. In practice this is measured using SDI15 fouling index measurement technique. The feed water to the RO will be designed to have an SDI lower than 3 following the ultra-filtration.

The fifteen minute Silt Density Index (SDI15) of the filtrate shall not exceed 3.0 during 95 percent of the time and shall never exceed 4.0

To achieve the above objectives the pretreatment plant scope of works includes:

- Chlorination, if required.
- Manual strainer
- Ultra-filtration
- Filtered water storage
- UF backwash pumps
- UF CIP system

Manual Strainer:

The Filtering process raw water enters the filter inlet through the coarse screen which protects the cleaning mechanism from large debris. The water passes through the fine screen, trapping dirt particles which accumulate inside the filter. Clean water flows through the filter outlet.

The gradual dirt buildup on the inner screen surface causes a filter cake to develop, with a corresponding increase in the pressure differential across the screen. A pressure differential switch senses the pressure differential and when it reaches a pre-set value, the cleaning process begins.

The Strainer shall be manual wedge wire type and shall have maximum rating of 200 microns.

Ultra-Filtration:

Ultra-filtration shall be provided to filter the screened clarified water. This will remove many of the colloidal particles remaining in solution and produce filtered water with low SDI and turbidity. The primary purpose of the UF system is to remove sub-micron particles including bacteria, large colloids and other suspended solids from the treated effluent to improve the performance of the downstream RO process by reducing fouling and minimising the chemical cleaning requirements. The secondary purpose of the UF System is to serve as one of the "multiple barriers" to the micro-organisms.

Total 8 Nos. of UF Trains (7W + 1S) must be provided. Each Rack must be equipped with provision to mount additional 20% (minimum) membranes in future and the hardware (feed pump, backwash pump and piping, must all be sized based on this

requirement). Space must also be provided in the layout for installing one additional skid at a later date, if required.

Guaranteed Performance Requirements:
The filtrate turbidity for any 24-hour period shall not exceed 0.5 NTU.

The fifteen minute Silt Density Index (SDI15) of the filtrate shall not exceed 3.0 during 90 percent of the time and shall never exceed 4.0

Flushing
The UF system shall be configured such that individual trains can be flushed or backwashed with RO permeate water during periods of extended reduced flow or standby.

Spare Capacity

The bidder shall provide additional "spare" space in the UF skids, layout and foot print such that additional modules can be readily installed into each of the membrane skids to provide 20% (minimum) additional membrane area per train and operate at a reduced flux in the future, if considered necessary.

Space and pipe connections provided for this additional 20% membrane area shall be shown on the detailed design layout, to allow for future installation of additional membrane area, in case of deterioration of feed water quality.

The bidder shall also provide sufficient space for the possible future addition of one(1) complete UF skid.

Membrane and Rack MOC Requirements:

Membrane Fibres: Modified / Reinforce PES
Module Body: PVC-U/ SS 316
Filtrate headers: PVC-U/ SS 316
Filtrate Pipes: PVC-U/ SS 316
Frames: 10037 (CS/MS) C4 coated

UF Backwash Water Storage:

Water from this UF permeate tank shall be used as Feed water to the RO trains. Some of the water is used to backwash the Ultra Filtration trains to maintain the operating flow/flux of the membranes

UF CIP system

A CIP system is provided for the ultra filtration plant. This can be used to undertake maintenance or recovery cleans of the UF membranes to maintain plant performance

In order to feed Reverse Osmosis system with desired and consistent quality of water Ultra-Filtration is selected as pre-treatment.

UF SYSTEM OPERATION:

The UF system consists of the following modes of operation:

- **Service Cycle:**

The UF membrane system will operate on an out-to-in mode where the feed stream flows on the outside of the membrane with the filtrate flowing through the inside.

To maintain a minimum cross – flow velocity, some of the reject stream shall be re-circulated to prevent the accumulation of solids on the surface of the membrane. The balance of the reject stream shall be bled-off to prevent the build-up of solids in the re-circulation loop. Such feed and bleed operation allows the UF to operate continuously before the need for backwash thereby improving recovery and availability of the system.

- **UF Backwash (BW) Cycle:**

With the accumulation of solids during filtration, the resistance to flow will increase which can be overcome by subjecting the membrane to a reverse flow, with the product water Air-scouring is also introduced concurrently to improve the effectiveness of the Backwashing. This backwashing operation shall be carried out periodically which can be predetermined by either total flow or elapsed time. The overall system will be controlled such that only one train will undergo backwashing at any one time. The backwash stream is discharged to the waste sump.

- **Maintenance Cleaning (MC):**

To maintain optimum filtration efficiency, periodic chemical cleaning of the membranes is required. MC is an automated sequence meant for short-term regaining of permeability, which is a short duration cleaning with chlorine and citric acid as per pre-set schedule with minimum stoppage of the system. The frequency of maintenance cleaning is dependent on the raw water quality and its variation. The expected frequency of this short term cleaning is 48-72 hours.

- **Recovery cleaning (RC):**

An extensive cleaning procedure requires longer stoppage on a process train for permanent regaining of the membrane permeability and performance. The membranes are subjected to a regime of soak and flush cycle which will remove the foulants or contaminants that cannot be removed by backwashing alone. Similar to MC, frequency of RC is dependent on the feed water quality and its variation; the expected frequency of this long term cleaning is once in 15-25 days

UF CIP SYSTEM:

A dedicated cleaning in place system will be provided for Ultra filtration system which consists of one number chemical preparation tank, Two (2) numbers of CIP pump & its necessary accessories.

ACID, SMBS AND ANTISCALANT DOSING SYSTEM:

The UF product water is then dosed with acid (if required) for bringing down the pH is aimed to reducing the LSI as per the membrane manufacturer's recommendation, which will enhance the life of membranes and In case any chlorine passes though, the Oxidation Reduction Potential (ORP) meter senses the free chlorine and trips the RO High pressure Pump. This

automation is to ensure that the chlorine water will not enter the RO Plant as the chlorine will hydrolyse the RO Membranes. Further to ensure that the RO membranes are protected from any accidental exposure to Chlorine(free), SMBS dosing shall be provided at the RO inlet. This SMBS dosing shall be manadatory.

The RO feed water has high scaling potential especially due to Silica, CaCO3, CaSO4 and CaF2, which are harmful to membranes and hence an on-line antiscalant dosing is provided for controlling the scaling and fouling tendency of the feed water. The Sodium hypo chlorite reacts with the ammonia present the water produces the chloramines. Chloramine can further react with sodium hypochlorite and gives sodium hydroxide and dichloramine which minimise/prevent bio fouling in reverse osmosis system.

All dosing system shall be provided at the inlet of final Micron Cartridge filters (5 microns). The dosing points shall have enough residence/ reaction time in the piping and no two dosing points shall be provided near to each other (minimum distance shall be maintainedas per manufacturer recommendation) to avoid any unnecessary reactions and by products.

Data Sheet of UF System:

Sr. No.	Particulars	Details
1	UF Feed Flow Rate	57 MLD (Average), 60 MLD Maximum
2	Recovery from UF System	88-90%
3	UF Filtrate Flow	50 MLD
4	Nos. Of Skids	8 Nos. (7W+1S)
5	UF Feed Flow Rate / Skid	357.14 m^3/hr
6	UF Filtrate Flow / Skid	297.61 m^3/hr
7	Type of Membrane	Hollow Fibre
8	Type of Membrane Mounting	Vertical
9	Active Filtration Area / Membrane	55 – 60 m^2
10	Mode of Operation	Crossflow/Dead End
11	Pore Size (nominal)	< 0.012 microns
12	Feed Temperature	Max 40°C
13	Design Flux Rate (When all trains are in operation)	35 lmh
14	Allowable TMP Filtration	1.5 bars
15	Chlorine Resistence (Normal)	Max 200 ppm
16	MOC of Membrane	PESM/Reinforced PES
17	MOC Membrane Housing	PVC-U / SS 316
18	MOC of Racks	PVC-U / CS (with powder coated paint)

REVERSE OSMOSIS UNITS:

Reverse Osmosis process is a membrane process in which a synthetic semi-permeable membrane is used to separate water from dissolved impurities. When a semi-permeable membrane separates a dilute and concentrates solution of salts, due to osmosis, the water from the dilute solution side passes through the membrane to the concentrated side till osmotic equilibrium is attained. Now, if the pressure is applied and increased gradually on the concentrated side, the flow of water continues to reduce till the applied pressure reverses the direction of flow of water and water from the concentrated side enters the dilute side. This process is called the Reverse Osmosis. It is very essential to ensure that the water fed to reverse osmosis membranes is free from particulate matter to prevent membrane fouling. Also, the water should be free from organic matter, heavy metals and oxidizing agents like free chlorine. Thin Film Composite Semi Permeable Membranes under the influence of external pressure will undergo the process of Reverse Osmosis separating high TDS water into Very Low TDS Permeate (more than 99% salinity rejection) and Very Highly TDS Reject streams. The RO system consists of minimum 5trains. The RO membrane shall be selected as low pressure / high pressure typr as per bidder's own design.

The partially blending of the RO permeate (30 MLD) with UF filtered water (10 MLD) will make suitable treated water quality (TDS < 500 ppm) as required.

LIMITING CONDITION OF FEED WATER TO RO UNIT

- SDI : <3
- Temperature : 40 deg. C (max.)
- Free chlorine : Nil or as per design
- Oil and grease : Nil or as per design

9.0	**REVERSE OSMOSIS (RO) SYSTEM**	
	A. CARTRIDGE FILTERS	
	Rated flow (m^3/h)	444.40 per Cartridge Housing
	Total flow(m^3/h)	1777.77 (4W Filter + 1 SB Filter)
	Micron rating (microns)	5 (Nominal)
	MATERIAL OF CONSTRUCTION	
	Cartridge filter membrane	PP
	Shell	SS316L
	Type of cartridge	PP wound
	B. RO Trains	
	System Manufacturer	Toray / Ovivo / Hydranautics
	Number of RO Trains	4 Nos. Working
	Feed Flow rate (m3/hr) per train	444.4

	Permeate Flow rate (m3/hr) per train	312.4
	Total Recovery	75% (single pass)
	Number of stages per train	2 Stages
	Pressure Vessel in Stage _1____	As per design
	Pressure Vessel in Stage __2___	As per design

SILT DENSITY INDEX

The SDI of feed water to RO shall be kept below 3 for a continuous operation of the RO plant. The SDI is a measure of colloidal particles in the feed water and hence SDI value of 3 indicates that the feed water has very low content of colloidal particles. This ensures minimal colloidal fouling of RO membranes. This test shall be carried out once in a week and its value recorded.

BACTERIAL CONTAMINATION

The feed water to RO shall be free from bacterial contamination. The check for bacterial content (CFU per ml) shall be carried out once a day and action initiated to minimize membrane fouling.

ORGANIC CONTAMINATION

To minimize organic fouling of membranes, it is necessary to monitor this parameter once a day and cleaning of membranes as per recommended procedure should be followed. The frequency of cleaning will have to be determined by RO plant operating conditions.

OIL & GREASE

The Oil & Grease should be NIL or as per membrane design requirements. The presence of it in the feed water to RO, severely affects the membrane performance. The presence of Oil and Grease physically fouls the membrane and make it ineffective, which is then very difficult to remove even by cleaning.

TEMPERATURE

The operating temperature of feed water shall not be exceeding 40 deg. Celsius or as per design requirements.

FREE RESIDUAL CHLORINE (FRC)

FRC at inlet to RO shall be monitored at least once a shift and recorded, as presence of FRC is detrimental to the performance of membrane.

RO CIP SYSTEM:

Reverse Osmosis membranes need periodic cleaning and servicing. For optimal performance specific chemicals are required, depending on the cause of the pollution.

Scaling

Scaling is concerned with the seclusion of suspended inorganic particles, such as calcium carbonate, barium sulfate and iron compounds.

Fouling

Fouling is concerned with the seclusion of organic, colloidal and suspended particles. Bacteria and other microorganisms that decompose these particles will create substrates. As a consequence they will grow and develop further.

It is very important to purify the membrane preventively. In many cases regular mild cleaning is better than cleaning periodically with an aggressive cleaning product. The membrane will than last longer.

S.No	Type of scaling	Cause
1.	Calcium Carbonate Scaling	Mainly Occurs with the high presence of Calcium
2.	Bio-film Formation	Growth of micro Organism on the membrane
3.	Organic Deposits	Oil & Organic Substance formation

A dedicated cleaning in place system will be provided for reverse osmosis system which consists of one number chemical preparation tank with agitator, Two (1W + 1 S) numbers of CIP pump & one number of 10 micron cartridge filter.

REJECT CUM WASTEWATER TREATMENT:

The reject from UF / RO will be subject to chemical treatment for rejection of mainly Suspended Solids and Organic matter. For this, the Bidder will provide the chemical treatment system which includes Flash Mixers, Clariflocculator, Chemical Dosing System and Sludge Dewatering System. The Bidder will design the system considering reject flow and wastewater flow from TTP. The reject flow will be pumped to Flash Mixer units and subsequently taken to Clariflocculator unit. The overflow from the Clariflocculator shall be connected to existing nearest point of treated sewage disposal line of Dindoli STP. The required Alum / PAC dosing system with pumps will be provided for chemical treatment. The sludge shall be dewatered in the existing centrifuge unit. The required Polyelectrolyte Dosing system including dosing tanks and pumps shall also be provided for sludge dewatering system. The dewatered sludge shall be disposed off into existing landfill site from the treatment facility at Dindoli.

One no. of Clariflocculator unit of 26.10 m dia with 4.0 m SWD will be designed and constructed by the Bidder for reject / wastewater treatment of the present TTP Plant. The operation and maintenance of the same will be responsibility of the successful bidder of proposed TTP.

DATA SHEETS FOR 40 MLD (Nett Output) TERTIARY TREATMENT PLANT

No.	ITEM/DESCRIPTION	PARTICULARS
1.	**UF FEED PUMP**	
	• Manufacturer	
	• Type	Verticle Turbine
	• Model No.	
	Number of working Pumps	2 Nos.
	Number of standby Pumps	2 Nos.
	Design Flow (m^3/hr) each	1250.0 m^3/hr

No.	ITEM/DESCRIPTION	PARTICULARS
	Design Head (m)	As per design
	• MOC:	
	Casing	1.5% NiCl
	Impeller	CF8M
	Shaft	SS 410
	Sleevs	SS 410
	Base Plate	Epoxy Coated MS
	Suction Pipe	SS 316
2.	**STRAINERS**	
	• Manufacturer	As per Tender List
	• Materials of construction:	
	• Body	SS 304
	• Screen	SS 304
	• Backwash valve	SS 304
	• Backwash arm and internals	SS 304
	• Seals	Mechanical
	Screen size (Micron)	200
	Screen type	Manual
	Number of units (Working)	4 Nos.
	Number of units (standby)	1 No.
	Design Flow (m3/hr)	625.0
3	**ULTRAFILTRATION SYSTEM**	
	A. Membranes	
	Nominal Molecular cut of weight	1,20,000 daltons
	Membrane material	Modified /Reinforced PES
	Membrane configuration	Hollow Fibre, Vertical
	Active Membrane area per module , m2	55 – 60 m^2
	Max. module operating temperature	8.2 bars @ 20^0C & 5 bars @ 40^0C
	Module operating pH range	pH 3 to pH 10

No.	ITEM/DESCRIPTION	PARTICULARS
	B. Loading	
	Design flux (When all trains in Operation)	35 lmh (Max)
	Number of train	7 W + 1 S
	Trans membrane pressure (TMP)	Max 1.5 bars
	C. Backwash	
	Interval	Min 20 mins – max 45 mins
	Backwash duration	55 s to 60 s
	Recovery (Min)	88 – 90%
	D. Cleaning	
	Anticipated cleaning interval @ design flux	As per process requirement
	Cleaning solution makeup water	RO Permeate / Process Water
4.	**UF BACKWASH PUMP**	
	• Manufacturer	As per Vendor List
	• Type	Horizontal Centrifugal
	• MOC Casing/Impeller	CF8M
	Design Capacity (m^3/hr)	As per Membrane Manufacturer design
	Design head (m)	As per design
	Number of working units	1 No.
	Number of standby units	1 No.
5.	**UF CEB – NaOCl DOSING PUMP (If required)**	
	• Manufacturer	As per Vendor List
	• Type	Simplex Diaphragm Type
	• MOC	
	Liquid end	PP
	Valve and Valve Seat	PTFE
	Plunger	CS
	Diaphragm	PTFE
	Design Capacity(m3/hr)	As per design
	Design head (m)	As per design

No.	ITEM/DESCRIPTION	PARTICULARS
	Number of working units	1 No.
	Number of standby units	1 No.
6.	**UF CEB – NaOH DOSING PUMP (If required)**	
	• Manufacturer	As per Vendor List
	• Type	Simplex Diaphragm Type
	• MOC	
	Liquid end	PP
	Valve and Valve Seat	PTFE
	Plunger	CS
	Diaphragm	PTFE
	Design Capacity(m3/hr)	As per design
	Design head (m)	As per design
	Number of working units	1 No.
	Number of standby units	1 No.
7.	**UF CEB – CITRIC ACID DOSING PUMP (If required)**	
	• Manufacturer	As per Vendor List
	• Type	Simplex Diaphragm Type
	• MOC	
	Liquid end	PP
	Valve and Valve Seat	PTFE
	Plunger	CS
	Diaphragm	PTFE
	Design Capacity(m3/hr)	As per design
	Design head (m)	As per design
	Motor Rating (KW)	
	Number of working units	1 No.
	Number of standby units	1 No.
8.	**UF CIP TANK – NaOH + NaOCl and HCL**	
	Diameter (m)	As per design
	Height (m)	As per design
	Tank Operating (useable) volume (M^3)	As per design
	Material	FRP / GRP
	Number required	1 No.

No.	ITEM/DESCRIPTION	PARTICULARS
9.	**UF CIP PUMP - NaOH + NaOCl**	
	• Manufacturer	As per Vendor List
	• Type	Horizontal Centrifugal end suction Pump
	• MOC: Casing/Impeller	CF8M
	Design Capacity (M^3/hr)	As per design
	Design head(m)	As per design
	Number of working units	1 No.
	Number of standby units	1 No.
10.	**UF CEB PUMP – HCL / Acid**	
	• Manufacturer	As per Vendor List
	• Type	Horizontal Centrifugal end suction Pump
	• MOC: Casing/Impeller	CF8M
	Design Capacity (M^3/hr)	As per design
	Design head(m)	As per design
	Number of working units	1 No.
	Number of standby units	1 No.
11.	**RO FEED PUMP**	
	• Manufacturer	As per Vendor List
	• Type	Horizontal Centrifugal end Suction
	Flow rate at duty point (m3/hr)	444.40 m^3/hr each
	Design Head (m)	120 m
	Number of units	6 Nos. (4W + 2S)
	MOC:	
	Casing	CF8M
	Impeller	CF8M
	Shaft	SS 316
	Sleeve	SS 316
	Base Plate	Epoxy coated MS
12.	**REVERSE OSMOSIS (RO) SYSTEM**	

No.	ITEM/DESCRIPTION	PARTICULARS
	A. CARTRIDGE FILTERS	
	Rated flow (m^3/h)	444.40 per Cartridge Housing
	Total flow(m^3/h)	1777.77 (4W Filter + 1 SB Filter)
	Micron rating (microns)	5 (Nominal)
	MATERIAL OF CONSTRUCTION	
	Cartridge filter membrane	PP
	Shell	SS316L
	Type of cartridge	PP wound / as per requirement
	B. RO Trains	
	System Manufacturer	Toray / Ovivo / Hydranautics
	Number of RO Trains	4 Nos. Working
	Feed Flow rate (m3/hr) per train	444.40
	Permeate Flow rate (m3/hr) per train	312.4
	Total Recovery	75% (single pass)
	Number of stages per train	2 Stages
	Pressure Vessel in Stage _1____	As per design
	Pressure Vessel in Stage __2___	As per design
13.	**RO CIP TANK**	
	Manufacture	As per Tender
	Diameter	As per Design
	Height	As per Design
	Tank Operating (useable) volume	As per Design
	Material	GRP / FRP / PP
	Heating Arrangement	To be provided
14.	**RO CIP PUMP**	
	• Manufacture	As per Vendor List
	• Type	Horizontal Centrifugal end suction
	• MOC: Casing/Impeller	CF8M
	Design Capacity (m3/hr)	As per design
	Design Head (m)	As per design
	Number of working units	1 No.
	Number of stand by units	1 No.
	Micron cartdrige filter required	To be provided

No.	ITEM/DESCRIPTION	PARTICULARS
15.	**RO FLUSH PUMP**	
	• Manufacture	As per Vendor List
	• Type	Horizontal Centrifugal end suction
	• MOC : Casing/impleller	CF8M
	Design Capacity (m^3/hr)	As per design
	Design head (m)	As per design
	Number of working units	1 No.
	Number of stand by units	1 No.
16.	**DOSING SYSTEM**	
	SODIUM HYPOCHLORITE STORAGE AND DOSING TANK	
	• Volume	20 m^3
	• Dimension – diameter	As per design
	• Dimension – Height	As per design
	• Material Of Construction	GRP / PP
	ANTISCALANT STORAGE AND DOSING TANK	
	• Volume	5 m^3
	• Dimension – diameter	As per design
	• Dimension – Height	As per design
	• Material Of Construction	GRP / PP
	HCL / H2SO4 STORAGE AND DOSING TANK	
	• Volume	20 m^3
	• Dimension – diameter	As per design
	• Dimension – Height	As per design
	• Material Of Construction	MS
	SODIUM HYDROXIDE STORAGE AND DOSING TANK	
	• Volume	10 m^3
	• Dimension – diameter	As per design
	• Dimension – Height	As per design

No.	ITEM/DESCRIPTION	PARTICULARS
	• Material Of Construction	GRP / PP
	RO FEED ANTISCALANT DOSING PUMP	
	Manufacturer	As per Vendor List
	Type	Simplex Diaphragm Type
	Flowrate (LPH)	As per design
	Operating head (m)	30 m
	Number of units (Working)	1 No.
	Number of units (stand by)	1 No.
	RO FEED SMBS DOSING PUMP	
	Manufacturer	As per Vendor List
	Type	Simplex Diaphragm
	Flowrate (LPH)	As per design
	Operating head (m)	30 m
	Number of units (Working)	1 No.
	Number of units (stand by)	1 No.
	RO FEED HCL / H2SO4 DOSING PUMP	
	Manufacturer	As per Vendor List
	Type	Simplex Diaphragm
	Flowrate (LPH)	As per design
	Operating head (m)	30 m
	Number of units (Working)	2 Nos.
	Number of units (stand by)	1 No.
17A.	**UF FEED SUMP**	
	No. of unit	1 No.
	HRT	30 min
	Design flow	41.66 m^3/min
	Volume	1250 m^3 (minimum)
	MOC	RCC M30
17B.	**RO FEED TANK**	

No.	ITEM/DESCRIPTION	PARTICULARS
	No. of unit	1 No.
	HRT	15 min
	Design Flow	29.62 m^3/min
	Volume	444.4 m^3 (min)
18.	**ACTIVATED CARBON FILTERS**	
	Total flow (m^3/h)	208.33 (2W Filter + 1SB Filter)
	Operating Press (kg/sqcm)	* (0.5 to 2.5 / or as per manufacturer's recommendation)
	Pressure drop at design flow should not exceed (kg/sqcm)	* (0.08 / or as per manufacturer's recommendation)
	Backwash Pressure (kg/sqcm)	* (0.5 to 2.5 / or as per manufacturer's recommendation)
	Empty Bed Contact time (minutes)	* (not less than 5)
	Carbon	Liquid Phase activated carbon
	Construction	Carbon steel Epoxy coated tank of adequate shell thickness or Fibre Reinforced Plastic (FRP) / Equivalent
19.0	**ANCILLARY ITEMS**	
19.1	**COMPRESSED AIR SYSTEM – PROCESS**	
	A. Air Compressors:	
	• Number (working)	2 Nos.
	• Number (Standby)	1 No.
	• Type	Screw
	• Capacity (m3/hr)	As per design
	• Design Pressure (m)	As per design
	B. Air Receiver:	
	• Number	As per requirement
	• Type(i.e vertical, cylindrical)	Vertical
	• Material of construction	MS
	• Volume	2.5 M^3
	• Design pressure (m)	As per design

No.	ITEM/DESCRIPTION	PARTICULARS
	C. Process Air Regulator Assembly:	
	• Number	As per requirement
	• Type	Spring loded
	• Minimum Design Inlet Pressure	8 bar
	• Minimum Design Outlet pressure	1 bar
20.	**RO REJECT CHEMICAL TREATMENT UNITS**	
	A. Flash Mixer	
	• No. of units	One No.
	• Design Flow – Each	18 MLD
	• Retention period	60 Seconds
	• Capacity	As per design
	• Size	As per design
	• Material of Construction	RCC
	Mixer	
	• No. of Mixers	One No.
	• Type	Turbine
	• Material of Construction	SS 304
	B. ALUM/PAC DOSING TANKS & MIXER	
	• No. of units	2 Nos. (1W + 1S)
	• Capacity	As per design
	• Size	As per design
	• Material of Construction	RCC with inside Epoxy Painted
	Mixer	
	• No. of Mixers	Two Nos.
	• Type	Turbine Type
	• Material of Construction	SS 304
	C. CLARIFLOCCULATOR	
	• No. of units & capacity	1 No., 18 MLD
	• Surface Loading	40 $m^3/m^2/day$

No.	ITEM/DESCRIPTION	PARTICULARS
	• Size of CLF	26.10 m dia
	• Side water depth of CLF	4.0 m
	• HRT of clarifier Zone	2.0 hr (min.)
	• Size of flocculator	10.3 m diameter
	• LD of flocculator	3.8 m
	• Free Board	500 mm
	• Material of Construction	RCC M:30
	• Desludging arrangement	sluice valve for sludge
	• Inlet Pipe	DI K-7
	• Inside finish	40 mm th.IPS on bottom raft and 20 mm th.smooth double coat cement plaster on vertical walls with water proofing treatment.
	• Outside finish	20 mm th.sand face plaster
	• Platform	1.2 mt. Wide RCC M30 on every common & outer wall of clarifier
	• Railing	G.I. (Class-B) pipe riling with epoxy paint
21.	**DIRTY WATER SUMP**	
	No. of Unit	1 No.
	Volume of sump	600 m^3
	Pump:	
	No. of Pump	2 Nos (1W + 1S)
	Capacity	300 m^3/hr
	Head	18 M
	Type	Submersible
	Sp Gravity	1.02
22.	**CENTRIFUGE FEED SUMP AND PUMP HOUSE**	
	Sump	

No.	ITEM/DESCRIPTION	PARTICULARS
	No. of unit	1 No.
	Capacity	15 m^3 (min)
	Pump House	
	Size	5 m x 6 m
	No. of pump	2 Nos. (1W + 1S)
	Capacity of Pump	20 m^3/hr
	Head	18 m
	Sp Gravity	1.03
23.	**POLYELECTROLYTE DOSING TANKS & MIXER (for Dewatering Unit)**	
	• No. of units	Two Nos. (1W+1S)
	• Capacity	3.37 m^3
	• Size	1.5 mx 1.5 m x 1.5 m LD
	• Material of Construction	RCC with inside Epoxy Painted
	Mixer	
	• No. of Mixers	Two Nos.
	• Type	Turbine Type
	• Material of Construction	SS 304
	Dosing Pump	
	No. of Pump	2 Nos. (1W + 1S)
	Capacity	150 LPH each @2.0 kg/cm2
24.	**PIPE WORK**	
		MOC
	• UF feed after strainers	GRP/UPVC
	• Filtrate	GRP/UPVC
	• Compressed air	GI or equivalent
	• Filtrate exhaust	GRP/UPVC
	• Backwash waste	GRP/UPVC
	• HP RO feed	SS 304
	• Interstage RO permeate	UPVC
	• RO Permeate	UPVC
	• RO Concentrate	SS

No.	ITEM/DESCRIPTION	PARTICULARS
	• UF CIP / CEB flow	UPVC
	• RO CIP flow	UPVC
	• RO flush	UPVC / SS
	• Anti-scalant	PE/CPVC
	• Sodium hydroxide and proprietary chemical	PE/CPVC
	• Sodium hypochlorite	PE/CPVC
	• HCL / H_2SO4	PE/CPVC/MS PTFE
	• Potable water (safety shower)	UPVC
	• SMBS	UPVC

COLLECTION AND ANALYSIS OF SAMPLES AND GUARANTEES

The guaranteed treated water quality shall be as per the quality specified elsewhere in the tender and for nett output of 40 MLD and shall be measured on the following basis for existing as well as newly proposed TTP.

1. **The output guarantee for the TTP shall be based on 330 days of operation in a year, the rest being days for maintenance downtime.**The above operational days will not include the mandatory shutdowns required by GEB/ End Users/ Force Majeurs conditions and the production loss on account of the same, shall not form part of the guaranteed nett output.
2. Water produced during the Process Gurantee Trial Run and/ or start up time to achieve the process stabilisation shall be attributedfor guaranteed quantity calculations.Moreover,the agency shall produce and supply treated product water to Pandesara industries as minimum 2/3rd of input quantity in case of inflow less than 60 MLD.
3. The Client shall provide input quality to TTP as per tender and any change of input quality shall not be considered for the treatment to avoid upset of membrane process .
4. The complete analysis of composite samples collected on 24 hour basis shall be consider for the guarantee purpose.
5. Analysis of grab samples collected at every 4 hours (except BOD 5-day test) for routine traking of efficiency of the plant.
6. IS:2488 (methods of sampling and test for individual effluent).

The details of the testing and trial run and Gurantee Trial Run shall be worked out jointly with SMC's representatives on completion of the plant.

1.22 Electrical & Instrumentation Works

It shall be the Contractor's responsibility to obtain adequate incoming HT power from State Electricity Authority based on the maximum demand load. The Employer will pay the charges for obtaining the above connection whereas

necessary liasoning for the same shall be done by the Contractor in consultation with Dy. General Manager and Ex. Engr. (Drainage).

The entire Plant shall be operated on 415 V, 3-Phase, 50 Hz, 4-Wire system. The Contractor's Scope of Work shall include the following:

- Obtaining incoming HT Power from State Electricity Authority including necessary liasonoing, documentation etc. complete.
- HT Cable with Termination Kit from "Source" to the Electrical HT Substation located at the Sewage Treatment Plant.
- HT Substation including 2-Pole Structure, Metering Kiosk, HT Panel, Transformers, PMCC, etc. complete.
- Motor Control Centres.
- Cabling including HT cable, Power, Control and Instrumentation Cables.
- Earthing for Electrical equipments as well as Instruments.
- Internal Lighting in Buildings.
- External Lighting.
- Local Push Button Stations near respective Drives.
- Any other item / accessories required for successful completion of the project.

The Contractor shall design/execute the System as per standard specifications, I.E. Rules and Regulations, requirements of State Electricity Board and other local Authorities and actual site conditions.

Also, the Contractor shall provide adequate automation for fully automatic operation of the entire Tertiary Sewage Treatment Plant through a Programmable Logic Centre (PLC) and Supervisory Control and Data Acquisition (SCADA) with Man-Machine Interface (MMI). Provision shall also be made to operate each Unit of the Plant manually, if required.

Bidder shall refer electrical specifications for further requirements / detailed specifications.

1.23 PLC/PC/SCADA BASED AUTOMATION SYSTEM FOR PLANT

The entire Tertiary Sewage Treatment Plant shall be designed for fully automatic operation through a Programmable Logic Centre (PLC) and Supervisory Control and Data Acquisition (SCADA) with Man-Machine Interface (MMI). Provision shall also be made to operate each Unit of the Plant manually, if required.

Salient features of the proposed System shall be as follows:

- Dynamic display of all Units, Equipments and Drives shall be available on SCADA Screen.
- Auto/Manual operation of each Drive shall be made by selecting a Soft Switch on SCADA Screen.
- In Auto mode, each Drive shall operate based on pre set sequence and interlock.
- In Manual mode, each drive shall be operated in Local/Remote mode by selecting a Soft Switch on SCADA Screen. In Local mode, each Drive shall be operated from the Local Push Button Station (LPBS) located nearby. In Remote mode, operation

from LPBS shall be disabled and each Drive shall be operated manually from PLC. Also Working/Standby selection of Drives shall be done by selecting a Soft Switch on SCADA screen.

- Run/Trip indication of all Drives shall be displayed on SCADA screen.
- Annunciation & Alarm facility shall be available in PLC/SCADA. In the event of a Fault, the symbol representing the Equipment/Drive shall continue flashing on SCADA Screen with Equipment/Drive description appearing at bottom of the SCADA Screen and electric Hooter shall continue blowing until the Fault Alarm is acknowledged.
- Data logging of Running Hours of each Drive, Alarm and Historical Trends of monitored Parameters etc shall be envisaged in SCADA.
- The new Automation system must be communicate and Hook up with existing PLC based SCADA System. Each and every thing required to make entire system as a single unit including old system must be incorporated.

Bidder shall refer instrumentation specifications for further requirements / detailed specifications.

1.24 MINIMUM UNIT SIZING

Bidder to note that Minimum Unit Sizing for proposed 40 MLD Net Output capacity TSTP shall be atleast as mention in this Chapter.

Note:- The sizes of units specifed are the minimum requirement and contractor shall provide the above mentioned minimum or higher sizes units as required during detailed engineering. However, for tanks & sumps contractor may revise the size as per process requirement / detailed engineering subject to maintaining the min. effective volume as worked out from above minimum sizes.

Signature of Contactor

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

18. SPECIFICATIONS FOR CIVIL AND STRUCTURAL WORKS

A. GENERAL

I Scope :

a. This specification gives the general design requirements and manners of construction of all civil and structural works, the scope of which is given separately.

b. Placing in position and fixing of all mechanical items, insert plates, sleeves, anchor bolts are also part of work covered by this specification.

c. Contractor shall be responsible for the designs and construction of all RCC works, structural steel and other relevent civil works.

d. The contractor shall submit to the SMSS all the design calculations and drawings for substrcture, superstructure and all other connected works for approval. However the approval of the drawings by the SMSS does not absolve the contractor of his responsibilities regarding the soundness of the structure.

e. The contractor shall sumbit a schedule of drawings proposes to make in line with the time schedule included elsewhere in these specification. The contractor shall submit necessary prints at the time of submissions for approvals and final records.

II Design :

a. The design shall generally be on the basis of structural design specifications enclosed herewith.

b. All structures/part of structures in contract with water shall be designed as water retaining structures as per IS 3370 parts I to IV [latest revision].

c. Soil data to be used for the design of the structures shall be as per the enclosed recommendations.

III Construction :

a. The construction shall be done as per latest relevant Indian standards.

DESIGN SPECIFICATIONS :

Scope :

The design criteria given herein establish the minimum basic requirements for design of reinforced concrete, structures and structural steel works.

IV Codes and Standards :

a. Design loads in building : IS : 875.

b. Concrete Structures :

- General Purpose : IS : 456
- Raft foundations : IS : 2950
- Machine foundations : IS : 2974
- Water retaining Structures. : IS : 3370

c. Steel Structures :

- Structural steel in General buidling constn : IS : 800
- Steel tubes in general buidling construction : IS : 806
- Metal arc welding for general building constn : IS : 816

d. All other relevant codes specified or referred in the above codes and wherever the reference is made it shall be with latest revisions.

e. Any exceptions or additions to these specifications, including any mandatory rules or regulations which are to apply, will be indicated on the design drawings/calculations.

V. Soil and Foundation Data :

The soil investigation data is enclosed as Annexure with Volume-I-BI of tender. Detailed Soil Investigation Report can be had from the office of the Dy. General Manager and Ex. Engr. (Drainage), if required by the bidder.

B. GENERAL TECHNICAL SPECIFICATIONS :

3.0.1 GENERAL :

All the items occuring in the work and as found necessary during actual execution shall be carried out in the best workman-like manner as per specifications and the written orders of the Engineer-in-charge.

Extra claim in respect of extra work shall be allowed only if such work is ordered to be carried out in writting by the Engineer-in-charge as extra

The contractor shall engage a qualified Engineer for the Execution of work who will remain present for all the time on site and will receive instructions and orders from the Engineer- in- charge or his authorised representative. The instructions and orders given to the Contractor's representative on site shall be considered as if given to the contractor himself.

A work order book as prescribed shall be maintained on the site of the work by the contractor and the contractor shall sign the orders given by the inspecting officers and shall carry out them promptly.

Quantities specified in the tender may vary at the time of actual execution and the contractor shall have no claim for compensation on account of such variation.

Diversion of road, if necessary, shall be provided and maintained during the currency of the contract by the contractor at his cost.

Figured dimensions of drawings shall superecede measurements by scale. Special dimensions or directions in the specification shall supercede all other dimensions.

All levels are given on drawings and the contractor shall be responsible to take regular level on the approved alignment before actually starting the work. The levels shall be connected to the G.T.S. levels and shall be got approved from the Engineer-in-charge.

If the arrangement for temporary drainage is required to be made during any work of this contract. The same shall be made by the contractor without claiming any extra cost.

3.0.2 LOCATION AND ACCESS TO SITE :

The place of the proposed project at Dindoli is located within the city limit and at the distance of 10.0 kmts. from the Surat Railway Station.

3.0.3 DESCRIPTION OF WORK :

The work under the contract consists of providing and executing civil, mechanical, electrical, instrumentation (if required), SCADA(if required) works. Services to be executed for sewage treatment plant which includes the necessary items to be executed. The work also includes providing necessary inserts, brackets supports in walls are required for installaing any other facilities to be provided by other agencies.

Painting and colouring operating platforms, leaders, hand railing, rungs etc. with one coat of red oxide primer and two coats of approved enamel.

It is not the intention of this tender to give detailed description and specifications of each and every item. The successful tenderer shall execute each item so as to ensure smooth and efficient working of the total system of which a item is a part. The successful tenderer shall not refuse to carry out any additional items of construction if the same are required for smooth and efficient working of the total system in the opinion of the SMC or the Engineer-in-charge.

All the items specified in the tender shall be carried out by the successful tenderer as per the practices set out in the relevant latest editions of Indian Standard specifications and IRC specifications.

3.0.4 WATER SUPPLY FOR WORK ;

The contractor shall make his own arrangement for supply of proper quantity and quality of water required for construction work and also for consumption of his employees unless otherwise charged as per prevailing SMC Rules and Regulation.

3.0.5 POWER SUPPLY ;

SMC shall help the contractor by giving a recommendation letter for electric power from G.E.B. / Torrent S.E. Co. not guarantee the supply of electricity and no componsation for non-supply or irregularity of electric power will be entertained. The contractor shall make his own arrangement to get electric power from G.E.B.at his own cost. He shall also keep a generator for power as standly.

3.0.6 CEMENT AND STEEL :

Contractor shall make his own arrangement to get cement and steel of the approved quality from any of the approved agencies at his own cost and delay in geting cement and steel from these agencies shall not be taken as a reasons for delay in execution of the various item of work.

3.0.7 CLASSIFICATION OF STRATA :

All materials encountered in excavation will be classified in the following ground irrespective of mode of excavating the materials and decision of the Engineer-in-charge in this regard shall be final and binding to the contractor.

3.0.8 SOILS & HARD MURRUM :

Soils of all sorts, silt, sand, gravel, soft murrum, stiff clay, kunkar and other excavation not covered in the item mentioned hereunder.

3.0.9 SOFT-ROCK & HARD-ROCK :

This shall include all materials which is rock but which does not need blasting and can be removed with a pick-bar, wedges, pavements breakers, penumatic etc.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

Signature & Seal of Contractor

19. SPECIFICATIONS OF MATERIALS

NOTE: Latest versions of all the I.S. codes mentioned below shall be considered.

M-1 WATER:

1.1 Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalies, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence or attack the steel in R.C.C. Container for transport, storage and handling of water shall be clean. Water shall conform to the standards specified in I.S. 456-2000.

1.2 If required by the Engineer-in-charge it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in I.S. 269-1976. Any indication of unsoundness, change in time of setting by 30 minutes or more or decrease of more than 10 percent in strength of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.

1.3 Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interfere with the hardening of mortar or concrete during curing or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.

1.4 Hard and bitter water shall not be used for curing.

1.5 Portable water shall generally be found suitable for curing mortar or concrete.

1.6 Permissible limit for solids:

	Tested as per	Permissible Limit Max.
Organic	IS:3025	200 mg/lit.
Inorganic	IS:3025	3000 mg/lit.
Sulphates (as SO3)	IS:3025	400 mg/lit.
Chlorides (as Cl)	IS:3025	2000 mg/lit. for concrete work not containing embedded steel and 500 mg/lit. for pre stressed/reinforced concrete work.
Suspended matter	IS:3025	2000 mg/lit.

M-2 LIME:

2.1 Lime shall be hydraulic lime as per I.S. 712-1973. Necessary tests shall be carried out as per I.S. 6932 (Parts I to X) 1973.

2.2 The following field tests for limes are to carried out ---

a A very rough idea can be formed about the type of lime by its visual examination i.e. fat lime bears pure white color, lime in form of porous lumps of dirty white color, indicates quick lime, and solid lumps the unburnt lime stone.

b Acid tests for determining the carbonate content in lime. Excessive amount of impurities and rough determination of class of lime.

2.3 Storage shall comply with I.S. 712-1973. The slaked lime, if stored, shall be kept in a weather proof and damp proof shed with impervious floor and sides to protect it against rain, moisture, weather and extraneous materials mixing with it. All lime that has been damaged in any way shall be rejected and all rejected materials shall be removed from site of work.

2.4 Field testing shall be done according to I.S. 162-1974 to show the acceptability of materials.

M-3 CEMENT:

3.1 Fresh quality cement shall be procured only from approved manufacturer/Supplier and shall be subject to prior approval of the Engineer-in-charge. Following types of cement shall be used:

i. All cement used for the work shall ordinary Portland cement / Portland Pozzalona Cement or such other cement as may be permitted by the Engineer-in-charge. Portland cement shall comply with the requirements of the latest issue of IS 269. High alumina cement, rapid hardening cement and Portland slag cement etc., can be used only when permitted by the Engineer-in-charge. Such cements shall be in accordance with relevant IS Codes. Portland pozzolana cement shall conform to IS 1489 Part-I.

ii. Cement which has remained in bulk storage at the mill for more than 6 months, or which as remained in bags at the dealer's storage for over 3 months, or which has been stored at project site for more than 3 months shall be re-tested before use. Cement shall also be rejected if it fails to conform to any of the requirements of these specifications.

iii. Different types of cement shall not be mixed.

3.2 Cement shall be ordinary Portland slag cement as per I.S. 269-1976 or Portland pozzolana cement as per I.S. 1489-Part-I.

M-4 WHITE CEMENT:

4.1 The white cement shall conform to I.S. 8042-1978.

M-5 SAND:

5.1 Sand shall be natural sand, clean, well graded, strong, durable and gritty particles free from injurious amounts of dust, clay, kankar nodules, soft or flaky particles, shale, alkalis, salts, organic mater, loam, mica or other deleterious substances and shall be got approved from the Engineer-in-charge. The sand shall not contain more than 8% of silt as determined by field tests. If necessary the sand shall be washed to make it clean.

5.2 Coarse Sand: The fineness modulus of coarse sand shall not be less than 2.5 and shall not exceed 3.0. The sieve analysis of coarse shall be as under ---

I.S. Sieve	% by weight	I.S. Sieve	% by weight

Designation	passing sieve	Designation	passing sieve
4.75 mm	100	600 Micron	30-100
2.36 mm	90-100	300 Micron	5-70
1.18 mm	70-100	150 Micron	0-60

5.3 Fine Sand : The finess modulus shall not exceed 1.0. The sieve analysis of fine sand shall be as under ---

I.S. Sieve Designation	% by weight passing thru'	I.S. Sieve Designation	by weight passing thru'
4.75 mm	100	600 Micron	40-85
2.36 mm	100	300 Micron	5-50
1.18 mm	75-100	150 Micron	0-10

M-6 STONE GRIT:

6.1 Grit shall consist of crushed or broken stone and be hard, strong, dense, durable, clean, of proper gradation and free from skin or coating likely to prevent proper adhesion of mortar. Grit shall generally be cubical in shape and as far as possible flaky elongated pieces shall be avoided. It shall generally comply with the provisions of I.S. 383-1970. Unless a special stone of a particularly quarry is mentioned, grit shall be obtained from the best black trap or equivalent hard stone as approved by the Engineer-in-charge. The grit shall have no deleterious reaction with cement.

6.2 The grit shall conform to the following gradation as per sieve analysis :

I.S. Sieve Designation	% passing thru' sieve	I.S. Sieve Designation	% passing thru' sieve
12.50 mm	100%	4.75 mm	0.20%
10.00 mm	85-100%	2.36 mm	0.25%

6.3 The crushing strength of grit will be such as to allow the concrete in which it is used to build-up the specified strength of concrete.

6.4 The necessary tests for grit shall be carried out as per the requirements of I.S. 2338 (Parts I to VIII)1963, as per instruction of the Engineer-in-charge. The necessity of test will be decided by the Engineering-in-charge.

M-7 LIME MORTAR:

7.1 LIME: Shall conform to specification M-2. WATER: Water shall conform to specification M-1. SAND : Sand shall conform to specification M-6.

7.2 PROPORTION OF MIX:

Mortar shall consist of such proportions of slaked lime and sand as may be specified in the item. The slaked lime and shall be measured by volume.

7.3 PREPARATION OF MORTAR :

Lime mortar shall be prepared by wet process as per I.S. 1625-1971. Power driven mill shall be used for preparation of lime mortar. The slaked lime shall be placed in the mill in an even layer and ground for 180 revolutions with sufficient water. Water shall be added as required during grinding (care being taken not to add more water) that will bring the mixed material to a consistency of stiff paste. Thoroughly wetted sand shall then be added evenly and the mixture ground for another 180 revolutions.

7.4 STORAGE : Mortar shall always be kept damp, protected from sun and rain till used up, covering it by tarpaulin or open sheds.

7.5 USE:

All mortar shall be used as soon as possible after grinding. It should be used on the day on which it is prepared. But in no case mortar made earlier than 36 hours shall be permitted for use.

M-8 CEMENT MORTAR :

8.1 Water shall conform to specification M-1. Cement shall conform to specification M-3. Sand shall conform to M-5.

8.2 PROPORTION OF MIX: Cement and sand shall be mixed to specified proportions, sand being measured by measuring boxes. The proportion of cement shall be by volume on the basis of 50 Kg./Bag of cement being equal to 0.0342 Cum.

The mortar may be hand mixed or machine mixed as directed.

8.3 PREPARATION OF MORTAR In hand mixed mortar, cement and sand in the specified proportions shall be thoroughly mixed dry on a clean impervious platform by turning over at least 3 times or more till a homogeneous mixture of uniform colour is obtained. Mixing platform shall be so arranged that no deleterious extraneous material shall get mixed with mortar or mortar shall flow out. While mixing, the water shall be gradually added and thoroughly mixed to form a stiff plastic mass of uniform colour so that each particle of sand shall be completely covered with a film of wet cement. The water cement ratio shall be adopted as directed.

8.4 The mortar so prepared shall be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 minutes.

M-9 STONE COARSE AGGREGATE:

9.1 Coarse aggregate shall be of machine crushed stone of black trap or equivalent and be hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

9.2 The aggregate shall generally be cubical in shape. Unless special stones of particular quarries are mentioned aggregates shall be machine crushed from the best black trap or equivalent hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement concrete and ordinary reinforced cement concrete shall generally be as per the table given below. However, in case of reinforced cement concrete the maximum limit may be restricted to 6 mm. less than the minimum lateral clear distance between bars or 6mm. less than the cover whichever is smaller.

TABLE

I.S. Sieve Designation	Percentage passing for single sized aggregates of Nominal size			I.S. Sieve Designation Normal Size	Percentage passing for single sized aggregates of		
	40 mm	20 mm	16 mm		40 mm	20 mm	16 mm
80 mm	-	-	-	12.5 mm	-	-	-
63 mm	100	-	-	10 mm	0.5	0.20	0.30
40 mm	85-100	100	-	4.75mm	-	0.50	0.50
20 mm	0-20	85-100	100	2.35mm	-	-	-
16 mm	-	-	85-100				

NOTE: This percentage may be varied somewhat by the Engineer-in-charge when considered necessary for obtaining better density and strength of concrete.

9.3 The grading test shall be taken in the beginning and at the change of source of materials. The necessary tests indicated in I.S. 383-1970 and I.S. 456-2000 shall have to be carried out to ensure the acceptability. The aggregates shall be stored separately and handled in such a manner as to prevent the inter mixing of different aggregates. If the aggregates are covered with dust, they shall be washed with water to make, them clean.

M-10 BLACK TRAP OR EQUIVALENT HARD STONE COARSE :

10.1 Aggregate for Design Mix Concrete : Coarse aggregate shall be of machine crushed stone of black trap or equivalent hard stone and be hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

10.2 The aggregates shall generally be cubical in shape, unless special stones of particular quarries are mentioned, aggregates shall be machine crushed from the best, black trap or equivalent hard stones as approved. Aggregate shall have no deleterious reaction with cement.

10.3 The necessary tests indicated in I.S. 383-1970 and I.S. 456-1978 shall have to be carried out to ensure the acceptability of the material.

10.4 If aggregate is covered with dust it shall be washed with water to make it clean.

M-11 BRICK BATS AGGREGATE :

11.1 Brick bat aggregate shall be broken from well burnt or slightly over burnt and dense bricks. It shall be homogeneous in texture, roughly cubical in shape, clean and free from dirt of any other foreign material. The brick bats shall be of 40 mm to 50 mm size unless otherwise specified in the item. The under burnt or over burnt brick bats shall not be allowed.

11.2 The brick bats shall be measured by volume by suitable boxes as directed.

M-12 BRICKS:

12.1 The bricks shall be hand or machine molded and made from suitable soils and kiln burnt. They

shall be free from cracks and flaws not nodules of free lime. They shall have smooth rectangular faces with sharp corners and shall be of uniform color. The bricks shall be molded with a frog of 100mm x 40mm and 10mm to 20mm deep on one of its flat sides. The bricks shall not break when dropped on the ground from a height of 600 mm.

12.2 The size of modular bricks shall be 190mm x 90mm x 90mm.

12.3 The size of conventional bricks shall be as under ---

225 x 110 x 75mm.

12.4 Only bricks of one standard size shall be used on one work. The following tolerances shall be permitted in the conventional size adopted in a particular work.

Length : 3.00 mm
Width : 1.50 mm
Height : 1.50 mm

12.5 The crushing strength of the bricks shall not be less then 35 Kg./Sq.Cm. The average water absorption shall not be more than 20% by weight. Necessary tests for crushing strength and water absorption etc. shall be carried out as per I.S. 3495 (Part I to IV)-1976.

M-12A FLYASH BUILDING BRICKS:

The Fly ash building bricks shall conform to Grade-5 of IS-13757.The frog of the 80 to 100 mm x 40 mm x 10 to 20 mm size.

The size of modular bricks shall be 190 mm x 90 mm x 90 mm.

The size of conventional brick shall be 230 mm x 110 mm x 70 mm.

Only bricks of one standard size shall used on one work. The following tolerances shall permitted in the conventional size adopted in a particular work:

Length: ± 4 mm
Width : ± 2 mm
Height: ± 2mm
The physical characteristic of bricks shall be as follows.

The minimum compressive strength of Fly ash building bricks shall not be less than 70 Kg/Sq.Cm. and the test shall be conform to IS-3495 (Part-I).

The averages water absorption not more than 20 percentage by weight and the test shall conform to IS-3495(Part-3). Sampling of Fly ash building bricks and criteria for conformity shall be as per I.S.:5454.

M-13 STONE:

13.1 The stone shall be of the specified variety such as Granite/ Trap stone/Quarzite or any other type of good hard stones. The stones shall be obtained only from the approved quarry and shall be hard, sound, durable and free from defects like cavities, cracks, sand holes, flaws,

injurious veins, patches of loose or soft materials etc. and weathered portions and other structural defects or imperfections tending to affect their soundness and strength. The stone with round surface shall not be more than 5% of dry weight. When tested in accordance with I.S. 1134-1974. The minimum crushing of the strength of the stone shall be 200 Kg./Sq.Cm. unless otherwise specified.

13.2 The samples of the stone to be used shall be got approved before the work is started.

13.3 The khanki facing stone shall be dressed by chisel as specified in the item for khanki facing in required shape and size. The face of the stone shall be so dressed that the bushing on the exposed face shall not project by more than 40 mm. from the general wall surface and on face to be plastered it shall not project by more than 19 mm nor shall it have depressions more than 10 mm from the average wall surface.

M-14 MILD STEEL BARS:

14.1 Mild steel bars reinforcement for R.C.C. work shall conform to I.S. 432 (Part-II)-1966 and shall be of tested quality. It shall also comply with the relevant part of I.S. 456-2000.

14.2 All the reinforcement shall be clean and free form dirt, paint, grease, mill scale or loose or thick rust at the time of placing.

14.3 For the purpose of payment the bar shall be measured correct up to 10 mm length and weight payable worked out as per the rate specified below :

i	6mm	0.22 Kg/Rmt.	viii	20mm	2.47 Kg/Rmt.
ii	8mm	0.38 kg/Rmt.	ix	22mm	2.98 kg/Rmt.
iii	10mm	0.62 kg/Rmt.	x	25mm	3.85 kg/Rmt.
iv	12mm	0.89 kg/Rmt.	xi	28mm	4.83 kg/Rmt.
v	14mm	1.21 kg/Rmt.	xii	32mm	6.31 kg/Rmt.
vi	16mm	1.58 kg/Rmt.	xiii	36mm	7.31 Kg/Rmt.
vii	18mm	2.00 Kg/Rmt.	xiv	40mm	9.86 Kg/Rmt.

M-15 HIGH YIELD STRENGTH STEEL DEFORMED BARS :

15.1 High yield strength steel deformed bars shall be Thermo Mechanically Treated Bar and shall conform to I.S. 1786 with its latest publication.

15.2 Other provision and requirements shall conform to specification No. M-14 for Mild Steel Bars.

15.3 Reinforcing steel shall not be stored directly on the ground. These shall be stored under cover and shall be protected from rusting, oil, grease and distortions as directed by the Engineer-in-charge.

M-16 HIGH TENSILE STEEL WIRES :

16.1 The high tensile wires for use in pre stressed concrete shall conform to I.S. 2090-1962.

16.2 The tensile strength of the high tensile steel bars shall be as specified in the item. In absence of the given strength and minimum strength shall be taken as per Para 6-1 of the I.S. 1785-1962. Testing shall be done as per I.S. requirements.

16.3 The high tensile steel shall be free from loose mill scale, rust, oil, grease or any other harmful matter. Cleaning of steel bars may be carried out by immersion in solvent solution, wire

brushing or passing through a pressure box containing carborundum.

16.4 The high tensile wire shall be obtained from manufactures in coils having diameter not less than 350 times the diameter of wire itself so that wire springs back straight on being uncoiled.

M-17 MILD STEEL BINDING WIRE :

17.1 The mild steel wire shall be of 1.63mm or 1.22mm (16 or 18 guage) diameter and shall conform to I.S. 280-1972.

17.2 The use of black wire will be permitted for binding reinforcement bars. It shall be free from rust, oil, paint, grease, loose mill scale or any other undesirable coating which may prevent adhesion of cement mortar.

M-18 STRUCTURAL STEEL :

18.1 All structural steel shall conform to I.S. 226-1965. The steel shall be free from the defects mentioned in I.S. 226-1975 and shall have a smooth finish. The material shall be free from loose mill scale, rust pits or other defects affecting the strength and durability. Rivet bars shall conform to I.S. 1148-1973.

18.2 When the steel is supplied by the contractor test certificates of the manufacturers shall be obtained according to I.S. 226-1975 and other relevant Indian Standards.

M-19 SHUTTERING:

19.1 The shuttering shall be either of wooden planking of 30mm minimum thickness with or without steel lining or of steel plates stiffened by steel angles. The shuttering shall be supported on battens and beams and props of vertical ballies properly cross bracked together so as to make the centering rigid. In places of ballie props, bricks pillar of adequate section built in mud mortar may be used.

19.2 The form work shall be sufficiently strong and shall have camber, so that it assumes correct shape after deposition of the concrete and shall be able to resist forces caused by vibration of concrete, live load of men working with it and other incidental loads associated with it. The shuttering shall have smooth and even surface and its joints shall not permit leakage of cement grout.

19.3 If at any stage of work during or after placing concrete in the structure, the form work sags or bulges out beyond the required shape of the structure, the concrete shall be removed and work redone with fresh concrete and adequately rigid form work. The complete form work shall be got inspected by and approved from the Engineer-in-charge, before the reinforcement bars are placed in position.

19.4 The props shall consists of bullies having 100mm minimum diameter measured at mid length and 80mm at thin end and shall be placed as per design requirement. These shall rest squarely on wooden sole plates 40 mm. thick and minimum bearing area of 0-10 sq.m. laid on sufficiently hard base.

19.5 Double wedges shall further be provided between the sole plate and wooden props so as to facilitate tightening and easing of shuttering without jerking the concrete.

19.6 The timber used in shuttering shall not be so dry so as to absorb water from concrete and

swell or bulge nor so green or wet so as to shrink after erection. The timber shall be properly sawn and planed on the sides and the surface coming in contact with concrete. Wooden form work with metal sheet lining or steel plates stiffened by steel angles shall be permitted.

19.7 As far as practicable, clamps shall be used to hold the forms together and use of nails and spikes avoided.

19.8 The surface of timber shuttering that would come in contact with concrete shall be well wetted and coated with soap solution before the concreting is done. Alternatively coat of raw linseed oil or oil of approved manufacture may be applied in place of soap solution. In case of steel shutteirng either soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Under no circumstances black or burnt oil shall be permitted.

19.9 The shuttering for beams and slabs shall have camber of 4mm per metre (1 in 250) or as directed by the Engineer-in-charge so as to offset the subsequent deflection. For cantilevers, the camber at free end shall be 1/50 of the projected length or as directed by the Engineer-in-charge.

M-20 TEAK WOOD:

20.1 The teak wood shall be of good quality as required for the item to be executed. When the kind of wood is not specifically mentioned, good Indian teak wood as approved shall be used.

20.2 Teak wood shall generally be free from large, loose, dead or cluster knots, flaws, warps, twists, shakes, bends or any other defects. It shall generally be uniform in substance and of straight fibers as far as possible. It shall be free from rot, decay, harmful fungi and other defects of harmful nature, which will affect the strength, durability or its usefulness for the purpose for which it is required. The colour shall be uniform as far as possible. Any effort like painting, using any adhesive or resinous materials made to hide the defects shall render the pieces liable to rejection by the Engineer-in-charge.

20.3 All scantlings, planks etc. shall be sawn in straight lines and planes in the direction of grains and of uniform thickness.

20.4 The tolerances in the dimensions shall be allowed at the rate of 1.5 mm per face to be planed.

20.5 First Class Teak Wood:

First class teak wood shall have no individual hard and sound knots, more than 6 sq.cm. in size and the aggregate area of such knots shall not be more than 1% of area of piece. The timber shall be closed grained.

20.6 Second Class Teak Wood:

No individual hard and sound knots shall be more than 15 sq.cm. in size and aggregate area of such knots shall not exceed 2% of the area of piece.

M-21 NON-TEAK WOOD:

The non teak wood shall be chemically treated, seasoned as per I.S. Specifications and of good quality. The type of wood shall be got approved before collecting the same on site. Fabrication of wooden members shall be started only after approval. For this purpose wood of Bio, Kalai, Sires, Saded, Behda, Jamun, Sisoo will be used for door frames whereas

only Kalai, Siras, ,Halda, Kalam etc. will be permitted for shutters after proper seasoning and chemical treatment.

The non teak wood shall be free from large, loose dead of cluster knots, flows, shakes, warps, bends, or any other defect. It shall be uniform in substance and of straight fibers as far as possible. It shall be free from rots, decay, harmful fungi and other defects of similar nature which will affect the strength, durability or its usefulness for the purpose for which it is required. The colour of the wood shall be uniform as far as possible. The scantalings, planks etc. shall be sawn in straight lines and planes in the direction of grain and of uniform thickness.

The department will use the Agency to produce a certificate from the Forest Department in the event of a dispute and the decision of the Department shall be final and binding to the contractor.

The tolerance in the dimension shall be allowed at 1.5 mm. per face to be planed.

M-22 WOODEN FLUSH DOOR SHUTTERS (SOLID CORE):

22.1 The solid core type flush door shutters shall be of decorative or non-decorative type as specified in the drawing. The size and thickness of the shutter shall be as specified in drawings or as directed. The timber species for core shall be used as per I.S. 2202-(Part-I) - 1980. The timber shall be free from decay and insect attack. Knots and knot holes less than half the width of cross-section of the members, pitch streaks and harmless pin holes shall be permissible except in the exposed edges of the core members.

The commercial plywood, cross bands shall conform to I.S. 303-1275.

22.2 The face panel of the shutters shall be formed by gluing by the hot press process on both faces of the core with either plywood or corss bands, and face veneers. The lipping, rebating, opening of glazing, venetion etc. shall be provided if specified in the drawing.

22.3 All edges of the door shutters shall be square. The shutters shall be free form twist or warp in its plane. Both faces of the shutters shall be sand papered to smoot even texture.

22.4 The shutters shall be tested for ---

i End Immersion Test: The test shall be carried out as per I.S. 2202 (Part-I) 1980. There shall be no delamination at the end of the test.

ii Knife Test: The face panel when tested in accordance with I.S. 1659-1979 shall pass the test.

iii Glue Adhesion Test : The flush door shall be tested for glue adhesive test in accordance with I.S. 2202 (Part-I)-1980. The shutters shall be considered to have passed the test if no delamination occurs in the glue lines in the plywood and if no single delamination more than 80 mm. in length and more than 3 mm. in depth has occured in the assembly glue lines between the plywood face and the style and rail. Delamination at the corner shall be measured continously around the corner. Delamination at the knots knot, hole and other permissible wood defects shall not be considered in assessing the sample.

22.5 The tolerance in size of solid core type flush doors under:

In nominal thickness # 1.2 mm. In nominal height # 3 mm. The thickness of the shutters

shall be uniform throughout with a permissible variation of not more than 0.8 mm. when measured at any two points.

M-23 ROLLING SHUTTERS:

23.1 The rolling shutters shall conform to I.S.6248-1979. Rolling shutters shall be supplied of specified type with accessories. The size of the rolling shutters shall be specified in the drawings. The shutters shall be constructed with interlocking lath sections formed from cold rolled steel strips not less than 0.9 mm. thick and 80 mm. wide for shutters upto 3.5 m. Width not less than 1.25 mm. thick and 80 mm. wide for shutters 3.5 m. in width and above unless otherwise specified.

23.2 Guide channels shall be of mild steel deep channel section and of rolled pressed or built up (fabricated) joint less construction. The thickness of sheet used shall not be less than 3.15 mm.

23.3 Hood covers shall be made of M.S. sheets not less than 0.92 mm. thick. For shutters having width 3.5 mts. and above, the thickness of M.S. sheet for the hood covers shall be not less than 1.25 mm.

23.4 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 position. The spring pipe shaft etc. shall be supported on strong M.S. or malleable C.I. brackets. The brackets shall be fixed on the or under the lintel as specified with rawl plugs and screws bolts etc.

23.5 The rolling shutters shall be of self rolling type up to 8 sq.m. clear area without ball bearing and up to 12 sq.m. clear area with ball bearing. If the rolling shutters are of larger then gear operated type shutters shall be used.

23.6 The locking arrangement shall be provided at the bottom of shutter at both ends. The shutters shall be opened from outside.

23.7 The shutters shall be completed with door suspension, shafts, locking arrangements, pulling hooks, handles and other accessories.

M-24 COLLAPSIBLE STEEL GATE:

24.1 The collapsible steel gate shall be in one or two leaves and size as per approved drawings or as specified. The gate shall be fabricated from best quality mild steel channels, flates etc. Either steel pulleys or ball bearings shall be provided in every double channel. Unless otherwise specified the particulars of collapsible gate shall be as under ---

i Pickets : These shall be of 20 mm. M.S. channels of heavy sections unless otherwise shown on drawings. The distance centre to centre of pickets shall be 12 cms. with an opening of 10 cms.

ii Pivoted M.S. flats shall be 20 mm. x 6 mm.

iii Top and bottom guides shall be from tee or flat iron of approved size.

iv The fittings like stoppers, fixing hold fasts, locking cleats, brass handles and cast iron rollers shall be of approved design and size.

M-25 GLASS:

25.1 All glass shall be of the best quality, free from specks, bubbles, smokes, veins, air holes blisters and other defects. The kind of glass to be used shall be as mentioned in the item or specification or in the special provisions or as shown in detailed drawings. Thickness of glass panes shall be uniform. The specifications for different kinds of glass shall be as under ----

Sheet Glass:

In the absence of any specified thickness or weight in the item or detailed specifications of the item of work, sheet glass shall be weighing 7.5 Kg./Sq.m. for panes upto 600 mm. x 600 mm.

For panes larger than 600 mm. x 600 mm. and upto 800 mm. x 800 mm. glass weighing not less than 8.75 Kg./Sq.m. shall be used. For bigger panes upto 900 mm. x 900 mm. glass weighing not less than 11.25 Kg./Sq.m. shall be used.

Sheet glass shall be patent flattened glass of best quality and for glasing and framing purposes shall conform to I.S.761-1960. Sheet glass of the specified colours shall be used, if so shown on detailed drawings or so specified. For important buildings and for panes with any dimensions over 900 mm. plate glass of specified thickness shall be used.

Plate Glass:

When plate glass is specified it shall be "Polished Patent Plate Glass" of best quality. It shall have both the surface ground flate and parallel and polished to obtain clear undistured vision and reflection. The plate glass shall be of the thickness mentioned in the item or as shown in the detailed drawing or as specified. In the absence of any specified thickness, the thickness of plate glass to be supplied shall be 6 mm. and a tolerance of 0.20 mm. shall be admissible.

Obscured Glass:

This type of glass transmits light so that vision is partially or almost completely obscured. Glass shall be plain rolled, figured, ribbed or fluted, or frosted glass as may be specified as required. The thickness and type of glass shall be as per details on drawings or as specified or as directed.

Wired Glass:

Glass shall be with wire netting embedded in a sheet of plane glass. Electrically welded 13 mm. Georgain square mesh shall be used. Thickness of glass shall not be less than 6 mm. wired glass shall be of type and thickness as specified.

M-26 FIXTURES & FASTENINGS:

General ---

i The fixtures and fastenings, that is, butt, hinges, tee and strap hinges, sliding door bolts, tower bolts, door latch, bath-room latch, handles, door stoppers, casement window fasteners, casement stays and ventilator catch shall be made of the metal as specified in the item or its specifications.

ii They shall be of iron, brass, aluminum, chromium plated iron, chromium plated brass, copper oxidised iron, copper oxidised brass or anodised aluminum as specified.

iii The fixtures shall be heavy, medium or light type. The fixtures and fastenings shall be smooth finished and shall be such as will ensure ease of operation.

iv The samples of fixtures and fastenings shall be got approved as regards quality and shape before providing them in position.

v Brass and anodised aluminum fixtures and fastenings shall be bright finished.

Holdfasts:

i Holdfasts shall be made from mild steel flat 30 cm. length and one of the holdfasts shall be bent at right angle and two nos. of 6 mm. dia. holes shall be made in it for fixing it to the frame with screws. At the other end, the holdfast shall be forked and bent at right angles in opposite directions.

Butt Hinges:

i Railway standard heavy type butt hinges shall be used when so specified.

ii Tee and strap hinges shall be manufactured from M.S. sheet.

Sliding Door Bolts (Aldrops):

i The aldrops as specified in the item shall be used and shall be got approved.

Tower Bolts (Barrel Type):

i Tower bolts as specified in the item shall be used and shall be got approved.

Door Latch:

i The size of door latch shall be taken as the length of latch.

Bathroom Latch:

i Bathroom latch shall be similar to tower bolt.

Handle:

i The size of the handles shall be determined by the inside grip length of the handles. Handles shall have a base plate of length 50 mm. more than the size of the handle.

Door Stoppers:

i Door stoppers shall be either floor door stopper type or door catch type. Floor stopper shall be of overall size as specified and shall have a rubber cushion.

Door Catch:

i Door catch shall be fixed at a height of about 900 mm. from the floor level such that one part of the catch is fitted on the inside of the shutter and other part is fixed in the wall

with necessary wooden plug arrangements for appropriate fixity. The catch shall be fixed 20 mm. inside the face of the door for easy operation of catch.

Wooden Door Stop With Hinge:

i Wooden door stop of size 100 mm. x 60 mm. x 40 mm. shall be fixed on the door frame with a hinge of 75 mm. size and at a height of 900 mm. from the floor level. The wooden door stop shall be provided with 3 coats of approved oil paint.

Casement Window Fastener:

i Casement window fastener for single lead window shutter shall be left or right handed as directed.

Casement Stays (Straigot Peg.Stay):

i The stays shall be made from a channel section having three holes at appropriate position so that the window can be opened either fully or partially as directed.

Size of the stay shall be 250 mm. to 300 mm. as directed.

Ventilator Catch:

i The pattern and shape of the catch shall be as approved.

Pivot:

i The base and socket plate shall be made from minimum 3 mm. thick plate, and projected pivot shall not be less than 12 mm. dia. and 12 mm. length and shall be firmly riveted to the base plate case of iron pivot and in single piece base in the case of brass pivot.

M-27 PAINTS:

27.1 Oil Paints:

Oil paints shall be of the specified colour and shade, and as approved. The ready mixed paints shall only be used. However, if ready mixed paint or specified shade or tint is not available white ready mixed paint with approved stainer will be allowed. In such a case, the contractor shall ensure that the shade of the paint so allowed shall be uniform.

All the paints shall meed with the following general requirements ---

i Paint shall not show excessive setting in a freshly opened full can and shall easily be redispressed with paddle to a smooth homogeneous state. The paint shall show no curdling, livering, caking or colour separation and shall be free from lumps and skins.

ii The paint as received shall brush easily, possess good leveling properties and show no running or sagging tendencies.

iii The paint shall not skin within 48 hours in a three quarters filled closed container.

iv The paint shall dry to a smooth uniform finish free from roughness, grit un evenness

and other imperfections.

Ready mixed paid shall be used exactly as received from the manufacturers and generally according to their instructions and without any admixtures whatsoever.

27.2 Enamel Paints:

The enamel paint shall satisfy in general requirements as mentioned in specification of oil paints. Enamel paints shall conform to I.S. 2933-1975.

M-28 FRENCH POLISH:

The French polish of required tint and shade shall be prepared with the below mentioned ingredients and other necessary materials :

i Denatured spirit of approved quality.
ii Shellac.
iii Chandras.
iv Pigment.

The French polish so prepared shall conform to I.S. 348-1968.

M-29 MARBLE CHIPS FOR MARBLE MOSAIC TERRAZZO:

29.1 The marble chips shall be of approved quality and shades. It shall be hard, sound, dense and homogeneous in texture with crystalline and coarse grains. It shall be uniform in colour and free from stains, cracks, decay and weathering.

29.2 The size of various colours of marble chips ranging from the smallest up to 20 mm. shall be used where the thickness of top wearing layers is 6 mm. in size. The marble chips of approved quality and colours only as per grading as decided by the Engineer-in-charge shall be used for marble mosaic tiles or works.

29.3 The marble chips shall be machine crushed. They shall be free from foreign matter, dust etc. Except as above the chips shall conform to I.S. 2114-1962.

M-30 FLOORING TILES:

30.1A Plain Cement Tiles -

30.1.1 The plain cement tiles shall be of general purpose type. These are the tiles in the manufacture of which no pigments are used. Cement used in the manufacture of tiles shall be as per Indian Standards.

30.1.2 The tiles shall be manufactured from a mixture of cement and natural aggregates by pressure process. During manufacture, the tiles shall be subjected to a pressure of not less than 140 Kg./Sq.cm. The proportion of cement to aggregate in the backing of the tiles shall be not leaner than 1:3 by weight. The wearing face, though the tiles are of plain cement, shall be provided with stone chips of 1 to 2 mm size. The proportion of cement to the marble chips aggregate in the wearing layer of the tiles shall be three parts of cement to one part of chips by weight. The minimum thickness of wearing layer shall be 3 mm. The colour and texture of wearing layer shall be uniform throughout its face and thickness. On removal from mould, the tiles shall be kept in moist condition continuously at least for seven days and subsequently, if necessary, for such long period as would ensure their conformity to requirements of I.S. 1237-1980 requiring resistance to wear and water

absorption.

30.1.3 The wearing face of the tiles shall be plain, free from projections, depressions and cracks and shall be reasonably parallel to the back face of the tile. All angles shall be right angle and all edges shall be sharp and true.

30.1.4 The tile sizes shall generally be square shape 24.85cm. x 24.85cm. or 25cm. x 25cm. The thickness of the tiles shall be 20 mm.

30.1.5 The tolerance of length and breadth shall be plus or minus 1 mm. The tolerance on thickness shall be plus 5 mm.

30.1.6 The tiles shall satisfy the tests as regards transverse strength, resistance to wear and water absorption as per I.S. 1237-1980.

30.2 B Plain Colored Tiles:

30.2.1 These tiles shall have the same specifications as for plain cement tiles as per (A) above except that they shall have a plain wearing surface wherein pigments are used. They shall conform to I.S. 1237-1980.

30.2.2 The pigment used for coloring cement shall not exceed 10% by weight of cement used in the mix. The pigments, synthetic or otherwise, used for coloring tiles shall have permanent colour and shall not contain materials detrimental to concrete.

30.2.3 The colour of the tiles shall be specified in the item or as directed.

30.3 C Marble Mosaic Tiles:

30.3.1 These tiles have the same specifications as per plain cement tiles except the requirements as stated below ---

30.3.2 The marble mosaic tiles shall conform to I.S. 1237-1980. The wearing face of the tiles shall be mechanically ground and filled. The wearing face of tiles shall be free of projections, depressions and cracks and shall be reasonably parallel to the back face of the tiles. All angles shall be right angles and all edges shall be sharp and true.

30.3.3 Chips used in the tiles be from smallest up to 20 mm. size. The minimum thickness of wearing layer of tiles shall be 6 mm. For pattern of chips to be bad on the wearing face, a few samples with or without their full size photographs as directed shall be presented to the Engineer-in-charge for approval.

30.3.4 Any particular samples, if found suitable shall be approved by the Engineer-in-charge, of he may ask for particular sized chips to be more or less in the sample presented. The samples shall have to be made by the contractor till a suitable sample finally approved for use in the work. The contractor shall ensure that the tiles supplied for the work shall be in conformity with the approved sample only, in terms of its dimensions, thickness of backing layer and wearing surface, materials, ingredients, colour shade, chips, distribution etc. required.

30.3.5 The tiles shall be prepared from cement conforming to Indian Standards or colored Portland cement generally depending upon the colour of tiles to be used or as directed.

30.4 D Chequered Tiles:

30.4.1 Chequered tiles shall be plain cement tiles or marble mosaic tiles. The former shall have the same specification as per (A) above and the latter as per marble mosaic tiles as per (C) except as mentioned below.

30.4.2 The tiles shall be of nominal size of 250mm x 250mm or as specified. The centre to centre distance of the Chequer shall not less than 25mm. and not more than 50mm. The overall thickness of the tile shall be 28mm.

30.4.3 The grooves in the Chequer shall be uniform and straight. The depth of the grooves shall not be less than 3mm. The chequered tiles shall be plain, colored or mosaic as specified. The thickness of the upper layer measured from the top of the Chequer shall not be less than 6mm. The tiles shall be given the first grinding with machine before delivery to site.

30.4.4 Tiles shall conform to relevant I.S. 1237-1980.

30.5 E Chequered Tiles for Staircases:

30.5.1 The requirements of these tiles shall be the same as chequered tiles as per (D) above except in following respects:

i The length of a tile including nose shall be 330 mm.
ii The minimum thickness shall be 28 mm.
iii The nosing shall have also the same wearing layer at the top.
iv The nosing edge shall be rounded.
v The front portion of the tile for a minimum length of 75mm. from and including the nosing shall have grooves running parallel to nosing and at centers not exceeding 25mm. Beyond that the tiles shall have normal Chequer pattern.

M-31 ROUGH KOTAH STONE:

31.1 The kotah stones shall be hard, even, sound and regular in shape and generally uniform in colour. The colour of the stone shall generally be green. Brown colored stones shall not be allowed for use. They shall be without any soft veins, cracks or flaws.

31.2 The size of the stones to be used for flooring shall be size 600 mm. x 60 mm. and/or size 600 mm. x 450 mm. as directed. However, smaller sizes will be allowed to be used to the extent of maintaining the required pattern. Thickness shall be as specified.

31.3 Tolerance of minus 30 mm. on account of chisel dressing of edges shall be permitted for length as well as breadth. Tolerance in thickness shall be plus 3mm.

31.4 The edges of stones shall be truly chiselled and table rubbed with coarse sand before paving. All angles and edges of the stone shall be true, square and free from chipping and the surface shall be true and plain.

31.5 When machine cut edges are specified, the exposed edges and the edges at joints shall be machine cut. The thickness of the exposed machine cut edges shall be uniform.

M-32 POLISHED KOTAH STONES:

32.1 Polish kotah stone shall have the same specifications as per rough kotah stone except as mentioned below.

32.2 The stone shall have machine polished smooth surface. When brought on site, the stones shall be single polished or double polished depending upon its use. The stones for paving shall generally be single polished. the stones to be used for dedo, skirting, platforms sink, veneering, sills, steps etc. where machine polishing after the stones are fixed in situ is not possible shall be double polished.

M-33 WHITE GLAZED TILES:

33.1 The tiles shall be of best quality as approved by the Engineer-in-charge. They shall be flat and true to shape. They shall be free from cracks, crazing, spots, chipped edges and corners. The glassing shall be of uniform shade.

33.2 The tiles shall be of nominal size of 150mm. x 150mm. unless otherwise specified. The maximum variation from the stated sizes, other than the thickness of tile, shall be plus or minus 1.5mm. The thickness of the tile shall be 6mm. except as above the tiles shall conform to I.S. 777-1970.

M-34 GALVANISED IRON PIPES AND FITTINGS:

Galvanised iron pipe shall be of the medium type and of required diameter and shall comply with I.S. 1239-1979.

The specified diameter of the pipes shall refer to the inside diameter of the bore. Clamps, screw and all galvanised iron fittings shall be of the standard `R' or equivalent make.

M-35 BIB COCK AND STOP COCK:

35.1 A bib cock is a draw off tap with a horizontal inlet and a free outlet. A stop cock is a valve with a suitable means of connection for insertion in a pipe line for controlling or stopping the flow.

35.2 They shall be of screw down type and or brass chromium plated and of diameter as specified in the description of the item. They shall conform to I.S. 781-1977 and they shall be of best Indian make. They shall be polished bright.

35.3 The minimum finished weight of bib cock and stop shall be as given below ---

Dia.	Bib Cock	Stop Cock	Dia.	Bib Cock	Stop Cock
8 mm.	0.25 Kg.	0.25 Kg.	15 mm.	0.40 Kg.	0.40 Kg.
10 mm.	0.30 Kg.	0.35 Kg.	20 mm.	0.75 Kg.	0.75 Kg.

M-36 GUN METAL WHEEL VALVE:

36-1 The gun metal wheel valve shall be of approved quality. These shall be of gun metal fitted with wheel and shall be of gate valve opening full way and of the size as specified. These shall conform to I.S. 778-1971.

M-37 WHITE GLAZED PORCELAIN WASH BASIN:

37-1 Wash basin shall be of white porcelain first quality best Indian make and it shall conform to I.S. 2556-(Part-IV)-1972 and I.S. 771-1979. The size of the wash basin shall be as specified in the item. The wash basin shall be of one piece construction with continued over-flow arrangements. All internal angles shall be designed so as to facilitate cleaning. Wash basin shall have single tap hole or two holes as specified. Each basin shall have a circular waste hole which is either rebated or bevelled internally with 65 mm. dia. at top and 10 mm. depth to suit the waste fitting. The necessary stud slot to receive the bracket on the under side of the basin shall be provided. Basin shall have an internal soap holder recess which shall fully drain into the bowl.

37.2 White glazed pedestal of the quality and colour as that of the basin shall be provided where specified in the item. It shall be completely recessed at the back for reception of supply and water pipe. It shall be capable of supporting the basin rigidly and adequately and shall be so designed as to make the height form the floor to top of the rim of basin 750 mm. to 800 mm. as directed.

M-38 CAST IRON PIPES AND FITTINGS:

38.1 All soil, waste, vent and antisyphonage pipes and fittings shall conform to I.S. 1729-1964. The pipes shall have spigot and socket ends with head on spigot end. The pipes and fittings shall be true to shape, smooth, cylindrical their inner and outer surfaces being as nearly as practicable concentric. They shall be sound and nicely cast and shall be free from cracks, laps, pin holes or other imperfections and shall be neatly dressed and carefully fettled.

38.2 The end of pipes and fittings shall be reasonably square to their axis.

38.3 The sand cast iron pipes shall be of the diameter as specified in the description and shall be in length of 1.5 M., 1.8 M. & 2.0 M. including socket ends of the pipe unless shorter length are either specified or required at junction etc. The pipes and fittings shall be supplied without ears unless specified or directed otherwise.

38.4 Tolerances: The standard weights and thickness of pipes shall be as shown in the table below. A tolerance up to minus 10% may however be allowed against these standard weights.

Sr. No.	Nominal Dia. of bore	Overall Thickness	Weight of Pipe Excluding Ears		
			1.5M.long	1.8M.long	2M.long
1.	75 mm.	5.0 mm.	12.83 Kg.	16.52 Kg.	18.37 Kg.
2.	100 mm.	5.0 mm.	18.14 Kg.	21.67 Kg.	24.15 Kg.
3.	150 mm.				
4.	250 mm.				

A tolerance up to minus 15% in thickness and 20 mm. in length will be allowed. For fittings tolerance in lengths shall be plus 25 mm. and minus 10 mm.

The thickness of fittings and their socket and spigot dimensions shall conform to the thickness and dimensions specified for the corresponding sizes of straight pipes. The tolerance in

weights and thickness shall be the same as for straight pipes.

M-39 ASBESTOS CEMENT PIPE (A.C. PIPE):

39.1 The asbestos cement pipe of diameter as specified in the description of the item shall conform to I.S. 1926-1980. Special like bends, shoes cowls, etc. shall conform to relevant Indian Standards. The interior of pipe shall have a smooth finish, regular, surface and regular internal diameter. The tolerance in all dimensions shall be as per I.S. 1926-Part-I-1980.

M-40 BITUMEN FELT FOR WATER PROOFING AND DAMP PROOFING:

40.1 Bitumen felt shall be on the fibre bases and shall be of type 2, self finished felt grade-2 and shall confor to I.S. 1322-1970.

M-41 SELECTED EARTH:

41.1 The selected earth shall be that obtained from excavated material or shall have to be brought from outside as indicated in the item. If item does not indicate anything, the selected earth shall have to be brought from outside.

41.2 The selected earth shall be good yellow soil and shall be got approved from the Engineer-in-charge. In no case black cotton soil or similar expansive and shrinkable soil shall be used. It shall be clean and free from all rubbish and perishable materials, stones or brick bats. The clods shall be broken to a size of 50 mm. or less. Contractor shall make his own arrangements at his own costs for land for borrowing selected earth. The stacking of materials shall be done as directed by the Engineer-in-charge in such a way as not to interfere with any constructional activities and in proper stacks.

41.3 When excavated material is to be used, only selected stuff got approved from the Engineer-in-charge shall be used. It shall be stacked separately and shall comply with all the requirements of selected earth mentioned above.

M-42 MARBLE SLAB:

Marble slabs shall be white or of other colour and of best quality as approved by the Engineer-in-charge. Slab shall be bard, close, uniform and in texture. They shall also be free defects and cracks. The surface shall be machine polished to an even and perfectly plane surface and the edges, machine cut true and square. The rear face shall be rough enough to provide key for the mortar.

Marble slabs with natural veins, if selected shall have to be laid as per the pattern given by the Engineer-in-charge. Size of the slabs shall be minimum 450mm. x 450mm. and preferably 600mm. x 600mm. However, smaller sizes will be allowed to be used to the extent of maintaining required pattern.

The slab shall not be thinner than the specified thickness at its thinest part. A few specimen of finished slab to be used shall be deposited by the contractor in the office for reference.

Except as above, the marble slabs shall conform to I.S.1130-1969 or as revised from time to time.

M-43 INDIAN TYPE WATER CLOSET:

The Indian type white glazed water closet of first class quality, size as specified in the item and conforming to I.S. 771-1979 and I.S. 2556-(Part-II)-1981. Each pan shall have integral flushing ring of suitable type with adequate number of holes all around as directed to have satisfactory flushing. It shall also have an inlet at back of front for connecting flush pipe as directed. The inside of the bottom of the pan shall have sufficient slope from the front towards the outlet and the surface shall be uniform and smooth. Pan shall be provided with 100 mm. diameter `P' or `S' trap with approximately 50 mm. water seal and 50 mm. diameter vent horn.

FOOT RESTS:

A pair of white glazed earthen ware rectangular foot rests of minimum size 250 mm. x 130 mm. x 20 mm. shall be provided with the water closet.

M-44 GLAZED EARTHEN WARE SINK:

The glazed earthenware sink shall be of specified size, colour and quality. The sink shall conform to I.S. 771-Part-II-1979. The brackets for sinks shall conform to I.S. 775-1970.

The pipes shall conform to I.S. 1239-Part-I-1973 and I.S.404-1962 for steel and lead pipes respectively. 32 mm. brass waste coupling of standard pattern with brass chain and rubber plug shall be provided with sink.

M-45 GLAZED EARTHEN WARE LIPPED TYPE FLAT BACK URINAL/CORNER TYPE URINAL:

The lipped type urinal shall be flat back or corner type as specified in the item and shall conform to I.S. 771-1979. It shall be of best Indian make and size as specified and approved by the Engineer-in-charge. The flat back or corner type urinal must be of first class quality, free from any defects, cracks etc.

M-46 FLUSH COCK:

Half turn flush cock (heavy weight) shall be of gun metal chromium plated of diameter as specified in the description of the item. The flush cock shall conform to relevant Indian Standards.

M-47 NAHNI TRAP:

Nahni trap shall be of cast iron and shall be sound and free from porosity or other defects which affect serviceability. The thickness of the base metal shall not be less than 6.5 mm. The surface shall be smooth and free form crack, chips and other flaws or any other kind of defects which affect serviceability. The size of nahni trap shall be as specified and shall be of self cleansing design.

The nahni trap shall be of quality approved by the Engineer-in-charge and shall generally conform to the relevant Indian Standards.

The nahni trap provided shall be with deep seal, minimum 50 mm. except at places where trap with deep seal can not be accommodated. The cover shall be cast iron. Perforated cover shall be provided on the trap of appropriate size.

M-48 GULLY TRAP:

Gully trap shall conform to I.S. 651-1960. It shall be sound, free from defects such as fire cracks or hair cracks. The glaze of the traps shall be free from crazing. They shall give a sharp clear note when struck with light hammer. There shall be no broken blisters.
The size of the gully trap shall be as specified in the item.

Each gully trap shall have one C.I. grating of square size corresponding to the dimensions, of inlet of gully trap. It will also have a water tight C.I. cover with frame inside dimensions 300mm. x 300mm. the cover weighing not less than 4,53 Kg. and the frame not less than 2.72 Kg. The grating cover and frame shall be of sound and good casting and shall have truly square machined seating faces.

M-49 GLAZED STONE WARE PIPE AND FITTINGS:

The pipes and fittings shall be of best quality as approved by to the Engineer-in-charge. The pipe shall be of best quality manufactured from stone-ware of fire clay, salt glazed thoroughly burnt throught the whole thickness, of a close even texture, free from air blows, fire blisters, cracks and other imperfections, which affect the serviceability. The inner and outer surfaces shall be smooth and perfectly glazed. The pipe shall be capable to withstand pressure of 1.5 m. lead without showing signs of leakage. The thickness of the wall shall not be less than (1/12)th of the internal dia. The depth of socket shall not be less than 38 mm. The socket shall be sufficiently large to allow a joint of 6 mm. around the pipe. The pipes shall generally conform to relevant I.S. 651-1980.

M-50 CRYDON BALL VALVE:

Ball valve of screwed type including polythene float and necessary lever etc. shall be of the size as mentioned in the description of item and shall conform to I.S. 1703-1977.

M-51 CRACKSEAL:

Crackseal manufactured by Chemistic/Chemisol Indian Ltd., is an acrylic base ready application compound.

M-52 BARBED WIRE :

1.0 The barbed wire shall be of galvanized steel and it shall generally conform to IS : 278. The barbed wire shall be of type –I, whose nominal diameter for line wire, shall be 2.5 mm and for point wire shall be 2.24mm. The nominal distance between two barbs shall be 75mm, unless otherwise specified in the item. The barbed wire shall be formed by twisting together two lines wires, one of them containing the barbs. The size of line and point wires and barbs spacing shall be as specified above. The permissible deviation from the nominal diameter of the line wire and point wire shall not exceed +0.08 mm.

2.0 The barbs shall carry four points and shall be formed by twisting two point wires, each two turns, lightly round one line wire, making altogether four complete turns. The barbs shall be so finished that the four points are set locked at right angle to each other. The barbs shall have length of not less than 13 mm and not more than 18 mm. The points shall be sharp and cut an angle not greater than 35^0 of the axis of the wire, forming the barbs.

3.0 The line and point wires shall be of circular section, free from scale and other defects and shall be uniformly galvanized. The line wire shall be in continuous length and shall not contend any weld other than those in the rod before it is drawn. The distance between two successive splices shall not less than 15m.

4.0 The length per 100kg of barbed wire, IS type –I, shall be as under :
Nominal 1000m.
Minimum 934 m.
Maximum 1066 m.

M-53 ASBESTOS CEMENT SHEET

1.0 Asbestos cement sheet plain, corrugated or semi corrugated and curved shall be from Everest or equivalent as approved by the Architect or Engineer-in-charge. It shall confirm to IS :459. The thickness of the sheet shall be as specified in the item. The sheet shall be free from all the defects such as cracks, holes, deformation, chipped edge or otherwise damaged.

2.0 It shall manufactured by reinforcing Asbestos in cement, in such a manner that every fibre is covered with fine particles of cement to ensure maximum strength. It shall be alkali resistance and anti-corrosive. It should not break during transportation, handling, laying etc. and should be non-destructible, non-inflammable and non-organic. It shall have high tensile strength and high slenderness ratio.

3.0 The minimum nominal thickness of sheets shall be 6mm, having covering efficiency of about 90% and weight 1518 kg/ cm^2. The sheet shall be free from all defects such as cracks, holes, deformation, chipped edge or otherwise damaged. The permissible bending stress shall be 130 kg/ cm^2

4.0 The accessories shall be same thickness that of AC sheets. They shall be suitable for all types of sheets and locations. They also shall be from approved manufacturer and shall be free from any defects. The fixing of AC sheets and accessories shall confirm o IS : 730.

5.0 Ridges & Hips :

5.1 Ridges & hips shall be of same thickness as that of AC sheets. The different types of ridges shall be suitable for its corresponding type of sheets and locations.

5.2 Other accessories to be used in roof such as flashing piece, caves, filer pieces, valley gutters, north light and ventilator curves, barge boards etc. shall be from standard manufacture and shall be suitable for the different types pf sheet location.

Signature of the Contractor.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

SPECIFICATION FOR RUBBER RINGS FOR SEWERS: INDIAN STANDARD:5382-1985

1.0 SCOPE:

1.1 This standard prescribes the requirements for materials used for vulcanized solid rubber sealing rings for water supply and drainage system, drain pipes, sewers and rainwater pipes, all at ambient temperature including gas connections. It covers joint rings for all pipe line materials including iron, steel, stone wares, asbestos cement concrete, pitch fiber, plastics and glass reinforced plastics.

2.0 TYPES:

2.1 This standard covers six types of pipe joint rings, namely, 21 to 6. These correspond to the respective nominal hardness of 40, 50, 60, 70, 80 and 88 IRHD.

2.2 Sealing rings having two different types of rubber are permitted.

3.0 REQUIREMENTS.

3.1 Material: The rubber shall be free from extractable substances which impart taste, odour of toxicity of water.

3.2 The rings shall be homogeneous, free from porosity, grit, excessive blooms, blisters or other visible surface imperfections.

3.3 Stretch Test: Stretch gaskets till the circumference is increased by 50 percent, then visually inspect for the following.

3.3.1 Gaskets shall be made of a properly vulcanized virgin rubber compound containing no scrap or reclaim.

3.3.2 The surface of the gasket shall be smooth free from pitting cracks, blisters, air marks, and any other imperfection that may affect its behavior in service. The body of the gasket shall be free from porosity and air pockets.

3.4 Unless otherwise specified, the materials shall be blacks.

3.5 Dimensions and Tolerances - All the dimensions and tolerances shall be as agreed to between the purchaser and the manufacturer.

3.6 Physical Requirements:

3.6.1 Hardness: Hardness when determined in accordance with Micro test method described in IS:3400 (Part-I)-1980 (Methods of test for vulcanized rubber : Part-2 Hardness.)

3.6.2 Tensile Strength and Elongation at Break: Determined by the method described in IS:3400 (Part-1)-1977 [Methods of test for vulcanized rubber : Part-1 Tensile stress-strain properties (first revision)].

3.6.3 Compression Set: Determined by the method described in IS:3400 (Part-10)-1977. [Methods of test for vulcanized rubber : Part-10 Compression set at constant strain (first revision)]

3.6.4 Accelerated Ageing in Air: By the oven method described in IS-3400 (Part-4)-1983, the changes in hardness, tensile strength and elongation at break after ageing shall comply.

3.6.5 Water Immersion: Determined according to the method given in IS-3400(Part-6)-1983 after 7 days immersion in neutral water pH 7 at 70

3.6.6 Cold Resistance: When cooled in a chamber described in Appendix-B, the increase in hardness, measured after 7 days at - C, from the initial hardness, shall comply with the requirements given in as per IS.

3.6.7 Water Absorption: Sealing rings shall not absorb more than 10 percent (m/m) of water when tested according to the method prescribed in relevant IS.

4.0 MARKING:

4.1 Each sealing ring or packing or both shall be marked indelibly with:

(a) The manufacturer's name or trade-mark, if any;
(b) The month and year of manufacture; and
(c) The type following by a word, such a 'Gas' or 'Water' or 'Sewers' depending on the application for which they are intended.

4.1.1 Each sealing ring or packing or both may also be marked with the Standard Mark.

Note: The use of the standard mark is governed by the provisions of the Bureau of Indian Standards Act 1986 and the Rule and regulations made there under. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to emply with the requirements of that standard under a well-defined system of inspection, testing, and quality control which is devised and supervised by BIS and operated by BIS for conformity to that standard as a further safeguard. Details of conditions under which a license for the use of the Standard Mark may be obtained from the Bureau of Indian Standards.

5.0 PACKING:

The material shall be packed as agreed to between the purchased and the supplier so as to protect them from undue expenses to light and heat and mechanical damages during transit and storage.

6.0 SAMPLING:

6.1 Scale of Sampling and Criteria for Conformity: For the purpose of ascertaining conformity to this standard the seals of sampling and criteria for conformity shall be as prescribed as per relevant I.S.

7.0 TIME LAPSE BETWEEN RECEIPT OF MATERIAL AND TESTING:

7.1 For all the test purposes, the minimum time between vulcanization and testing shall be 16 h.

7.1.1 For product tests, whenever possible, the time between vulcanization and testing should not exceed 4 months. In other cases, tests shall be made within 2 months from the date of receipt of the product by the customer.

8.0 TEST PIECE:

8.1 Wherever possible, for all test, test pieces shall be cut from the finished article. Where this is not possible, the manufacturer shall provided test slabs from the same batch of rubber and vulcanized to the same degree and in the same manner as that of the rubber from which the sealing rings have been manufactured.

8.1.1 Wherever it is not possible to cut standard test piece from the rings, for determination of tensile strength and elongation at break, test piece as shown in drawing shall be used with the rate of traverse of moving grip as 15 cm/min.

APPENDIX-C

(Clause 3.7.8)

WATER ABSORPTION:

C.1 PROCEDURE:

C.1.1 From the finished ring, cut a piece of about 3 g. Weight it accurately. Put in 150 ml of distilled water. Boil under reflux with air condenser for 168 hours. Remove the piece and weigh again after surface water layer is dried up.

C.2 CALCULATION:

C.2.1 Calculate the water absorption as follows:

$$\text{Water absorption, percent by mass} = \frac{M2 - M1}{M1} \times 100$$

Where
M1 = original mass in g of the test piece before immersion in water and
M2 = mass in g of the test piece after immersion in water.

APPENDIX-D

(Clause 6.1)

SAMPLING AND CRITERIA FOR CONFORMITY:

D.1 SCALE OF SAMPLING:

D.1.1 Lot - In a consignment all the sealing rings of the same type, dimensions, design and manufactured from the same type of rubber under essentially similar conditions of production shall be grouped together to constitute a lot.

D.1.2 Samples shall be selected and tested from each lot separately for ascertaining its conformity or otherwise to the requirements of this specification.

D.1.3 The number of sealing rings to be selected at random from a lot for different tests shall depend upon the size of the lot and shall be in accordance with col 1 and 2 of Table-3

TABLE-3 SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF DEFECTIVES

No. of Sealing Rings in the lot	For dimensions and finishing defects (see 3.3 and 3.4)		No. of Tests for each charac-teristic for hardness, tensile strength, Elongation Compression set, water absorption & stretch tests.	No. of Tests for each charac-teristic for for ageing and water immersion test (Tables 1 & 2)
	Sample Size	Permissible No. of Defectives		
(1)	(2)	(3)	(4)	(5)
Up to 100	5	0 }		
101 to 150	8	0 }	3	1
151 to 300	13	0 }		
301 to 500	20	0 }		
501 to 1000	32	1	5	2
1001 and above	50	2	8	3

D.1.3.1 The rings to be selected from the lot shall be chosen at random. In order to ensure the randomness of selection, random number tables shall be followed. In case random number tables are not available, the rings may be selected from the lot in the following manner:

D.1.3.2 Starting from any ring in the lot, the rings shall be counted as 1.2..... and so on in one order, where r is the integral part of N/n (N and n being the lot size and sample size respectively). Every rth ring thus counted shall be withdrawn to constitute the sample.

D.1.3.2 If the rings are packed in bundles, at least 10 percent of the bundles shall be opened and the required number of rings shall be selected by taking approximately equal number of rings at random from each of the bundle.

D.2 NUMBER OF TEST AND CRITERIA AND CONFORMITY:

D.2.1 All the sealing rings selected according to D.1.3 shall be examined for dimensions and finishing defects. Any ring failing in one or more of these characteristics shall be considered as defective. If the number of defectives found in the sample in less than or equal to the corresponding permissible number given in col-3 of Table-3, the lot shall be declared as conforming to these requirements, otherwise not.

D.2.1.1 In the case of those lots when have been found unsatisfactory according to D.2.1 all the sealing ring may depending upon the agreement between the purchaser and the supplier, be inspected for these characteristics and the defective ones removed.

D.2.2 The lot having been found satisfactory for workmanship and dimensions according to D.2.1 shall then be examined for hardness, tensile strength, elongation strength, swelling, water absorption and compression characteristics. The number of tests to be conducted for such of these characteristics is given in col-4 of Table-3. For this purchase, required number of rings shall be selected at random from those already selected under D.1.3 and if necessary, from the lot. For each of the characteristics the various tests shall be conducted on independent test pieces. The lot shall be declared as satisfactory if the medium value of the test results of compression characteristic satisfies the relevant requirements and for the remaining characteristics none of test fails.

D.2.3 The lot which has been found satisfactory according to D.2.2 shall then be subjected to relevant ageing and oil immersion tests. The number of independent tests to be conducted for each of the characteristics is given in col-5 of Table-3. For this purpose, required number of rings shall be selected from those which have been tested and found satisfactory under D-2.2. The lot shall be declared satisfactory with respect to ageing characteristic if none of the test fails.

Signature of the Contractor.

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

20. DETAILED SPECIFICATIONS CIVIL WORKS

1.0 CLEARING THE SITES :

1.1 The site at which the construction is to be done and the areas required for setting out and other operations shall be cleared of all obstructions, loose stones, and rubbish of all kinds, stumps of trees, C.I. Pipes, R.C.C. Pipes, brushwood as well as all trees shall be removed as directed. The roots shall be entirely grubbed up.

1.2 The products of the clearing to be stacked in such a place and in such a manner as directed by Engineer-in-charge.

1.3 In site clearing all trees not specially for preservation, bamboos, junglewood and brushwood shall be cut down and their roots grubbed up. All wood and materials from the clearing shall be the property of Surat Smart City Development Limited and shall be arranged as directed by the Engineer-in-charge or his authorised agent. The materials found to be useful by the Engineer-in-charge shall be conveyed and properly stacked as directed within the specified limit.

Useless materials will be burnt or otherwise disposed off as directed.

1.4 All holes or hollows, whether originally existing or prodeced by digging up roots, shall be carefully filled up with earth, well rammed and levelled off, as may be directed.

1.5 The contractor shall have to dismantle the existing concrete/ steel structure obstructing in construction area above as well as below ground shall be removed and cleared of as directed.

1.6 The contractor shall have to visit the site and familiarized themselves thouroughly with the site condition and all obstruction in construction of treatment plant before submitting the tender and shall have to quote the tender accordingly.

1.7 The contractor shall have to remove the existing C.I.and hume steel pipe line and any kind of structure obstructing during excavation.

1.8 During excavation if any obstruction like pipe/cable are found, the same should be shifted as directed by the Engineer-in-charge.

1.9 No extra charge will be paid for removing any kind of obstructions.

2.0 EXCAVATION :-

The excavation in foundation shall be carried out in true line and level and shall have the width and depth as directed. The contractor shall do the necessary shoring and shuttering in required. The bottom of the excavated area shall be leveled both longitudinally and transversely as directed by removing and watering as required. No earth filling will be allowed for bringing it to level, if by mistake or any other reason excavation is made deeper or wider than that shown on the plan or as directed. The extra depth or width shall be made up with concrete of the same proportion as specified for the foundation concrete at the cost of the contractor.

2.1 DISPOSAL OF EXCAVATED MATERIALS :

2.1.1 No materials excavated from the foundation trenches, of whateverkind they may be, are to be placed even temporarily, upto 1.5 mts. or at the distance prescribed by the Engineer, from the outer edge of excavation. All materials excavated shall remain the property of the Surat Smart City Development Limited. Materials suitable and useful for backfilling or other use shall be stacked in convenient places butnot in such a way as to obstruct free movement of men, animals and vehicles or encroach upon the area required for constructional puposes. The site shall be left clean of all debris on completion.

2.1.2 Disposal of excavated materials is subject to the following Unsuitable materials obtained from clearing site and excavation shall be disposed off within City Limit area as directed. Useful materials obtained from clearing site and excavation shall be stacked at convinient place as directed. Materials suitable for backfilling shall be stacked at convenient places as directed.

2.2 CARTING OF SURPLUS EXCAVATED EARTH

2.2.1 The contractor has to convey the surplus excavated stuff from the site to the place as directed by Engineer-in-charge within the Municipal limit, (maximum distance of 5 KM. from work site) should be dumped and/or spread in such a way as not to obstruct the path of vehicles but it should also make approach to lay the earth beyond that dump. Neither any excuse for difficulties for passing the vehicle over the dumped earth shall be allowed not any extra charge will be paid to the contractor for the same.

2.2.2 The conveying of earth shall be done in such a manner that it shall not cause any delay in the progress of the work.

2.2.3 During the conveying of the earth due care shall be taken that the earth should not be misused or wasted. The contractor shall have arranged to collect the mis-spread earth with his own cost

2.2.4 The earth should be loaded, unloaded and spread or dumped in the presence of the Engineer-in-charge or his representative.

3.0 DEWATERING :

3.1 The contractor shall arrange bailing out of water in the foundation or trenches, accommodated due to rains or by springs subsoil water, canal or river seepage end broken water mains or drains. The excavation shall be kept free from water and moisture content.

(i) During inspection.
(ii) When concrete work is in progress and will come above the natural water level.

3.2 Pumping from the interior of any foundation enclosure shall be done in such a manner as not to produce the possibility of the movement of water through any fresh concrete.

3.3 No pumping shall be permitted during the placing of concrete or for any period of at least 24 hours thereafter unless it is done from a suitable sump separated from the concrete work by a water tight wall or similar other means or by any other method.

3.4 The operations of removal of water from trenches shall be so conducted by the contractor that there is no danger to foundation or stability of adjoining earth or structure.

3.5 In no case the dewatering should be stopped or failed during the work in progress.

3.6 The contractor has to arrange his own machinery, motor, engine, pump and other mechanical equipments with all the maintenance and labour as required for full efficiency of the work.

3.7 Necessary fuels and/or electrical power will be arranged by the contractor with all expenditure due to that on his part.

4.0 PLAIN CEMENT CONCRETE :

4.1.0 MATERIALS:

4.1.1 Water shall conform to M-1, Cement shall conform to M-3. Sand shall conform to M-5 Stone aggregate 40-mm nominal size shall conform to M-9.

4.2.0 WORKMANSHIP:

4.2.1 General :
Before starting concreting the bed of foundation trenches shall be cleared of all loose materials, leveled, watered and rammed as directed.

4.2.2 Proportion of Mix:
The proportion of cement, sand coarse aggregate shall be 1 part of cement, 3 parts of sand 6 parts of stone aggregate measured by volume.

4.2.3 Mixing:
The concrete shall be mixed in a mechanical mixer at the site of work. Hand mixing may however be allowed for smaller quantity of work if approved by Enginer-in-charge. When hand mixing is permitted by The Engineer-in-charge in case of break down of machinery and in the interest of the work, it shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. However, in such case 10% more cement than otherwise required shall have to be used without any extra cost. The mixing in mechanical mixer shall be done for a period of 1 ½ to 2 minutes. The quantity of water shall be just sufficient to produce dense concrete of required workability for the purpose.

4.2.4 Transporting and placing the concrete:
The concrete shall be handed from the place of mixing to the final position in not more than 15 minutes by the method as directed and shall be placed into its final position, compacted and finished within 30 minutes of mixing with water i.e. before the setting commences. The concrete shall be laid in layers of 15 cms to 20 cms.

4.2.5 Compacting : The concrete shall be rammed with heavy iron rammer and rapidly to get the required compaction and to allow the interstices to be filled with mortar.

4.2.6 Curing:
After the final set, the concrete shall be kept continuously wet, if required by ponding for a period of not less than 7 days from the date of placement.

5.0 REINFORCEMENT CEMENT CONCRETE :

5.1 The maximum size of coarse aggregate shall be as large as possible within the limits specified but in no case greater than one fourth of the minimum thickness of the number, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and to fill the concrete of the form.

5.2 For reinforced concrete work, coarse aggregate having a nominal size of 20 mm are generally considered satisfactory.

5.3 For heavily reinforced concrete members as in the case of ribs of main beams, the nominal maximum size of coarse aggregate should usually be restricted to 5 mm. main bars, or 5 mm. less than the minimum cover to the reinforcement whichever is smaller.

5.4 Where the reinforcement is widely spaced as in solid slabs, limitations of size of the aggregate may not be so important, and the nominal maximum size may sometimes be as great as or greater than the minimum cover.

5.5 Admixture may be used in concrete only with approval of Engineer-in-charge based upon the evidence that with the passage of time, neither the compressive strength of concrete is reduced nor are other requisite qualities of concrete and steel impaid by the use of such admixture.

5.6 Form work shall conform to the shape lines and dimensions as shown on the plans and be so constructed as to remain sufficiently rigid during the placing and compacting of the concrete. Adequate arrangements shall be made by the contractor to safeguared against any settlement of the form work during the course of concreting and after concreting. The form work of shuttering, centering, scaffolding, bracing etc. shall be as per design.

Cleaning and Treatment of forms
All rubbish, particularly chippings shaving and saw dust shall be removed, from the interior of the form before the concrete is placed and the form work in contact with concrete shall be cleaned and thoroughly wetted or treated. The surface shall be then

coated with soap solution applied before concreting is done. Soap solution for the purpose shall be prepared by dissolving yellow soap in water to get consistency of paint.

Alternatively a coat of raw linseed oil or form oil of approved manufacturer may be applied in case of steel shuttering in used. Soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Care shall be taken that the coating does not get on constructin joint surface and reinforcement bars.

Stripping Time

In normal circumstances and where ordinary cement is used forms may be struck after expiry of following period

a] Sides of wall columns and vertical faces of beams	2-4 Days
b] Beam soffits [crops left under]	7 Days
c] Removal of props slabs	
i] Slabs spanning upto 4.5 Mts.	7 Days
ii] Spanning over 4.5 Mts.	14 Days
d] Removal oof porops to beams and Arches	
i] Spanning upto 6 Mts.	14 Days
ii] Spanning over 6 Mts.	21 Days

Procedure when removing the form work

All form work shall be removed without such shock or vibration as would the reinforced concrete. Before the soffit form work and struts are removed, the soffits and the concrete surface shall be where necessary in order to ascertain that the concrete has sufficiently hardened.

5.7 Centering

The centering shall be sufficiently strong to ensure absolute of the form work and concrete work before, during and after pouring concrete. Watch should be kept to see that behaviour of centering and form work is satisfactory during concreting erection should also be such that it would allow removal of forms in proper sequence without damaging either the concrete or the form to be removed.

5.8 Scaffolding

All scaffolding, hoisting arrangements and ladders etc. required for the facilitating of concreting shall be provided and removed on completion of the work by the contractor. The scaffolding, hoisting arrangements and ladders etc. shall be strong enough to with stand all live, dead and impact loads expected to act and shall be subject to the approval of the Engineer-in-charge.

However, the contractor shall be wholely responsible for the safety to the scaffolding, hoisting arrangements, ladders, work and workman etc.

The scaffolding, hoisting arrangements and ladders shall allow easy approach to the work spot and afford easy inspection.

5.9 Re-use

Before re-use, all forms shall be inspected by the Engineer-in-charge and their suitability ascertained. The forms shall be scarred, cleaned and joints gone over, repaired where required. Inside surface shall be retreated to prevent adhesion of concerte.

Reinforcement

The bars shall be kept in position by the following methods-

[i] In case of beam and slab construction, sufficient number of precast cover blocks in cement mortar 1:2 (1 Cement, 2 coarse sand) about 4 x 4 cms. section and of thickness equal to the specified cover shall be placed between the bars and shuttering as to secure and maintain the requisite cover of concrete over the reinforcement.

[ii] In case of columns and walls, the vertical bars shall be kept in position by means of timber temphtes with slotes accurately cut in them, the temphtes shall be removed after concreting has been done below it. The bars may also be suitably tied by means of annealed steel wires to the shuttering to maintain their position during concreting.
All bars projecting from pillars, columns beams slabs etc. to which other bars and concrete are to be attached or bounded to later on, shall be protected with a coat of thin neat cement grout, if the bars are not likely to be incorporated with succeeding mass of concrete within the following days. This coat of thin neat cement shall be removed before concreting.

5.10 Mixing

For all works, concrete shall be mixed in a mechanical mixer which alongwith other accessories shall be kept in first class working condition and so maintained throughout the construction.

Measured quantity of aggregate, sand and cement required for each batch shall be poured into the drum of the mechanical mixer while it is continuously running. After about half a minute of dry mixing measured quantity of water required for each batch of concrete mix shall be added gradually and mixing continued for another one and a half minute. Mixing shall be continued till materials are uniformly distributed and uniform colour of the entire mass obtained and each individual particle of the coarse aggregate shows complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer.

When hand mixing is permitted by the Engineer-in-charge forsmall jobs or for certain other reasons, it shall be done on a smooth watertight platform large enough to allow efficient turning over of the ingredients of concrete before and after adding water. Mixing platform shall be so arranged that no foreign materials gets mixed with concrete not does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture of uniform colour. Specified quantity of water shall then be added gradually through a rose can and the mass turned over till a mix of

required consistency is obtained.In hand mixing quantity of cement shall be increased by 10% above that specified.

Mixers which have been out of use for more than 30 minutes shall be throughly cleaned before putting in a new batch. Unless otherwise agreed to by the Engineer-in-charge the first batch of concrete form the mixture shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

5.11 Consistency

The degree of consistency which shall depend upon the nature of the work and methods of vibration of concrete, shall be determined by regular slump tests in accordance with I.S. 1199- 1959. The slump of 10 mm to 25 mm shall be adopted when vibrators are used and 80 mm when vibrators are not used.

5.12 INSPECTION

Contractor shall give the Engineer-in-charge due notice before placing any concrete in the forms to permit him to inspect and accept the false work and forms as to their strength, alignment and general fitness but such inspection shall not relieve the contractor of his responsibility for the safety of men, machinery, materials and for results obtained. Immediately before concreting, all forms shall be thoroughly cleaned. Centering design and its erection shall be got approved from the Engineer-in-charge. One carpenter with helper shall invariably be kept present throughout the period of concreting. Movement of labour and other persons shall be totally prohibited from reinforcement laid in position. For access to different parts, suitable mobile platforms shall be provided so that steel reinforcement in position is not disturbed. For ensuring proper cover mortar blocks of suitable size shall be cast and tied to the reinforcement timber, kapachi or metal pieces shall not be used for this purpose.

5.13 TRANSPORTING AND LAYING

The method of transporting and placing concrete shall be as approved. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes place.

All form work shall be cleaned and made free form standing water, dust, snow or ice immeediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the Engineer-in-charge has been obtained.

Concreting shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes of its discharge from the mixer. Except where otherwise agreed to by the Engineer-in-charge, concrete shall be deposited in horizontal layers to a compacted depth of not more than 0.45 metres when internal vibrators are used and not exceeding 0.30 metres in all other cases.

Unless otherwise agreed to by the Engineer-in-charge concrete shall not be dropped into placed from a hieght exceeding 2 metres. When trunking or chutes are used

they shall be kept close and used in such a way as to avoid segregation. When concreting has to be resumed on a surface which has hardened, it shall be roughened swept clean, thoroughly wetted, and covered with a 13 mm thick layer of mortar composed of cement and sand in the same ratio as in the concrete mix itself. This 13 mm. layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of any particles of coarse aggregate. The surface shall then be throughly wetted, all fresh water removed and then coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 150 mm. in thickness and shall be well rammed against old work, particular attention being given to corners and close spots.

All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwisepermitted by the Engineer-in-charge for exceptional cases, such as concreting under water, where vibrators cannot be used.

Sufficient vibrators in serviceable condition shall be kept at site so that spare equipment is always available in the event of breakdowns. Concrete shall be judged to be compacted when the mortar fills the spaces between coarse aggregate and begins to cream up to form an even surface. Compaction shall be completed before the initial setting starts i. e. within 30 minutes of addition of water to dry mixture. During compaction, it shall be observed that needle vibrators are not applied on reinforcement which is likely to destroy the bond between concrete and reinforcement.

5.14 COMPACTING

Concrete shall be prooperly compacted by use of vibrators or by rodding and spacing as directed by the Engineer, tamping as above shall be continued until all the entrained air is removed and the concrete has been compacted and completely fills the form. The sides of the form work shall be gently tapped by spades during concreting.

5.15 CURING OF CONCRETE

All concrete work shall be protected from direct rays of the sun and be kept wet for a minimum period of 10 days or for longer directed by Engineer-in-charge. Concrete laid shall not be disturbed and shall be suitably protected from any injury until completely set, particular care shall be taken at all corners and edges of the member. All horizontal concrete surface shall be kept constantly wet by ponding or any other manner. Concrete surface shall be cured either by sprinking or by spraying water.

Flat or fine vertical surfaces may be covered with damp gunny bags and watered frequently. In order to ensure adequate quantities of water for curing, the contractor shall make necessary arrangement such as proviing sufficient lengths of temporary pipe line of suitable sizes, storage of water in tanks and/or use of bhisties.

5.16 CONCRETING THOROUGH WATER :

Concrete shall not be deposited under water without the prior consent in writing of the Engineer. In the event of permission being given, the amount of cement in every batch shall be increased by twenty five percent entirely at the expense of the contractor

and he shall take every reasonable precaution to ensure that cement or fine aggregate is not washed out of any concrete so deposited by any flow of water.

5.17 FINISH OF CONCRETE :

[a] On removal of the shuttering and after the approval of the Engineer, honey combed surfaces shall be made good immediately by the method approved by the Engineer and superficial water and air holes shall be filled in. Unless instructed to the contrary, the faces of exposed concrete placed against shuttering shall be rubbed down with a carborandum stone immediately upon removal of the shuttering to remove fins or other irregularities. The face of concrete for which shuttering is not provided other than a slab, shall be smoothed with a wooden float to give finished equal to that of the rubbed down face where shuttering is provided. No cement wash, mortar or print may be applied to any concrete surface without the express instruction or permission of the Engineer.

[b] All floors, slabs and inverts shall be laid to the required depths, thickness inclinations and curvatures, shown on the detail drawings Subsequently, and just before settling the concrete shall be finish off to a smooth and even surface with metal floats, unless otherwise ordered.

[c] Laying of concrete floors and inverts in two courses will not be permitted, except where specified or special permission of the Engineer in writing. Where screeds are required or approved, the structural concrete shall be keyed and prepared as specified for construction joints and the screeding properly bonded.

[d] First class plane surface free from ripples, hollows airholes or exposed aggregate is required.

5.18 SAMPLING & TESTING OF CONCRETE

Samples from fresh concrete shall be taken as per I.S. 1199-1959 and cubes shall be made, cured and tested at 7 days or 28 days as per requirements in accordance with I.S. 516-1959. A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested i.e. the sampling should be spread over the entire period of concreting and cover all mixing units. The minimum frequency of sampling of concrete of each grade shall be in accordance with the following---

Quantity of Concrete in the work	No. of Samples
1 - 5 Cmt.	1
6 - 15 Cmt.	2
16 - 30 Cmt.	3
31 - 50 Cmt.	4
51 & above	4 + 1 additional sample for each additional 5 Cmt or part thereof

Note : Atlest one sample shall be taken from each shift. Ten test specimens shall be made from each sample, five for testing at 7 days and the remaining five at 28 days. the samples of concrete shall be taken on each day of the concreting as per above frequency. The number of specimens may be suitable increased as deemed necessary by the Engineer-in-charge when procedure of tests given above reveals a poor quality of concrete and in other special cases.

The average strength concrete in proportion 1:4:8; 1:3:6; 1:2:4 & 1:1.5:3; 1:1:2 of the group of cubes cate for strengthof 75, 100, 150, 200 & 250 Kg/Sq.cm. respectively at 28 days. 20% of the cubes cast for each day may have value less than the specified strength provided the lowest value is not less than 85% of the specified strength. If the concrete made in accordance with the proportions given for a particular grade does not yield the specified strength, such concrete shall be classified as belonging to the appropriate lower grade. Concrete made in accordance with the proportions given for a particular grade shall not, however, be placed in a higher grade on the ground that the test strength are higher than the minimum specified.

5.19 STRIPPING

The Engineer-in-charge shall be informed in advance by the contractor of his intention to strike the form work. While fixing the time for removal of form work, due consideration shall be given to local conditions, character of the structure, the weather and other conditions that influence the setting of concrete and of the materials used in the mix. In normal circumstances (generally where temperatures are above 20 degrees centigrade) and where ordinary concrete is used, forms may be struck after expirary of periods specified for respective item of form work.

All form work shall be removed without causing any shock or vibration as would damage the concrete. Before the soffit and struts are removed, the concrete surface shall be and struts are removed, the concrete surface shall be exposed, where necessary in order to ascertain that the concrete has sufficiently hardened, centering shall be gradually and uniformly lowered in such a manner as to permit the concrete to take stresses due to its own weight uniformly and gradually. Where internal metal ties are permitted, they or their removable parts shall be extracted without causing any damage to the concrete and remaining holes filled with mortar. No permanently embedded metal parts shall have less than 25 mm. cover to the finished concrete surface. Where it is intended to re-use the form work, it shall be cleaned and made good to the satisfaction of the Engineer-in-charge. After removal of form work and shuttering, the Engineer-in-charge shall inspect the work and satisfy by random checks that concrete produced is of good quality.

Immediately after the removal of forms, all exposed bolts etc. passing through the cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of a least 25 mm. below the surface of the concrete and the resulting holes be filled by cement mortar. All fine caused by form joints, all cavaties produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in proportions used in the grade of concrete that is being finished and of as dry consistency as is possible to use.

Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which are pointed shall be kept moist for a period of 24 hours.

If rock pockets/honeycombs in the opinion of the Engineer-in-charge are of such an extent or character as to effect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and required the removal and replacement of the portions of the structure affected.

CONSTRUCTION JOINTS :- Concreting shall be carried out continuously upto construction joints, or predetermined by the Engineer-in-charge.

When the work has to be resumed on a surface which has hardened, such surface shall be roughened. The surfaces shall then be thoroughly cleaned, and all laitance removed with wire brushes and compressed air. In addition to that, the surface shall be completely wetted and slushed with a coat of neat cement grout immediately before placing of new concrete. The first layer of concrete to be placed on these surfaces shall not exceed 150 mm in thickness and shall be well rammed against old work, particular attention being paid to corners and close sports. Shear keys shall be provided to all construction joints.

Reinforcing rods shall be extended 35 diameters beyond construction joints unless otherwise indicated.

Joints in beams shall be kept at places where the shear force is minimum and these shall be at right angles to the direction of main reinforcement. In the case of columns, the joints shall be horizontal and about 150 mm below the bottom of the deepest beam framing into the column head, and the portion of the column between the stopping off level and the top of the slab shall be concreted with the beam. Joints in the R.C.C. slab shall be provided parallel to main reinforcements, or slabs supported thereon. Beams, girders, brackets, columns capitals and branches shall be considered as part of the floor system and shall be monolithically placed therewith.

Construction joints in water retaining structure :

Construction joints for the water retaining structures and underground storage area and lift pits in water logged areas shall be constructed as directed by the Engineer-in-charge prior to taking up any work of this type. Work shall conform to I.S. 3370 unless shown other wise.

Standard key joints should, however, be provided if so directed, in addition to the water stoppers in the concrete.

The water stoppers shall be PVC or rubber type. Whenever required the transverse joints of the sheets shall eigher be welded or brased, or overlapped. In case of overlapping of the stoppers the overlap should be minimum and equal to the width of stoppers, the stoppers can be of approved make. Deposition and compaction of concrete prior and after the construction joint should be very carefully done, so as to avoid internal honey combing. Before the next pour of concrete, the joints should be

cleaned of the loose mortar, aggregates dust, preferably by hosing down the water. The surface of the old concrete which is coming in contact with the next pour should be wire brushed and reasonably sprinkled with thick cement slurry so as to ensure proper bond.

5.20 PROTECTION OF CONCRETE :

a] Concrete placed below ground level shall be protected from falling earth during and after placing. Concrete placed in ground containing deleterious substances shall be kept free from contact with such ground and with water draining there during placing for a period of three days or as otherwise instructed thereafter.

b] No load of any kind, however light, shall be allowed on concrete which has not properly set, and unless it has been pronounced by the Engineer.

c] Immediately after the compaction of the concrete has been completed contractor shall ensure that it is adequantely protected from the weather. Protective materials shall be kept continuously damp and in position for a minimum period of fourteen days or such other times as the Engineer may direct.

d] Where large sections of concrete are poured special precautions as approved by the Engineer shall be taken to reduced and dissipate the heat generally by the settling and hardening of the concrete.

5.21 CONCRETE ADDITIVE :

a] The use of retarders will not be permitted.
b] Other activities shall only be used if written permission has been obtained from the Engineer. They shall be obtained from a manufacturer approved by the Engineer and shall be used strictly in accordance with the manufacturer's and the Engineer's instruction.

5.22 PERMISSION FOR STARTING THE CONCRETE WORK :

The surface whether concrete or rock or form work etc. on which concrete is to be placed, shall be got inspected and approved by the Engineer, who shall then issue the permission for starting the work. Any concrete work done without such a permission shall be cut and removed at the cost of contractors. If concreting is to be done on concrete previously laid, the surface of the old concrete shall be cleaned with wire brushes and all laitance removed to expose the original surface of metal and sand particles, etc. It shall then be covered with a 7 mm thick layer of cement mortar [1:2] before laying the fresh concrete.

B] FORM WORK :

1] Material :

All form work for concrete works shall be made either of planned and matched timber or M.S. plates. The timber for the form work shall be hard wood dry and well seasoned. It shall not be so dry to absorb water from concrete nor shall it be so green as to shrink after erection. When steel plate are used for forms, the plates shall be free

from wrinkles, dents, lumps or other imperfections. The timber boards or steel plates shall have sufficient thickness to withstand the construction loads and the pressure exerted by the wet concrete as well as vibration during placing of concrete.

Normally the thickness shall not be less than 38 mm for timber and 18 gauge for M.S. plates. However, in case where the depth of concrete to be poured in the form work is small, the thickness of timber planks may be reduced in consultation with the Engineer.

2] Arrangements :

All the forms shall conform to the shape, lines dimensions as shown on the drawings. The form work shall include all wedging, bracing, tie rod, clamps, stop off boards and other devices necessary to mould the concrete to the desired shape. The form work shall be so contructed as to remain sufficiently rigid during the placing and compacting of concrete.

The use of bolts passing through concrete members which form parts or any water retaining structures shall be permitted for the purpose of securing and aligning the form work. The form work shall be so arranged as to permit easy erection initially and later easy removal without disturbing the concrete.

Before concrete is placed all rubbish shall be removed from the interior of the forms and the surfaces of the work in contract with concrete shall be cleaned and thoroughly wetted, and inside surface treated with lime, oil or any other material. The slab centering shall be covered with double wax' water proofing paper' or tar paper or polythene sheet as directed by the Engineer.

3] Removal of form work :

In no circumstances shall forms be struck off untill the concrete reaches adequate strength as required, without obtaining permission of the Engineer. All the form work shall be removed without such shock or vibration as would damage the concrete. Removal of the form work whether whole or in part, shall rest entirely with the contractor who must never the less be guided by the opinion of the Engineer in this regard.

4] Surface treatment and finish :

When the form work is struck, all the faces of concrete shall be smooth and sound, free from voids and air holes, If any roughness filled up while the concrete is still green, with cement wash and/or 1:1/2 cement mortar properly towolled and finished as directed by Engineer. If the concrete shall be dismantled and fresh concrete of proper quantity be reinstated at contractor's cost.

5.23 CONCRETE IN WATER RETAINING STRUCTURES :

General

a] The specifications define the materials, constructional and performance requirements for water tight concrete necessary for following structures.

The work shall be done in accordance with this specification together with IS:3370 [PART-I to IV].

b] The water retaining structure is to be constructed as per the general design indicated in the drawings supplied/However, necessary for piping and electric conduits are to be provided during construction without any extra cost to owner.

c] After construction, the structure has to be tested for water tightness as detailed hereunder and as per relevant Indian Standard Specifications, which is also included in the scope of this contract.

d] For such structures where water tightness in addition to structural strength is of prime importance, special care shall be taken to get the most suitable grading of aggregate so as to produce the densest possible concrete.

Water cement ratio shall also be controlled, consistent with the requirement of workability, to produce an impervious concrete.

e] Concrete shall have at least the minimum cement required as per IS:3370.

f] The concrete between the reinforcement and the form work on the water face shall be well compacted and the board joints made tight so that seepage of water shall not take place.

Shutter vibrators at a rate of one vibrator per 2.5 m2 of shutter area shall be used to produce a compact concrete with dense skin. herever it is not possible to use shutter vibrators, pin vibrator shall be used. No extra payment will be made for use of shutter vibrators. The form work must also be so designed that shutter vibrators can be fixed and dismantled quackly.

5.24 Admixture :

Admixture shall be used in concrete only with the approval of the Engineer-in-charge. Normally approved compounds like"CICO", "PIDIPROOF" or equivalent of proven quality shall be permitted.

It shall be used as per manufacturers specifications and the direction of the Engineer-in-charge. Contractor shall provide test certificates from recognised laboratories before use of admixture, if so desired by the Engineer-in-charge. Calcium chlorides shall not be used in admisture.

Construction, contraction and Expansion joints :

Joints are potential positions of leakage. It is also advantageous to avoid horizontal joints by using continuously moving forms or by providing sufficient form work of ordinary type to enable the entire wall to be concrete without interruption. Where days' work joints are formed whether horizontally or vertically, they shall be rebated as called out on drawings. Care shall be taken to remove from the carlier lift all loose pieces of gravel/stone chips, wooden, country nails or any other foreign materials. All laitence shall also be thoroughly removed. If necessary the face of the old concrete shall be well hacked to expose the aggregate and after washing the surface, a thin coat

of mortar or grout [1 Cement: 1 Sand] shall be applied immediately before resuming concreting. A waterstop shall be placed through the joint specifically where the tank walls bond into the floor. Where an effective bond cannot be assumed at horizontal joints, a method that has been successful is to form a socket and spigot joint well caulked with asphalt or a bitumen filler and arrange to ensure that the water pressure tends to force the filling into rather than out of the joint. joints shall not be made at changes of concrete section if they can be conveniently placed elsewhere. Moving them even a few cms is often sufficient to prevent the secondary stresses being concetrated in one place leading to cracks. In long reservoir walls the design often incorporates permanent joints which assist in preventing cracks due to shrinkage and temperature changes. When these joints are not indicated in drawings, it is best to concrete the wall in short section and provide spaces as per drawings between sections. As far as possible after completing the sections, the intervening spaces shall be filled in taking care to bond the old with the new work.

5.25 WATER STOPPER :

5.25.1 The quality of water stoppers shall be of 150 mm vide ribbed type or approved by the Engineer-in-charge, before bring the same to the site of work. It shall be either "Cali Plast" "Omal" or "Chem Plast", AARTI or any other make as approved by the Engineer-in-charge.

5.25.2 At every horizontal and vertical joints of water retaining structure, water stopper of approved quality is to be provided as directed by Engineer-in-charge.

5.25.3 The water stops shall be thoroughly examined before putting it to use. It shall be placed in position carefully so as not to damage the same. Half of the width shall be embeded on each side of the joints between the adjacent sections, when embedding the first half of the width of the water stops great care should be taken to protect the other half from coming into contact with concrete by means of a suitable covering. After the concrete on the first half of the water stop sets, the protecting cover on the other half shall be removed and concrete poured to embed it.

5.25.4 It is essential that the water stop is properly aligned and placed in position during embedding. Where necessary the water stops shall be welded so as to have water proof joints.

5.25.5 The instructions for welding and/or vulcanizing as prescribed by the manufacturer shall be strickly adopted. It shall be seen that during the welding and vulcanizing of two pieces alignment of the central bulb is taken care of as this is essential for the correct finishing of the water stop.

5.25.6 The concrete shall not be poured from excessive height so as not to damage the water stops to prevent bending of the water stops.

5.26 RENDERING :

Rendering of cement mortar with addition of water proofing compound or equivalent shall be used with the object of covering weak patch in the concrete which still fresh the form work being struck as early as possible and the rendering applied immediately. The concrete surface shall be well wetted and if necessary,

hacked or otherwise treated to form a key. If the rendering is applied in two coats, the joints shall be broken. The mortar shall be steel trowelled, but finished with a wooden flat.

5.27 HYDRAULIC TESTING :

Testing shall be restricted to underground, on ground and overhead structure only. These structures shall be tested strictly in accordance with IS : 3370 [PART-I] for water tightness. for underground structure the total maximum drop in water surface level over seven days shall not exceed 40 mm.

5.28 TREATMENT OF SUSPENSION OF WORK :

Whenever work is suspended on any section for more than one hour, the horizontal edges of the concrete next to the forms on surface which will be exposed shall be brought to a horizontal place perpendicular to the plane of the forms and treated so that the finished work will shown smooth straight line.

5.29 FITTINGS :

Pipes or other fittings passing through the walls and bottoms of water retaining structures are another potential source of weakness, and shall be on site in time to errect them in position in the shuttering before concreting commences. They shall be well embedded in the concrete and if provided with normal water bar flanges, there is little risk or leakage. An objection to building in fittings is that of the flanges arenot in line with connecting flanges extra labour is required in making adjustments. Some Engineers prefer to have holes and fix the pipes fittings subsequently after completing the concrete work, however this difficult to ensure that this construction shall definately be leak proof.

Fittings built into concrete shall preferably be of non- corrosive material, so as to avoid frequent replacement leading to water leakage. If made of ferrous metals, the sections should be sufficiently substantial to prevent weakening by small corrosions. Care shall be taken that corrosive metal coming in contact with portland cement shall receive a bitumen or equivalent corrosion preventing paint.

5.30 GROUTING :

i] Grouting of Pockets -

The grouting shall be done with C.M. in proportion of one part of portland cement plus one part of sand and one part of grit (mix. size 6 mm). Adequate quantity of water shall be added. The pockets shall be thoroughly cleaned before fixing the holding-down bolts. In cases where the anchor bolts with sleeves are orivuded, it should be the responsibility of the contractor to keep them clean. Similarly, the treated portion of the bolts shall be greased to protect them from damage. Grout shall be gradually poured in the pockets without disturbing the holding down bolts, and shall be tamped with a steel rod for proper compaction.

[ii] Grouting under baseplates & machine bases -

The grouting shall be done in C.M. of one part of Portland cement and 2 parts of sand mixed with adequate quantity of water, unless otherwise specified. It shall be workied in and compacted, so that the entire space under baseplates and around the anchor

bolts in thoroughly filled with the dense grout. Care should be taken that no air bubbles are left inside the grout. The grout shall be cured for a minimum period of 7 days by wetting the exposed areas. The shin plates under the bases should be left undisturbed while grouting in undertaken, prior to grouting, the space under the steel shall be thoroughly cleaned and watered without disturbing the shin plates. No grouting work shall by carried out all the basis are properly aligned and plumbed. After the grouting is done, anchor bolts should be tightened, while the grout is green till all the air bubbles cease and cement slurry comes out to ensure that the surface of bearing plate is entirely in contact with the grout.

5.31 REINFORCED CEMENT CONCRETE [R.C.C.] :

MIX DESIGN [M-30]

The Contractor shall get the concrete mix designed confirming to various design parameters given in these specifications and latest revision of IS:10262 for each grade of concrete mentioned above by a Government approved laboratory. The cost / charge of the MIX DESIGN work shall be borne by the Contractor.

The MIX DESIGN shall be got approved from the Structural Consultant. No volume batching shall be allowed at site. The concrete mix at site shall be **WEIGH BATCHED OR READY MIX CONCRETE.** The proportion of cement, sand and coarse aggregates, water and admixtures if any shall be determined by weight. The Contractor shall make arrangements to weigh water by an electronic device at the site.

The Contractor shall follow the following specifications for mix design reinforced cement concrete work.

5.31.1 Proportioning Mix:

The mix of fine and coarse aggregate, cement and water as per the DESIGN MIX shall give the most dense concrete confirming to minimum quantity of cement paste and maximum water cement ratio for binding the materials to give required strength, Water content and the water cement ratio shall give the specified strength with the materials proposed for use in actual work carried out before the work is started, adopting the consistency suitable for the work and method of compaction that will be actually used on site subject to the water cement Ratio as Tabulated separately.

5.31.2 Test:

Tests shall confirm to the specifications laid down in I.S. 456 – 2000. These tests shall be got done in an approved laboratory at the cost of Contractor.

a) Preliminary tests :

In preliminary test, three separate tests shall be carried out on samples collected from different stacks. Each test shall be carried out with six samples of 15 cm. (About 6") cubes and 3 of these shall be tested at 7 days and 3 at 28 days. In preliminary tests the average crushing strength attained shall be 33 percent higher than that required on work tests.

b) Work test:

For each of the work test, 6 samples shall be prepared from the concrete being used on the site, 3 samples being tested at 7 days and the remaining 3 samples at 28 days.

Work tests shall be carried out on each of the first six days and subsequently once in three working days or for every 60 cu.m. of concrete which ever is less and also whenever the quality or grading of the materials is changed. When a relation between the strengths at 7 days and 28 days is established, only 3 samples may be prepared and tested at 7 days only. This number of controlled specimen tests may be increased if the Engineer-in-charge considers it necessary.

5.31.3 Field Mix :

In the work tests, bulkage of sand due to moisture, if any, should be allowed for different batches according to the moisture actually present at the time of mixing. The moisture will be taken into account in controlling the mixing water also. The proportions once fixed by preliminary tests shall not be changed so long as the materials are the same, subject only to the quantities of fine aggregate and water being adjusted to compensate for bulkage due to the moisture in sand and free water in fine aggregate at the time of use.

No change of materials shall be allowed unless fresh tests with new materials show satisfactory results.

Water and cement content per batch or concrete as determined MIX DESIGN shall be maintained constant except for suitable allowances to be made for surface moisture of the aggregates at the time of actual use. Immediately upon the receipt of the award of the contract, the Contractor shall inform the Engineer-in-charge the exact location of the sources of the acceptable materials which he proposes to use and get approved materials to be used. The CONCRETE MIX shall be got designed in an approved laboratory by the Contractor with minimum water cement ratio to give specified strength in the preliminary tests and the proportions got approved by the Engineer-in-charge in writing. These proportions shall be used so long as the materials contains to be of the same quality and from the same source subject only to slight changes in the relative quantities of fine and coarse aggregates for the purpose of promoting workability provided the works tests require the same. If during the progress of the work, the Contractor wishes to change the materials, the proportion shall be fixed on the basis of fresh MIX DESIGN to give the required strength after the Engineer-in-charge is satisfied that the materials satisfy the specifications. No adjustment of cost shall be made for change of proportions of cement fixed in the original preliminary tests.

5.31.4 Maximum Water Cement Ratio : As per Schedule A

5.31.5 DETAILED SPECIFICATONS FOR CONCRETE:

[1] INGREDIENTS

1. Cement :
   The cement shall be ordinary Portland Cement confirming to IS:269. Under special circumstances other cements may be used with prior approval of Engineer-in-charge. Cement shall conform to M-3

2. Aggregate:

Aggregates shall comply with the requirements of IS:383. Generally aggregates having a nominal size of 20 mm shall be used. Coarse and Fine aggregate shall be weigh batched separately. Sand shall conform to M-5, Grit shall conform to M-6, Graded stone aggregate of design size shall confirm to M-9

3. Water :
Water shall conform to M-1. Water used for mixing and curing shall be as per Clause 5.4 of IS:456-2000.

4. Admixtures:
Admixtures such as plasticizer / super plasticizer shall be used with prior approval of the Engineer-in-charge.

[2] Grades of concrete to be used shall be M10, M15, M20, M25, M30.

Minimum cement content for different grades of concrete shall be as provided in Schedule A.

[3] All reinforcement shall be free from loose mill scale, loose rust, and coats of paints, oil, mud or other coatings. The Contractor shall get the reinforcement cleaned by using wire brush, rubbing with gunny bags, light acid itching etc. as required.

[4] Workability of concrete shall be as per Clause 6.0 of IS:456.

[5] Durability :
In order to provide / produce durable concrete with low permeability, it must have an adequate cement content and a low water cement ratio. By using strong dense, aggregates, sufficient low water cement ratio, ensuring thorough compaction and sufficient hydration of cement through proper curing methods, a sufficient low permeability is achieved. Therefore cement content shall be sufficient to provide adequate workability with a low water cement ratio so that concrete can be completely compacted with the means available.

The permissible limits of chlorides and sulphate in concrete shall be as per Table 1 of IS-456-2000.

5.31.6 CONCRETE MIX PROPORTIONING

The Concrete mix should be so proportioned that when the concrete is hardened it shall be of the required strength, durability and surface finish. For this purpose the Contractor shall establish a well equipped concrete testing laboratory at site. The results of these shall be sent to Consultant for their comments / approval / suggestion for modification of Design Mix.

[1] Strength Requirement of Concrete :

Where ordinary Portland cement conforming to IS:269 or Portland blast furnace cement conforming to IS:455 is used, the compressive strength requirements for various grades of concrete, controlled as well as ordinary shall be as given in Table-1.

Where rapid hardening Portland cement is used, the 28 days compressive strength requirement specified in Table-1 shall be met at 7 days. For controlled concrete, the mix shall be so designed as to attain in preliminary tests, a strength at least 33 percent higher than that required on work tests, for concrete mix upto and including M-250 and 25 percent higher for higher strengths. Prelimnary tests need not be made in case of "ordinary concrete".

TABLE-1

Grade of concrete	Compressive work strength in Kg/cm2 on 150 mm cubes as per Testing conducted in accordance with IS:516.	
	min.at 7 days	min.at 28 days
M-100	70	100
M-150	100	150
M-200	135	200
M-250	170	250
M-300	200	300
M-350	235	350

Note: In all cases, the 28 days compressive strength specified in Table-1 shall be the criterion for acceptance or rejection of the concrete.

When the strength of a concrete mix as indicated by test, lies in between the strength for any two grades specified in Table-1 such concrete shall be classified for all purpose as concrete belonging to the lower of the two grades between which its strength lies.

Field Test cubes shall be taken as per IS 456 required / or directed by Engineer In Charge. The same shall be tested in approved laboratory & results shall comply with required strength of mix used. The cost of taking cubes and testing shall be included in rates quoted.

[2] Nominal Mix Concrete:

Under special circumstances nominal mix concrete for grades of M20 or lower may be used with prior approval of Engineer-in-charge. Nominal Mix concrete shall be as per Table 9 of IS 456:2000

READY MIX CONCRETE:

Concrete mix shall be design for 33% higher strength than the grade of concrete specified. The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work in question and can be properly compacted with the means available.

Except where it can be shown to the satisfaction of the Engineer-in-charge that a supply of properly graded aggregate of uniform quality can be maintained till the completion of work, grading of aggregate should be strictly controlled. The different sizes,

shall be stocked in separate stock piles. Required quality of material shall be stock-piled several hours, preferably a day, before use. Grading of coarse and fine aggregate shall be checked as frequently as possible, frequency for a given job being determined by the Engineer-in-charge to ensure that the suppliers are maintaining the uniform grading as approved for samples used in the design mix.

The quantity of both cement and aggregate shall be determined by weight. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean, and serviceable condition. Their accuracy shall be periodically checked.

It is most important to keep the specified water-cement ratio constant and at its correct value. To this end, the moisture content in both fine and coarse aggregates shall be determined by the Engineer-in-charge according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. For the determination of moisture content in the aggregates, IS:2386 (Part-III) shall be referred to. Suitable adjustments shall also be made in the weights of aggregates to allow for the variation in weights of aggregates due to variation in their moisture content.

The special conditions/ Specifications regarding RMC are as follows.

1. The details like location, capacity, experience, delivery schedule etc. of the RMC agency shall be submitted by the successful tenderer for prior approval of the undersigned.

2. The RMC shall be conforming to IS 4926 with its latest amendments.

3. All the responsibility of RMC i.e. procurement of all materials, operation of plant and machinery, transit mixers, pumping machineries relevant piping etc. shall be on the account of the contractor.

4. The SMC Shall not be held responsible for any delay/damage/loss due to deployment of RMC for this project.

5. The octroi for the RMC shall have to be borne by the contractor as per prevailing rates.

6. RMC process shall be fully automatic and computerized.

7. When a transit mixer is used for transportation of concrete, no extra water should be added to the concrete from else where after initial introduction of mixing water from the batch, except when on arrival at the site of the work, the slump of the concrete is less than that specified: such additional water to bring the slump within required limits shall be injected into that specified: such additional water to bring the mixer under such pressure and direction of flow that requirements for uniformity are met.

8. Records and Certificates: The contractor shall keep from the manufacture batch records of

the quantities by mass of all the solid materials, of the total amount of water used in mixing and of the results of all tests. If required by the SMC, the contractor shall furnish certificates, at agreed intervals, giving this information.

9. The contractor shall supply the following information for guidance of the manufacturer:

   a. The type of cement to be used
   b. Details Specifications of aggregates to be used.
   c. Type of admixture to be used, if specified
   d. Min. acceptable strength
   e. Slump of concrete or compacting factor
   f. Ages at which the test cubes or beams are to be tested, and the frequency and number of test to be made
   g. Any other requirement

10. Tolerance: Unless otherwise agreed to between the architect and the contractor, the concrete shall be deemed to comply with the requirements of this, if there results of testes where applicable lie with in the tolerance specified below.

11. Consistency of workability: The slump average of two test shall not differ from the specified value by + 10 mm for a specified slump of 75 mm. The compacting factor average of two tests shall be within + 0.03 of the value specified. If any other method of determining consistency to be used a suitable tolerance shall be agreed to be between the purchaser and the manufacture. The tests for consistency or workability shall be complete within 15 minutes of the time of receipt of the ready mix concrete at the site.

12. Aggregate- When tested in accordance with IS 2386 (part-I) 1963, the quantity of aggregate larger than the max size specified by the purchaser hall not exceed 5% of the qty. of coarse aggregate and all such excess shall pass sieve of next higher size.

The water cement ratios shall be not more than those specified in the Schedule-A. The cement content of the mix specified in the Schedule-A shall be increased if the quantity of water in a mix has to be increased to overcome the difficulties of placement and compaction so that the water-cement-ratio specified in the Schedule-A is not exceeded.

Workability of the concrete shall be controlled by maintaining a water-cement-ratio that is found to give a concrete mix which is just sufficiently wet to be placed and compacted without difficulty with the means available.

The maximum size of coarse aggregate shall be as large as possible within the limits specified but in no case greater than one fourth of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and to fill the corners of the form.

For reinforced concrete work, coarse aggregate having a nominal size of 20 mm. are generally considered satisfactory.

For heavily reinforced concrete members as in the case of ribs of main beams, the nominal maximum size of coarse aggregate should usually be restricted to 5mm. main bars, or 5 mm. less than the minimum cover to the reinforcement whichever is smaller.

Where the reinforcement is widely spaced as in solid slabs, limitations of size of the aggregate may not be so important, and the nominal maximum size may sometimes be as great as or greater than the minimum cover.

No materials other than the essential ingredients, i.e., cement, aggregates and water, shall ordinarily be used in the manufacture of concrete or mortar. But the Engineer-in-charge may permit the use of approved admixtures for improving the workability of the concrete, if so specified, on satisfactory evidence that its use does not in any way adversely affect the properties of concrete particularly its strength, volume changes, durability and has no deleterious effect on the reinforcement. Admixtures where allowed shall conform to relevant IS:9103.

Chloride content in admixture shall be independently tested for each batch before acceptance.

5.31.7 CONSTRUCTION TOLERANCES

(a) Length

(i) Members upto 3 mt length + 3mm to -6mm
3 mt to 4.5 mt length + 3mm to -8 mm
More than 4.5 mt length + 3 mm to -10mm

(b) Cross-Sectional Dimensions

Dimensions up to 15 cm	+ 2mm
Dimensions between 15 cm and 23 cm	+ 3mm
Dimensions greater than 23 cm	+ 4mm

Straightness : When a straight edge or line is applied to the member it shall not show concavity or convexity exceeding.

For length upto 4.5 mt	4.5 mm
For length between 4.5 mt	6.0 mm
For length exceeding 6 mt	8.0 mm

Shape of Cross Section – No line on the cross section of a member shall deviate from its correct position by an angle exceeding 1 Degree. Vertical members shall not deviate in verticality from its true position by more than 5% of vertical length subject to maximum of 20 mm.

Member which do not confirm to above mentioned constructional tolerances shall be removed and redone or modified / strengthened as per instructions of Engineer-in-charge / Consultant.

5.31.8 SPECIFICATIONS FOR FORMWORK, CENTERING & SCAFFOLDING

Materials :

Formwork shall be in plywood, sawn timber or steel as required for shaft, container walls, stairs, slab, beams, columns, parapets, etc. for all concrete work.

Workmanship :

The formwork shall conform to the shape, lines and dimensions as shown on the drawings and shall be so constructed so as to remain sufficiently rigid and water-tight, during placement and compaction of the concrete. Adequate arrangement shall be made by the Contractor to safe guard against any settlements of the formwork during the course of concreting and after concreting.

Centering :

The centering, which has been got approved should be sufficiently strong and safe before, during and after pouring concrete and should be so erected that it would allow removal of forms in proper sequence without damaging either the concrete or the forms to be removed.

The props of centering shall be provided on firm foundation or base of sufficient strength to carry the loads, without any settlement.

Scaffolding :

All scaffolding, hoisting arrangements and ladders etc, required for facilitating of concrete shall be provided and removed on completion work by Contractor, at his own expense. The scaffolding, hoisting arrangement, ladders etc shall be strong enough to withstand all live, dead and impact loads expected to act. The Contractor shall be solely responsible for the safety of the scaffolding, hoisting arrangement, ladders, work and workmen etc.

The scaffolding, hoisting arrangement and ladders shall allow easy approach to the work spot and afford easy inspection.

6.0 SAND FILLING :

6.1 The sand to be use for filling shall be free from salts, organic or other foreign matter. All clods of sand shall be broken.

6.2 As soon as the work in foundation has been completed the site of foundation shall be cleared of all debris, brick bats, mortar dropping etc. sand filled with sand in layers not exceeding 20 Cms. Each layer shall be adequately watered, rammed and consolidated before the succeeding layer is laid. The sand shall be rammed with iron rammers where feasible and with the butt ends of crowbars, where rammer cannot be used.

6.3 The plinth shall be similarly filled with sand in layers not exceeding 20 cms. adequately watered and consolidated by ramming with iron or wooden rammers. When filling reaches finished level, the surface shall be flooded with water for at least 24 hours and allowed to dry and then rammed and consolidated.

6.4 The finished level of filling shall be kept to shape intended to be given to floor.

6.5 The sand shall be allowed to be used in filling the trenches and plinth. Under no circumstances black cotton soil be used for filling the plinth.

7.0 WATER PROOFING MATERIAL :

7.1 The water proofing compound ("CEM WET") or equivalent) shall conform to I.S. 9103-1979 and shall be approved by the Engineer-in-charge

7.2 The water proofing material of approved make shall be added to the cement at the rate of 200 gms. per 50 Kgs. cement bag or the proportion of water proofing materials to be mixed with 50 kgs. cement bags shall be as recommended by the manufacturer of the water proofing material and before using it shall be got approved by Engineer-in-charge

7.3 The water proofing materials and cement in specified proportion shall be thoroughly mixed till a homogeneious mixture of uniform colour is obtained and to have efficient workability.

8.0 REINFORCEMENT : *CRS (corrosion resistant steel) bars conforming to IS 1786*

8.1 General :
Requirement specified here in provided for reinforcing work, complete as indicated, specified and required and including supply and delivery of reinforcing bars, and mesh, bending, wire brushing and cleaning, steel fixing and the attendance of a fitter during concreting, to inspect fixed reinforcing bars and maintain bars in correct position at each four locations. Whenever mention of I.S. code is made, the latest editions thereof shall be applicable.

8.2 Quality Assurance :

a] Code requirement -

Unless otherwise stated herein all work specified herein and as shown on the drawings shall conform to be applicable requirement of IS-456-latest edition. In case of water retaining structure IS-3370 Part-I and IV shall be applicable.

b] Standards :
Steel for reinforcing shall be of the following kinds as may be specified in the drawings. Mild steel plain bars conforming to IS:432-1960 and it's latest edition. Corrosion Resistant Steel (CRS) bars conforming to IS:1786 and its latest edition.

c] Field quality control :
All continuous inspections shall be performed by the Engineer-in-charge's representative or his authorized assistant or a specialist called by the SMSS or the Engineer-in-charge. Reports as required by code or authorities concerned shall be prepared and submitted to the SMSS and such authorities. The steel brought by the contractor when tested should comply with the test specifications in IS:1521 and IS:1608-1960.

8.3 Submittals :

A] Drawing :

The Engineer-in-charge will supply detail drawing ofreinforced concrete work and bar bending schedules. The contractor shall check the drawing and the schedules and satisfy himself that these complement each other. In the event of a discrepancy the Engineer-in-charge shall be notified in wiriting and his ruling obtained.

8.4 Materials :

A] Reinforcing bars :

Reinforcement bars shall have to be brought by the Contractor as laid down in the tender condition.

B] Welded Wire mesh :

Mesh reinforcement, where specified shall conform to IS:1566-1967.

C] Binding wire :

Steel fixing shall be by 1.65 mm dia soft anneled wire.

D] Supports and Accessories :

Supports, cover or spacer for reinforcement shall be provided by precast mortar [1:2] blocks made with embedded wire ties. The cover blocks shall be made so as to provide the exact specified cover to reinforcement. Stays, blocks, ties, spacers or other supports as approved by Engineer-in- charge shall be provided at appropriate intervals to avoid sagging of bars between supports. Broken stones, bricks pieces, wooden blocks shall not be allowed.

E] Dowels :

Where and as designated on the drawings, steel bars dowels shall be provided for anchorage to previously cast concrete for anchorage where shown or required to existing construction, an approved non-shrink epoxy type grout or approved deferred bolting devices shall be used.

8.5 Execution :

A] Bending :

Unless otherwise indicated or specified bars shall be bent and fixed in accordance with the provisions of IS:2502. All bending shall be done with the use of an approved bending tool. Rebending of incorrectly bent bars shall not be permitted.

B] Cleaning :

Before placing reinforcement and again before concrete is placed, reinforcement shall be wire-brushed and cleaned of loose mill scale, oil, or other coating that might destroy or reduce bend.

C] Concrete cover :

Cover over reinforcing bars shall be as indicated. Correct concrete cover to reinforcement shall be maintained with the aid of approved cover blocks. Top

reinforcement in slabs shall be maintained in position by means of chairs made out of mild steel, the diameter and quantity bending sufficient to ensure security of the reinforcement in shape and position.

D] Securing in place :
All reinforcement shall be securely and accurately fixed in positions shown on the drawings, care being taken to prevent contract with coated shutterings and forms. All intersection of bar should be secured with approved clips or with wire, the ends being turned into the body of concrete.

E] Splices shall be wired contract lap splices unless otherwise indicated or approved. Splices at points of maximum tensile stress shall be avoided and shall be stagered elsewhere, lap length and other provisions shall conform to IS:456. Splicing of vertical bars in concrete be at be at approved positions.

Unless otherwise shown in case of horizontal bars lap splices shall be made with at least one continuous bar between adjacent splices, where double mats of bars occur in walls, lap splices in opposite mats shall offest at least 1.5 m.

8.6 Welding :-
When permitted or required joints of reinforcement bars shall be welded so as to transmit their full stresses. Welded joints shall preferably be located at points when steel will not be subjected to more than 75% of the maximum permissible stresses and welds so staggered that at any one section not more than 20% of the rods are welded. Only electric welding using a process which excludes air from molten and conforms to any or all other special provisions of or the work shall be accepted. Suitable means shall be provided for holding bars securely in postion during welding. It shall be ensured that no voids are left in welding and when welding is done in two or three stages, previous surface shall be cleaned properly. Ends of the bars shall be cleaned of all loose scale, rust, grease, paint and other foreign matter before welding. Only competent welders shall be employed on the work. The M.S. electrodes used for welding shall conform to IS:814. Welded pieces of reinforcement shall be tested. Specimen shall be taken from the actual site and their number and frequency of test shall be as directed.

9.1 FABRICATION WORK :
The structural steel work shall conform to M-18, red lead paint primer shall conform to I.S.-102-1962.

9.2 The steel sections as specified or required shall be cut, square and to correct lengths. The cut ends exposed to view shall be finished smooth. No two pieces shall be welded or otherwise jointed to make up the required length of member, except as permitted prior to starting of work as directed. All straigh- tening and shaping to form shall be done by application of pressure and not by hammering. Any bending or cutting shall be carried out in such a manner so as not to impair the strength of the metal. All operations shall be done in cold state unless otherwise directed/permitted.

9.3 The steel structure as per direction of the Engineer-in-charge shall be laid out on a level platform to full scale and in size or parts. A steel tape shall be used for measurements to ensure maximum accuracy.

9.4 Welding shall generally be done by electric process. Gas welding shall be resorted to, using oxyacetylene flame with specific prior approval. Gas welding shall not be permitted for structural steel work.

9.5 The welding work shall conform to I.S. 816-1969.

9.6 Preparation of surfaces : Surfaces which are to be welded together shall be free form loose mill scale,rust, paint,grease or other foreign matter. A coating of boiled linseed oil shall be permitted.

9.7 Assembly for welding : Before welding is commenced,the plates shall first be brought together and firmly clamped or spot welded at specified distance. This temporary connection has to be strong enough to hold the plates accurately in place without displacement.

9.8 Precautions : All operations connected with welding and cutting equipment shall conform to safety requirements given in I.S.-1118-1968.

The following points shall be borne in mind during the process of welding ---

a] Welds shall be made in flat position wherever practicable.

b] Arc length, voltage and amperage shall be suited to the thickness of material type of groove & other circumstances of the work.

c] The segments of welding shall be such that where possible the members which offer the greatest resistance to compression are welded first.

9.9 The defective welds which shall be considered harmful to the structural strength shall be cut out and rewelded.

9.10 Finished welds and adjacent parts shall be protected with clean boiled lineed oil and after all stag has been removed welds and adjacent parts shall be painted after the same are approved.

9.11 All the members shall be thoroughly cleaned, of rust, scales, dust etc. and given a priming coat of red lead paint before fixing them in position. Testing of welding to be added in the specification I.N. 12.2.2.12-(i) to (viii).

10.0 BRICK WORK :

Using fly ash bricks confirming to IS-13757-1993, IS-5454, IS- 3495, IS - 12894 building bricks having crushing strength not less than 70 Kg/Sq.cm2 in cement mortar 1:6 (1 cement : 6 fine sand)

10.1.0 MATERIALS

Water shall conform to M-1, Cement shall conform to M-3, Sand shall conform to M-5, Fly ash Bricks shall conform to IS 13757, IS 5454, IS 3495, IS 12894 Cement mortar shall conform to M-8.

10.2.0 WORKMANSHIP

19.2.1 Proportion : The proportion of cement mortar shall be 1:6 (1 cement : 6 find sand) by volume.

10.2.2 Wetting of bricks : The bricks required for masonry work shall be thoroughly wetted with clean water for about two hours before use or as directed. The cessation of bubbles, when the bricks are wetted with water, is an indication of thorough wetting of bricks.

10.2.3 Laying : Bricks shall be laid in English bond unless directed otherwise. Half or cut bricks shall not be used except when necessary to complete the bond. Closures in such case shall be cut to required size and used near the ends of the walls.

A layer of mortar shall be spread on full width for suitable length of the lower course. Each brick shall first be properly bedded and set home by gently tapping with handle of trowel or wooden mallet. Its inside face shall be flushed with mortar before the next brick is laid and pressed against it. On completion of course, the vertical joints shall be fully filled from the top with mortar. The walls shall be taken up truly in plumb. All courses shall be truly horizontal and all vertical joint shall be truly vertical. Vertical joints in alternate course shall generally be directly one over the other. The thickness of brick course shall be kept uniform. Thickness of mortar bed shall be 6 to 8mm.

The brick shall be laid with frogs up wards. A set of tools comprising of wooden straight edges, manson's spirit level square, half meter rub, and pins, string and plumb shall be kept on the site of work for frequent checking during the progress of work.

Both the faces of walls of thickness greater than 23 cms. shall be kept in proper place. All the connected brick work shall be kept not more than one metre over the rest of the work. Where this is not possible, the work shall be raked back according to bond (and not left toothed) at an angle not steeper than 45 degrees.

All fixtures, pipes, outlet of water, hold fasts of doors and windows etc. which are required to be built in wall shall be embedded in cement mortar.

10.2.4 Joints : Bricks shall be so laid that all joints are quite flush with mortar. Thickness of joints shall not exceed 12 mm. The face joints shall be raked out as directed by raking tool daily during the progress of work, when the mortar is still green so as to provide key for plaster or pointing to be done.

10.2.5 Curing : Green work shall be protected from rain suitably, Masonry work shall be kept moist on all the faces for a period of seven days. The top of masonry work shall be kept well wetted at the close of the day.

10.2.6 Preparation of Foundation Bed : If the foundation is to be laid, directly on the excavated bed, the bed shall be levelled, cleared of all loose materials, cleaned and wetted before starting masonry.

If masonry is to be laid on concrete footing, the top of concrete shall be cleaned and moistened. The Contractor shall obtain the Engineer's approval for the foundation bed, before foundation masonry is started. When puccas flooring is to be provided flush with the top to plinth, the inside plinth offset shall be kept lower than the outside plinth top by the thickness of the flooring.

10.2.7 Fixtures – The frames of doors, windows, cup-boards etc. shall be housed into the brick work at the correct location and level as directed. The heavy steel doors, window frames etc. shall be built in with brick work, but for ordinary steel doors and windows required opening for frames, hold – fasts etc. shall be left in the wall and frames embedded later on in order to avoid damage to the frames.

10.2.8 Scaffolding –Necessary scaffolding shall be provided. The supports shall be sound and strong tied together with horizontal places, over which the scaffolding planks shall be fixed. Simple scaffolding shall be allowed normally. In this case scaffolding hole shall rest in hole header horizontal course only. Minimum number of holes shall be left in brick work for supporting horizontal scaffolding poles. The Contractor is responsible for providing and maintaining sufficiently strong scaffolding so as to withstand all loads likely to come upon it.

10.2.9 Packing out of joints – For the face of brick work, where plastering is to be done, joints shall be raked out to a depth not less than thickness of joints. The face of brick work shall be cleaned and mortar dropping removed on very same day that brick work is laid.

11.0 UNCOURSED RUBBLE MASONARY :

Providing uncoursed rubble masonary work, cement mortar 1:6 upto plinth level including providing scaffolding, curing, racking out joints including all labour and material.

11.1 Stone :

Stone shall be of approved quality. It shall be should, uniform in colour and free from decay and weathering, stone with round surface shall not be used. Unless otherwise approved, stones from one single quarry shall be used for any one work.

11.2 Dressing :

Stone shall be hammer dressed on the face and sides. The "bushing" on the face shall not project more than 20 mm on an exposed face and 15 mm on an exposed face and 15 mm on the face to be plastered.

11.3 Mortar :

The mortar to be used for jointing shall be as specified in the schedule of rates.

11.4 Laying :

All stones shall be wetted before use. They may be laid at random without being brought upto any level except at plinth. The bond shall be obtained by fitting in closely the adjacent stones and by using bond stones. For stones shall extend and

bond well into the backing. Proper breaking of joints shall be done. Their height shall not be greater than the breadth at face or the depth inward. Interior filling of the wall face shall consist of rubble stones not less than 130 mm in any direction, carefully laid, hammered down with a wooden mallet into position and solidly bedded in mortar.

No hollow space shall be left anywhere in the masonary chips not more than 20% of quantity of stone masonary may be used in the interior to fill interestices between adjacent stones in hearting wherever necessary to avoid thick mortar bed or joints. At about one meter interval vertical "plumbs", projecting upward about 50 to 200 mm shall be firmly embedded to forth a bond between successive courses. The masonary in a structure shall be carried regularly.

11.5 Bond stone :

Bond or through stone running right through the thickness of wall shall be provided in the walls having thickness upto 600 mm. If the walls are thicker that 600 mm, two or more bond stones overlapping each other by atlest 150 mm shall be provided in a line from face to back. Atlest one bond stone or a set of bond stones shall be provided for every 0.5 sq.m. of wall surface.

11.6 Quoins :
Teh quoins shall be of selected stones neatly dressed to the required angle and shall be of the same height as the course in which they occur and laid header and stretcher alternately. No quoin stone shall be less than 0.03 cu.m.

11.7 Joints :
Stones shall be so laid that all joints are full of mortar. Face joints shall vary from 12 mm to 25 mm thick, but not less than 12 mm. Joints shall be raked to a depth of 20 mm during construction, if walls are to be plastered or pointed. For the faces of wall which are not to be plastered stone surfaces shall be cleared of mortar dropping to give uniform appearance.

11.8 Curing :
Green work shall be protected from rain by suitable covering. Masonary work shall be kept constantly wet for a minimum period of 10 days.

12.0 PLASTER :

12.1 Inside plaster:
Inside Cement plaster shall be of 20 mm thick cement plaster with approved water-proofing compound in water retaining part of all units, including free board portion with cement mortar 1:3 (1 Cement : 3 fine sand)

12.1.1 MATERIALS:
Water shall confirm to M-1 Cement mortar shall conform to M-8.

12.1.2 WORKMANSHIP.

[1] The work shall be carried out in two coats. The backing coat (basecoat) shall be 12 mm. thick in C.M. 1:3. The relevant specifications of item No. 10 shall be followed except that the thickness of back coat shall be 12 mm. average and the proportion shall be of cement mortar 1:3 (1 cement : 3 sand). Before the first coat hardens its surface shall be beaten up by edges of wooden tappers and close dents shall be made on the surface. Subsequent coat shall be applied after this coat has been allowed to set for 3 to 5 days, depending upon the weather conditions. The surface shall not be allowed to dry during this period.

The second coat shall be completed to 8 mm thickness in C.M. 1:1 as described above, including raising, sand facing by brushing. The sample of sand face shall be got approved before the work is started. The whole work shall be carried out uniformly as per approved sample.

[2] CURING:
The curing shall be started overnight after finishing of plaster. The plaster shall be kept wet for a period of 7 days. During this period, it shall be protected from all damages.

[3] The relevant specifications of Item No. 8.3.0 shall be followed except that the sand face plastering up to 10 mt. above ground level shall be measured and paid under this item.

12.2 Scaffolding - Wooden ballies, bamboos, planks,treatles and other scaffolding shall be sound. These shall be properly examined before erection and use. Stage scaffolding shall be provided for ceiling plaster which shall be independent of the walls.

12.3 Preparation of Background - The surface shall be cleaned of all dust, loose mortar droppings, traces of algae, afflorsence and other foreign matter by water or by brushing. Smooth surface be roughened by wire brushing if it is not hard and hacking if it is hard. In case of concrete surface, if a chemical retarder has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the retarders is left on the surface. Trimming of projections on brick/concrete surfaces where necessary shall be carried out to get an even surface.

Raking of joints in case of masonary work where necessary shall be allowed to dry out for sufficient period before carrying out the plaster work.

The work shall not be soaked but only damped evenly before applying the plaster. If the surface becomes dry, such areas shall be moistened again.

12.4 15 mm thick inside smooth cement plaster shall be applied in all parts of super-structure and inside the buildings on wall, as per above specifications.

12.5 10 mm thick inside smooth cement plaster shall be applied underneath of ceilings & soffits etc.,of slabs, stair-cases, as per above specifications.

12.6 Outside plaster:-

Providing and applying 20 mm.thick sand faced cement plaster on walls upto height 10 metres above ground level consisting of 12 mm.thick backing coat of C.M. 1:3[1 cement:3 sand and 8 mm. thick finishing coat in C.M.1:1 [1 cement:1 sand] etc.comp.

Materials :-

Water shall conform to M-1 cement mortar shall conform to M-8.

Workmanship :-

The work shall be carried out in two coats. The backing coat [baseoat] shall be 12 mm. thick in C.M. 1:3. The relevant specifications of Item No.14 shall be followed except that the thickness of back coat shall be 12 mm. average and the proportion shall be of cement mortar 1:3 [1 cement:3 sand]. Before the first coat hardens its surface shall be beaten up by edges of wooden tappers and close dents shall be made on the surface subsequent coat shall be applied after this coat has been allowed to set for 3 to 5 days, depending upon the weather conditions. The surface shall not be allowed to dry during this period.

The second coat shall be completed to 8 mm thickness in C.M. 1:1 as described above, including raising sand facing by bushing.The sample of sand face shall be got approved before the work is started. The whole work shall be carried out uniformly as per sample approved.

For external plaster,the plastering operation shall be started from top floor and carried downwards. For internal plaster,the plastering operations may be started wherever the building frame and cladding work are ready and the temporary supports of the ceiling resting on the wall of the floor have been removed. Ceiling plaster shall be completed before starting plaster to walls.

12.5 APPLICATION OF PLASTER

The plaster about 15 x 15 Cms. shall be first applied horizontally and vertically at not more than 2 metres intervals over the entire surface to serve as gauge. The surface gauges shall be truly in place of the finished plastered surface. The mortar shall then be applied in uniform surface slightly more than the specified thickness then brought to a true surface by working a wooden straight edge reaching across the gauges with small upward and sideways movements at a time.Finally,the surface shall be finished off true with a trowel or wooden float according as a smooth or a sandy granular texture is required. Excessive trowelling or overworking the float shall be avoided. All corners,arises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished.Rounding or chamfering, corners, junctions etc. shall be carried out with proper templates to the size required.

Cement plaster shall be used within half an hour after addition of water.Any mortar or plaster which is partially set shall be rejected and removed forthwith from the site.

In suspending the work at the end of the day, the plaster shall be left out clean to the line both horizontally and vertically. When recommending the plaster, the edges of the old work shall be scrapped clean and wetted with cement putty before plaster is applied to the adjacent areas to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of the wall and nearer that 15 cms. to any corners or arises. It shall not be closed on the body of features such as plaster bands and cornices not at the corners or arrises. Horizontal points in plaster work shall not also occur on parapet tops and copings as those invariably lead to leakage. No portion of the surface shall be left out initially to be packed up later on.

Each coat shall be kept damp continuously till the next coat is applied for a minimum period of 7 days. Moistening shall commence as soon as plaster is hardened sufficiently. Soaking or walls shall be avoided and only as much water as can be readily absorbed shall be used, excessive evaporation on the sunny or windward side of building in hot air to dry weather shall be prevented by hanging mattings or gunny bags on the outside of the plaster and keeping them wet.

13.0 WATER PROOF PLASTER :

13.1 The relevant specification of Item No. 12 shall be followed except that the water proofing materials as cement or approved make as per I.S. 9130-1979 shall be added to the cement at the rate specified or as directed by the Engineer-in-charge. The propertion of water proofing materials to be by the manufacturer of the water proofing materials.

14.0 I.P.S. FLOORING :

14.1 I.P.S. flooring shall be 40 mm thick in cement concrete 1:2:4 (1 Cement : 2 coarse sand : 4 Stone aggregate 20 mm. nominal size) with a floating coat of neat cement.

14.2 The cement concrete flooring of 40 mm. thick (average) is to be laid as per the site condititons. The concrete shall be mixed in a mechanical mixer at the work. Hand maxing may be allowed for smaller quantities of work and in case of failure of machineries or as permitted by the Engineer-in-charge. It shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. However, in such cases 10% more cement than otherwise required shall have to be used without any extra cost. The mechanical mixing shall be done for a period of 1.5 to 2 minutes. the quantity of water shall be just sufficient to produce a dense concrete of required workability for the purpose. Flooring of specified thickness shall be laid in accordance with the approved pattern or as directed. Finishing operation shall start shortly after the cessation or beating and shall be spread over a period of one to six hours depending upon the temperature and atmospheric conditions. The surface shall be left for some time till moisture mixed with water to form a thick slurry and spread over the surface while the concrete is still green. Use of dry cement or cement and sand mixture sprinkled on this surface to stiffen the concrete or absorb excessive moisture shall not be permitted. The cement slurry shall then be properly pressed twice by means of iron floats, once when the slurry is applied and the second time when cement starts setting and finished floated smooth. The surface shall be marked with string or B.R.C. fabric jali to make the surface non-slippery as and when

directed. The junction of floors with wall plaster, dado or skirting shall be rounded off where so required upto 25 mm. radius flooring in lavatories and bath rooms shall be laid after fixing of water closet and squatting pans and floor traps which shall be plugged while laying the floors and opened after the floors are completed. Any damage done to the water supply or sanitary fittings during execution of work shall be made good.

14.3 After the final set, the concrete shall be kept continuously wet, if required by ponding for a period of not less than 7 days from the date of placement.

14.4 The form work shall be provided if necessary as directed by the Engineer-in-charge. Concreting shall be done as per alternate bay method with necessary centering either by mastic or cement mortar as directed.

15.0 TEAKWOOD DOORS, WINDOWS AND VENTILATIONS :

a] Thickness of shutters - 35 mm.

b] Size of frame : 10 cm x 7 cm.

15.1 Frames - All members of frames shall be exactly at right angles. The right angle shall be checked from inside surfaces of the respective members.

All members of frames shall be straight without any warp or bow and shall have smooth surfaces well planned on the three sides exposed at right angles to each other. The surfaces touching the wall may not be planned unless it is required in order to straighten up the member or to obtain the overall sizes within the tolerances as specified.

Frame shall have dovetail joints. When windows is included, it shall be provided by having full length one piece post for door or windows and clearstory window extending the frame on top at eh head to the required extent. Horns shall not be provided in the head of the frame. When no sills are provided, the vertical posts of the frame in the ground floor shall be embedded in the sill masonary for 10 cm. on upper floors, the vertical posts shall be fixed in the floor or masonary by forming notches 10 mm. deep. Sight adjustment of spacing as necessary shall be done to have the holdfasts in the joints of masonary course. The frame shall be erected in postion and held plumb with strong support iron both sides and built in masonary as it is being built. The transom shall be through tenoned in the mortices of the jamb post to the full width of the jamb post and the thickness of the tenon shall be not less than 15 mm.

15.2 Tolerance - Unless specially mentioned otherwise tolerance of 01 # 1.5 mm. shall be allowed for each wrought face.

15.3 The tenons shall be closely fitting into the mortices and suitably pinned with wood dowels not less than 10 mm. dia. meter. The depth of rebates for housing the shutter shall be as directed.

15.4 The contact surface of tenon and mortise shall be treated before putting together with an adhesive of approved make.

15.5 Minimum number of three holdfasts shall be fixed on each side of door and window frames, one at the centre point and the other two at 30 cms. iron the top and the bottom of the frames. In case of window and ventilator frames whose height is less than 1 M. two holdfasts, in each side shall be fixed at quarter points of the frames. The size of each holdfasts shall be 300 x 25 x 6 mm. and of mild steel with split end. The holdfasts shall be fixed with screws to frames.

15.6 Mild steel hold fasts shall be protected with a coating of coal asphalt tar. The surface of frame abutting the masonary or concrete faces shall be properly treated by applying a coat of approved coating.

Shutters - Pannelled shutters shall be constructed in the form of timber frame work of styles and rails with panel inserted of type as specified in the detailed drawings. Panel shall be fixed by providing grooves in the styles and rails.The styles and rails shall be joined to each other by mortise and tenon joints at right angles.

All members of the shutters shall be straight without any warp or bow and shall have smooth, well planned faces at right angles to each other.

The size of styles and rails shall be as per drawings or as directed. Styles and rails of shutters shall be made of one piece only.

Timber Panelling - Thickness of the panel shall be as specified in the drawings or as directed. If the panel is made from more than one piece, the piece shall be finished as shown in the detailed draswings and shall be joined with continuous groove with specified size. The end pieces of the panel and the top and the bottom of the panel shall be provided with continuous tongue to frame into groove of the frame shutter. An air space of 1.5 mm. shall be left in the groove of frame of shutter while framing the panel in it.

The faces of the panel as well as various pieces of the panel shall be closely fitted to the sizes of the grooves. Finishing of the corners or raised panel edge shall be done as shown in drawings or as directed. The thickness specified shall be finished thickness and no tolerance will be permitted.

Glazing - The glass panels shall be embeded in putty and secured to the rebate by wooden bends, or mouldings shape and size as approved with counter sunk screws of suitable size.

The glass panel shall be properly cut to fit the rebate of the frames and sashes fully with a slight minus margin of about 1.5 mm. of all sides. Before glazing the frame shall be primed and prepared for painting so that wood may not draw oil out of putty. The rebate shall be putted to an extent to provide bedding all round the glass.

The glass shall than be bedded in putty and fitted to frames with wooden beads or moulding as directed and screwed with wooden beads or moulding as directed and screwed with counter sunk screws. The screws shall be spaced not more than 100 mm. from each corner and nor more that 200 mm. apart.

The size of the rebate in the frame and size and shape of beads or moulding shall be as per detailed drawing or as directed. The beads or mouldings shall have mitred corners.

Fixtures & Fastenings - All fixtures and fastening of approved quality shall be provided with necessary screws. The hinges, bolts and other items cromium plated of iron mongery with moving part shall be properly oiled by the contractor before handing over the building.

15.8 Painting - The surface shall be cleaned and rubbed with sand paper to bring it in the one place. When finished, no scratches from the sand paper should show. After preparing the surface, one coat of white paint shall applied as priming coat.

After priming coat, all small holes, cracks, open joints and similar other minor defects of every kind shall be stopped with putty made from pure whitenin mixing to the appropriate consistency with raw linseed oil.

Little white lead being worked in other mixing to help hardening of putty. The work shall be rubbed down smooth with sand paper and the consequent coats of paint of the specified shade approved by the Engineer-in-charge shall be applied.

The paints shall be applied with brush.It shall be spread as smoothly as possible. Final coat shall be very crossed and laid off, so that brush marks are not visible.

Each coat of paint shall be allowed to dry thoroughly and shall be little rubbed in before the next one is laid.

Finish surface shall not show any hair marks ridges or dry patches of paint and no puddles shall be left in the corners of panels, angles of the mouldings etc.

16.0 ROLLING SHUTTER :

16.1 Rolling Shutter - The rolling shutter shall conform to I. S. 6248-1979. Rolling shutter shall be supplied of specified type with accessaries. The size of the rolling shutter shall be as required & as directed. The shutter shall be constructed with interlocking plate sections formed from cold rolled steel strupesnot less than 0.9 mm. thick and 80 mm. wide for shutters upto 3.5 m. width and not less than 1.25 mm. thick and 80 mm. wide for shutters 3.5 m. in width and above unless otherwise specified.

Guide channels shall be of mild steel deep channel section & of rolled pressed or built up(fabricated)jointless construction.The thickness of sheet shall not be less than 3.15 mm.

The rolling shutter shall be of self rolling type upto 8 Sq.M. clear are without ball bearing and upto 12 Sq.M. clear area with ball bearing. If the rolling shutters are of larger than gear operated type shutters shall be used.

The locking arrangements shall be provided at the bottom of shutters at both ends. The shutter shall be opened from the outside.

The shutters shall be completed with door suspension shafts locking arrangements, pulling hooks, handles and other accessories.

17.0 20 MM THICK MARBLE/MOSAIC WHITE CEMENT TILES :

17.1 Bedding - Before spreading the mortar, the sub-base of the floor shall be cleaned of all dirt, scum and loose materials and then well wetted without forming any pools of water on the surface.

In case R.C.C. floors, the top shall be left a little rough. All points of level for the finished surface shall be marked out. The lime mortar of proportion 1:1.5 (1 lime putty : 1.5 fine sand) or cement mortar of proportion C.M. 1:6 as directed shall then be evenly and smoothly spread over the base. Bedding layers of mortar shall be not less than 10 mm. and average thickness of bedding shall be 25 mm.

17.2 Laying - Before laying the terrazzo (marble/mosaic) tiles. The tiles shall be thoroughly wetted with water. Neat cement group of required consistency at 4.4 Kg. cement per Sq.Mt.shall be spread on the mortar bed. The tiles shall be laid on the neat cement float and shall be evenly and firmly bedded to the required level and slope. There shall be no hollows left. The joints shall be of uniform thickness and in straight line as per the pattern.

The surface of flooring shallbe checked frequently with a straight edge atleast two metres long so as to obtain a true surface with the required slope.

The tiles which are fixed in the floor adjoining the wall shall go about 10 mm. under plaster. Skirting or dado shall be left unfinished for about 50 mm. above finished floor level and unfinished strip then left earlier shall be finished.

In places where full tiles cannot be fixed. The tiles shall be cut to the size and smoothened at edges to give straight and joints.
After the tiles have been laid, the surplus cement slurry and the joints shall be cleaned and washed fairly deep before cement hardens.

The day after tiles have been laid,the joints shall be cleaned of grey cement grout with a wire brush to a depth of about 5 mm. and then grouted with cement with or without pigment to match the shade of the topping of the tiles. The same cement slurry shall then be spread over the whole surface in a thin coat to protect the surface from abrasive damage and to fill pin holes that may exist on the surface.

17.3 Curing - The flooring shall be kept wet with damp sand or water for seven days. It shall be kept undisturbed at least for 14 days. The grinding shall normally be commenced after 14 days.

Polishing - After the tiles are properly cured,first grinding shall be done with carboundum stone of 48 to 60 gms. grit fitted in machine. Water shall be properly

used durin grinding. When the chips show up and the floor has been uniformly rubbed, it shall be cleaned with water, bearing all pin holes. It shall then be covered with a thin coat of white cement mixed with or without pigments to match the colour of the topping of the tiles.. Pin holes if any shall thus be filled. This grout shall be kept moist for a week. Thereafter, second grinding shall be started with carborundum of 120 grit. Grouting and curing shall follow again. Final grinding shall be done when other works are finished. The machine shall be fitted with carborundum of grit 220 to 350 using water in abundance. The floor shall then be washed clean with water. Oxalic acid powder shall then be dusted at 33 gms. per square metre on the surface and the surface rubbed with machine fitted with hessian bobs or rubbed hard with pad of woolen rags. The floor shall then be washed clean and dried with a soft cloth or linen. The finished floor shall not sound hollow when tapped with mallet.

If any tile is disturbed or damaged it shall be refitted or replaced properly jointed and polished.

Testing of the tiles shall be carried out by the contractor at his own cost as per I.S. requirement for required tests.

18.0 WATER CLOSET :

18.1 The pan shall be sunk into the floor and embedded in a cushion of average 15 cms. cement concrete 1:5:10 (1 cement; 5 fine sand; 10 graded stone aggregate or brick aggregate 40 mm. nominal size) or as specified. This concrete shall be left 115 mm. below the top level of the pan so as to allow for flooring and its bed concrete. The floor should be suitably sloped so that the waste water is drained into the pan. The pan shall be provided with 100 mm. `P' or `S' trap with approximately 50 mm. seal. The joints between the pan and the trap shall be made leak- proof with cement mortar 1:1 (1 cement; 1 find sand).

18.2 The `P' or `S' trap shall be fixed with pan and cast iron pipe with C.M. 1:1. The pan shall be provided with a 100 mm. `P' or `S' trap an approximately 50 mm. seal. The joint between the pan and the trap shall be made leakproof with cement mortar 1:1 (1 cement; 1 fine sand).

18.3 After laying the floor, the floor shall be suitaly sloped so that the waste water is drained into the pan. A pair of footrests of size 250 mm x 130 mm x 30 mm of white vitreous china shall be set in cement mortar 1:3 (1 cement; 3 coarse sand). The foot rests shall be fixed at a distance of 175 mm. from the inner edge of the back side of the pan and shall be fixed at convenient angle.

19.0 WASH BASIN :

19.1 The wash basin shall be fixed on the wall as and where directed. The wash basin shall be supported on a pair of R.S. or C.I. brackets fixed in C.M. 1:3 (1 cement; 3 sand). The bracket shall conform to I.S. 775-1962. The wall plaster on the rear shall

be cut to rest the top edge of the wash basin. After fixing the basin, plaster shall be made good and surface finished to match with the existing one.

19.2 The bracket shall be painted white with ready mixed paint. The C.P. brass trap and union shall be connected to 32mm.dia. waste pipe which shall be suitably bent towards the wall and which shall discharge into an open drain leading to a gully trap or direct into the gully trap on the ground floor and shall be connected to a waste pipe through a floor trap on the upper floors. C.P. brass trap and union may not be provided where the surface drain or a floor trap is placed directly under the basin and the waste is discharged into vertically.

19.3 The height of the front edge of the wash basin from the floor level shall be 80 cms.

19.4 The capstan head pillar tap of specified dia. shall be fixed as directed with required washers of selected leather or rubber asbestos composition or plastic as directed. The cock shall be fixed with pipe line with white zink and spun yarn, to make joint water tight. The work shall be carried out in best workman like manner.

19.5 C.P. brass waste trap and union shall be connected to 32mm.dia. waste pipe which shall be connected suitably towards the wall and which shall discharge into the drain through a floor trap. The C.P. brass waste trap shall be provided for wash basin or sink as the case may be.

19.6 The stop cock shall be fixed in position by means of jam, nut & socket. The stop cock shall be fixed near the inlet of the water metre or as directed. The joints shall be done with white zinc and spun yarn. The joint shall be tested for leak proofing.

19.7 The necessary inlet, outlet connections and fittings such as pillar coasks, C.P. brass waste trap, waste pipe, stop cock etc. shall be fixed as specified above.

20.0 URINAL :

20.1 The white earthenware flat back or corner type urinal of size 430mm. x 260mm. x 350mm. shall conform to M-45.

20.2 The urinals shall be fixed in position by using wooden plugs and screws and shall be at a height of 65 cms. from the floor level to the top of the lip of urinal, unless otherwise directed. The wooden plug shall be 50 mm. x 50 mm. at base lappering to 38 m. x 38 mm. at top and 50mm. in length shall be fixed in wall in cement mortar 1:3 (1 cement; 3 coarse sand). The urinal shall be connected to a 32 mm. dia. galvanised mild steel waste pipe which shall discharge in the channel or after tap. The connection between the urinal and flush or waste pipe shall be made by means of putty or white lead mixed with chopped hemp.

21.0 GLAZED TILES :

21.1 Bedding -The sub-grade shall be cleaned, wetted and mopped. The bedding shall then be laid evenly over the surface tamped and corrected to desired levels and allowed to

harden enough to offer a rigid cushion to tiles and to enable the mason to place wooden planks across and squat on it.

The white / coloured glazed tiles shall be laid on cement mortar bedding of 12 mm. thick in C.M. 1:3. The mortar shall have sufficient plasticity for laying and there shall be no hard lumps that would interfere with the evenness of bedding. The base shall be cleared and well wetted. The mortar shall then be spread in thickness not less than 10 mm. any place and on an average 12mm. thickness. The proportion of the cement mortar shall be as specified in the item.

21.2 Fixing Tiles -The tiles before laying shall be soaked in water for at least two hours. Neat grey cement grout at 3.3 Kgs./ Cement/ Sq.Mts. of honey like consistency shall be spread over the mortar bedding as directed. The edges of the tiles shall be well pressed and gently tapped with a wooden mallet till they are properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints between the tiles shall be as thin as possible in straight line or as per pattern.

The tiles shall not have staggered joints. The joints shall be thereto centre line both ways. The nahni trap coming in the flooring shall be so positioned that its grating shall replace only one tile as far as possible. Where full size tiles cannot be fixed, they shall be cut (swan) to the required size and the edge rubbed smooth to ensure straight and true joints. The joints shall be filled with grey cement grout with wire, brush or trowel to a depth of 5mm. and loose material removed. White cement shall be used for pointing the joints. After fixing the tiles finally in an even plane the flooring shall be kept wet and allowed to stay undisturbed for 7 days.

21.3 Cleaning - The surplus cement grout that may have come out of the joints shall be cleared off before it sets. Once the floor has set, it shall be carefully washed, cleared by dilute acid and dried. Proper precautions and measures shall be taken to ensure that the tiles are not damaged in any way till the completion of the construction.

21.4 For skirting risers of steps and dado :
Preparation of Surface - In case of brick masonary work, the joints shall be raken out to a depth of at least 15 mm. while the masonary is being laid. In case of concrete wall the surface shall be chiselled and roughened with wire brushes. The surface shall be cleaned and wetted thoroughly before commencing the laying work.

Laying - The wall surface shall be covered with 10 mm. thick plaster of cement mortar 1:3 mix and allowed to harden. The plaster shall be roughened with wire brushes both ways. The back of tiles shall be floated with grey cement slurry and edges with white cement slurry set in bedding mortar. The tiles shall be gently tapped in position one after the other keeping the joints as thin as possible. Dado shall be truly horizontal and the joints vertical or as per the required pattern.

Risers of steps, skirting and dado shall rest on top of treads or flooring. Where full size tiles cannot be fixed, they shall be cut to the required size and the edges to besmoothened.

The joints shall be cleaned and flush pointed with white cement. The surface shall be kept wet for seven days. After curing the surface shall be washed clean.

22.0 C.I.NUHNI TRAP (75 MM DIA) :

22.1 The nahni trap with 100 mm.dia. inlet and 50 mm.dia.outlet shall be fixed as required or as directed.

22.2 The nahni trap shall be jointed with C.I.pipe, 75 mm. dia. with lead joints.The lead joints shall be done in conformation with I.S. 782-1976.

23.0 GULLY TRAP : (150 MM X 100 MM) :

23.1 The gully trap shall be set in c.c. 1: 4: 8 extending 30 cms. beyond the trap on the three sides over which shall be constructed one brick masonary chamber of suitable size with C.I. cover in top. The lid of cast iron along with C.I. frame of size 300 mm. x 300 mm. inside shall be of approved quality and fixed in c.c. 1:2:4 75 mm. thick at top. The trap shall have C.I. gratings on top.

23.2 The C.I. cover shall be painted with two coats of anticorrosive paint of approved make.

24.0 SEWER TRAP : (100 MM X 150 MM) :

24.1 Necessary excavation shall be done as required. The foundation cement concrete of 1: 4: 8 shall be laid for a thickness of 15 cms. The S.W. trap shall be fixed into the position on the main sewer side of the chamber as directed. Brick masonary chamber of one brick thickness in C.M. 1:5 shall be constructed with the inside dimensions 60cms. x 45cms.

24.2 The inside of the chamber shall be plastered in 12 mm.thick C.M. 1:3 and shall be finished smooth with cement slurry.

The outside of the chamber shall be plastered to a depth of 30 cms. from the top of the chamber. The item also includes providing and laying 1: 2: 4 cement concrete for fixing the C.I. frame and cover. The C.I. frame and cover shall be of the specified size and it shall not weigh less than 50 Kgs. including farme and cover.

25.0 GALVANIZED MILD STEEL TUBES :

25.1 Galvanised mild steel tubes of specified dia. nominal bore shall conform to I.S. 1239- 1961. The galvanised fittings, clamps, etc. required for specified dia. bore pipes shall be of best quality and make as approved by the Engineer-in-charge.

25.2 Cutting, Laying & Jointing - When the tubes are to be cut or rethreaded, the ends shall be carefully filed out so that no obstruction to bore is offered. The ends of the tubes shall then be theaded conforming to the requirements of I.S. 554- 1955 with pipe dies and taps carefully in such a manner as will not result in slackness of joints when the two pieces are screwed together.

The taps and dies shall be used only for straightening screw threads which have become bent or damanged and shall not be used for turning of the threads so as to make them slack as the latter procedure may not result in a water tight joint. The screw threads for the tube and fittings shall be protected from edge until they are fitted.

In jointing the tubes, the inside of the socket screwed end of the tubes shall be oiled and smeared with white or red lead and wrapping around with a few turns of fine spun yarn round the screwed end of the tube. The end shall then be tightly screwed in the socket, tees, etc. with a pipe wrench. Care shall be taken that all pipes and fittings are properly jointed so as to make the joints completely water tight and pipes are kept at all times free from dust and dirt during fixing. Burr from the joints shall be removed after screwing. After laying the open ends of the pipes shall be temporarily plugged to prevent access of water, soil or any other foreign matter.

Any threads exposed after 3 jointing shall be painted or in the case of under ground piping thickly coated with approved anti-corrosive paint to prevent corrosion.

25.3 Laying in Trenches - The width and depth of the trenches for different diameters of the tubes shall be as - For 15 to 80 mm. dia. tube width of trenches shall be 30 cms. and depth of trenches 60 cms. At joints, the trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient in accordance with general specifications of earth work in trenches.

The pipes shall be painted with two coats of anti-corrosive bitumastic paint of approved quality. The pipe shall be laid on a layer of 75mm. sand filled upto 150mm. above the pipe if so specified. The remaining portion of trench shall be then filled with excavated earth. The surplus earth shall be disposed of as directed.

When the excavation is done in rock the bottom shall cut deep enough to permit the pipe to be laid and cushion of sand 75fmm. In case of bigger diameter of tube where pressure is very high, thrust block of cement concrete 1:2:4 (1 cement; 2 coarse sand; 4 graded stone aggregate of 20 mm. nominal size) shall be constructed on all bends to transmit the hydraulic thrust without imparing the ground and spreading it over a sufficient area if so specified.

25.4 Fixing of Tube Fittings to wall ceiling & floors - In case of fixing of tubes and fittings to the walls or ceilings, these shall run on the surface of the wall or ceiling (not in chase) unless otherwise specified. The fixing shall be done by means of standard pattern, holder clamps keeping the pipes about 15mm. clear of the wall. When it is found necessary to conceal the pipe sand when specified so, chasing may be adopted or pipe fixed in ducts or recesses etc. provided that there is sufficient space to work on the pipe with usual tools.The pipe shall not ordinarily be buried to walls or solid floors, where unavoidable, pipes may be buried for short distances provided that adequate protection is given against damage and where so required joints are not buried. Where required M.S. tube sleaves shall be fixed at a place a pipe is passing through a wall or floor for expansion and ocntraction and other movements. In

case the pipe is embeded in walls or floors, it should be painted with anti- corrosive bitumastic paint of approved quality. The pipe should not come in contact with lime mortar or lime concrete as the pipe is affected by lime, under the floors, the pipe shall be laid in layer of sand filling.

All pipes and fittings shall be fixed truly vertical and horizontal unless unavoidable. The pipes shall be fixed to walls with standard pattern clamps or required size and shape, one end of which shall be properly plugged or cemented into walls with cement mortar 1:3 (1 cement; 3 coarse sand) and the other tightened round the pipes to hold it securely. These clamps shall be spaced at regular intervals in straight lengths at 2 M c/c interval in horizontal run and 2.5 M. intervals in vertical run. For pipe of 15 mm. dia. upto 25 mm. dia. the holes in the walls and floors shall be made by drilling with chisel or jumper and not by dismantling the brick or concrete. However, for higher diameter pipes and holes shall be carefully made of the smallest required size. After fixing the pipe holes shall be made good with cement mortar 1:3 (1 cement; 3 coarse sand) and properly finished to match the adjacent surface.

25.5 Testing of Joints - After laying and jointing, the pipes and fittings shall be inspected under working conditions of pressure and flow. Any joint found leaking shall be redone, and all leaking pipes removed and replaced without extra cost. The pipes and fittings after they are laid shall be tested to hydraulic pressure of 6 Kg./sq.cm. The pipe shall be slowly and carefully charged with water allowing all air to escape and avoiding all stock and water hammer. The draw off takes and stock shall then be closed and specified hydraulic pressure shall be applied gradually. The pressure gauge must be accurate The pipes and fittings shall be tested in sections as the work of laying proceeds, veeping the joints exposed for inspection during the testing.

26.0 R.C.C.NP2 / NP3/ NP4 CLASS PIPE :

26.1 Excavation of Trenches- The width of trenches shall be required and depth shall correspond to inlet level of the pipe and to the required levels as directed. At joints, the trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line, and gradient in accordance with general specifications of earth work in trenches.

26.2 Laying - The pipe shall be laid accurately and perfectly true to line, levels and gradients. Great care shall be taken to prevent sand etc.from entering the pipes. The pipes between two manholes shall be laid truly in a straight line without vertical or horizontal undulation. All junctions and changes in direction and diamter shall be made in cement concrete finished smooth and benched on both sides. The body of the pipe shall rest for its entire length, on an even level bed grips being made or left on the bed to receive the sockets of the pipes.

26.3 Jointing - Trarred gaskin or yarn soaked in near cement slurry shall first be placed with in caughing space of each pipe and the collar shall then be placed well home over the joint of the pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and gaskin ceulked home so as to fill not more than 1/4th of the

total depth of (13 mm. in depth) the collar. The remainder of the collar shall be filled with stiff mixture of cement mortar in proportion of one part of cement and one part of sharp sand. When the collar is filled, a filled shall be formed round the joints trowel, forming an angle of 450 with the barrel of the pipe The cement mortar of(prop. 1:2) shall be mixed as necessary for immediate use.After the joint is made, any extraneous materials shall be removed from the inside of the joints with a suitable scraper or `badger'.The newly made joints shall be protected, until set, from the sun, dry winds, rain or frost, sacking of other suitable materials which shall be used for the purpose. The mortar shall be cured for 10 days.

26.4 Testing of joints - The pipe line shall be tested as directed. If any leakage is visible the defective part of the work shall be made good at no extra cost. A slight amount of sweating which is uniform may be overlooked, but excessive sweating from a particular pipe of joint shall be watched for and taken as indicating a defect to be made good.

27.0 SLUICE VALVE :

[i] (a) All Cast Iron Sluice Valves shall be manufactured strickly in accordance with and conforming to Indian standard specification IS : 2906 : 1984 and detailed specification of Surat Mahangar Seva Sadan.

(b) The valves are intended to be used in water supply system in vertical/horizontal position.

[ii] The material for different component parts of sluice valves shall conform to requirements given in Table : 1.

TABLE-1

Sr.	Components	Material	Ref. to IS
(a)	Body, bonnet, wedge, stuffing box, gland, thrust plate, cap	Grey Cast Iron (F.G.200)	210:1980
(b)	Stem	High tensile brass (forget) (HT.2)	320:1980 6912:1973
(c)	Wedge nut	Leaded tin (Bronze) (LTB.2)	318:1981
(d)	Body seatring wedge facing ring	Leaded tin (Bronze) (LTB.2)	318:1981
(e)	Body & Nuts	Carbon steel (Class 4:6)	1363:1967
(f)	Bonnet Gasket	Carbon steel (Class 4:6)	1363:1967
(g)	Gland packing	(a) Jute & hemp (b) Asbestos	2414:1969 4687:1980
(h)	Shoe & channel	Brass	320:1980

(iii) Manufacturing :

(a) Bodies and Bonnets : Bodies & Bonnets shall be so designed as to withstand the best pressure specified in IS: 2906: 1984.

(b) Flange : The flanges and their dimensions of drilling shall be in accordance with IS : 1538 : 1976.

(c) Wedge : The Valves shall be fitted with double faced cast iron wedge made in one piece and having two machined facing rings securety fixed in to machined recessess in the wedge (also not `F' below)

(d) Guides & Lugs : The guides and lugs shall be provided to guide the wedge through its full travel. The lugs & guide shall be lined with bronze.

(e) The clearance between lugs and guides for different sizes of sluice valves shall be as given below :-

Valve size mm	Maximum clearance on either sides of lug mm.
350 to 450	4
500 to 600	5
700 to 1200	6

(f) Facing or seat rings : The dimentions of the body seat rings and wedge facing rings shall conform to IS 2906 : 1984. The wedge facing rings & body seat rings shall be secur rivetted over and above sufficient hydraulic press fittings.

(g) Stems & Wedge Nuts : The dimensions of stems and wedge nuts shall be in accordance with IS : 2906 : 1984 stems shall have a machine cut, single start trapizoidal threads of such length that the wedge can be raised to a position so as to ensure full or part flow passage through the valves. In fully closed position of the value the stem/spindle shall remain in full contract with wedge nut for its entire length with at least 10 mm projection. The length of the stem particularly below the collar should be kept accordingly.

(h) The spindle nut must remain security engaged in the wedge. The detailed drawing showing dimension of spindle nut and portion of wedge engaging the spindle nut must be furnished and in case of order, got approved prior to manufacturer. The fulfilment of this condition is a must whether included in the relevent Indian Standard or not.

(i) Stuffing Box : The minimum inside dimensions of the stuffing box shall be in accordance with IS 2906:1984.

(j) Valve Caps : All valves shall be provided with caps/ Valves caps shall be provided with nominal dimensions in accordance with IS 2906 : 1984. The direction of closing shall be indicated on the caps.

(k) Gum metal scour or C.I. clearing door at the bottom of S.V. body shall be provided.

(l) Bolts & Nuts : Bolts and nuts shall conform to IS 1363 : 1967 and IS 4218 : 1967.

(m) Height of valve : The height of valves shall conform to IS 2906 : 1984.

(n) Gears : Gears shall be of suitable design (IS 2535 : 1978) and workmanship, so as to ensure satisfactary working of sluice valve.

(iv) COATING :-
Immediately after casting and before machining all C.I.parts shall be thorough cleaned, and shall be coated by dipping in bath containing a composition heaving a tar base. The coating shall be such that it shall not impart any tests or smell to water.

(v) Testing:-
All C.I. sluice valves shall be tested in presence of representative of the Surat Smart City Development Limited at manufacturer's works only & testing certificates shall be furnished alongwith each lot of supply.

a) Hydraulic Test:- Each values shall be subjected to hydraulic tests as described in appendix B of IS:2906:1984.

Test pressure & Test duration of sluice valves.

PN rating of valves	Test	Test Pressure Map (Gauge)	Test Duration mm
PN 1.6	Body test Seat Test	2.4 1.6	5 2

b) Liquid penetrant Test:- The forged high tensile brass stems shall not show any sign of flaw when subjected to liquid penetrate flow detection testing accordance with IS : 3658 : 1981.

c) Atleast 15 days clear notice about readines of testing should be given to the Surat Smart City Development Limited to enable representative to witness various tests at manufacturer's work.

MARKING:-

The following information shall be cast on each valve body in raised letters.

a) ISI Certification Mark.
b) The manufacturer's name or Trade Mark.
c) The nominal pressure of valve.
d) The size of valve.
e) Heat number of cast.

28.0 VALVE CHAMBER :

28.1 The size of the chamber shall be as required and as directed. Necessary excavation shall be carried out for constructing the chamber, foundation of c.c. 1:3:6 shall be 25 cm. thick and shall extend 8 cm. beyond the outer faces of the chamber. The thickness of the wall shall be as required or as directed by the Engineer depending upon the depth ofthe chamber.

But in no case the thickness shall be less than 23 cm. The masonary shall be plastered by 20 mm. thick in C.M. 1:3 to a full depth inside the chamber and for a depth of upto 30 cm. below the ground level on the outside of the chamber. Providing and laying R.C.C. slab in 1:2:4 c.c. with required reinforcement and

providing and fixing manhole cover and frame in position cutting the reinforcement and placing and fixing the same in position by using binding wires as directed by the Engineer. The weight of the manhole cover frame shall be not less than 200 Kgs. Necessary C.I. steps weighting not less than 5.30 Kgs. shall be provided at 0.37 meter c.c. on one side of the wall. The exposed surface of the R.C.C. slab shall be plastered with C.M. 1:3.

Brick Masonary - The bricks shall be table moulded good,sound, hard, square well burnt, with straight sharp edges. Their size shall be uniform. No bricks after 24 hours immersion in water should absorb more than 20 percent of their dry weight. Any brick which in the opinion of the Engineer are defective in quality, will be allowed to go into the work. Resistance of bricks to crushing shall not be less than 500 lbs. to the square inch. No bricks shall under any circumstances be used except such as to fulfill in all respects the conditions above specified and should the cntractors fail to supply the bricks of the quality and description specified, and in such quantities as may from time to time be necessary for the expeditious progress of the work, the Engineer shall be at liberty to purchase on account of the contractor, and bring to the work such and so many bricks as the Engineer may from time to time deem necessary or desirable and the contractors shall in such case be charged with all cost which the Engineer may incur in supplying such bricks, and shall be bound to use in the work bricks so supplied.
The work shall be of best description and workmanship.No bricks shall be used in it except as closures, and in case of the contractors failing to supply good bricks, bricks approved by the Engineer only shall be used.

All bricks shall thoroughly immersed in water at least for 12 hours before being used, and the brick work shall be protected form the sun and kept well moistened for at least three days after completion. The bricks are to be evenly and truly laid, breaking joint, course by course and properly bent together in every part. The joints are to be closed and regular and in no case exceed three eighth of an inch thickness. The bond shall be english, except where otherwise specified.

All bricks masonary work shall be plastered both inside and outside. To receive cement plastering, the walls shall be prepared by racking out the joints to a depth of 1/2" and watered. The cement plastering shall consist of three parts of fine sand and one part of cement. A rendering of cement plastering of the required thickness properly guaged, shall then be applied in an even and uniform coat and shall be well and repeatedly wetted and trowelled until hard and glossy surface is obtained.

29.0 FILLING WITH EXCAVATED EARTH :

29.1 The earth to be used for filling shall be free from salts, organic or other foreign matter. All clods of earth shall be broken.

29.2 As soon as the work in foundation has been completed and measured the site of foundation shall be cleared of all debris, brick bats, mortar dropping etc.and filled with earth in layers not exceeding 20 Cms. Each layer shall be adequately watered, rammed and consolidated before the succeeding layer is laid. The earth shall be

rammed with iron rammers where feasible and with the but ends of crowbars, where rammer cannot be used.

29.3 The plinth shall be similarly filled with earth in layers not exceeding 20 Cms. adequately watered and consolidated by ramming with iron or wooden rammers. When filling reaches finishing level, the surface shall be flooded with water for at least 24 hours and allowed to dry and then rammed and consolidated.

29.4 The finished level of filling shall be kept to shape intended to be given to floor.

29.5 In cases of large heavy duty flooring the consolidation may be done by power rollers, where so specified. The extent of consolidation required shall also be as specified.

29.6 The excavated stuff of the selected type shall be allowed to be used in filling the trenches and plinth. Under no circumstances black cotton soil be used for filling the plinth.

30.0 SNOWCEM, DISTEMPER, OIL PAINT :

30.1 GENERAL

a] Preparation of Surface & Priming coat :

The surface shall be thoroughly brushed free from motor dropping and other foreign matter and sand papered smooth.

A priming coat of whiting shall be applied over the prepared surface in case of water-bound distempering and distemper primer or cement primer shall be applied in the case of oil bound distemper. No white washing coat shall be used as a priming coat for distemper.

b] Application :

After the primer coat has dried for at least 48 hours, the entire surface shall be coated uniformly with proper distemper brushes in horizontal strockes, immediately followed by vertical ones which together shall contitute one coat.

c] Scaffolding -

Where scaffolding is necessary it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be white or colour washed. A properly secured strong and well tied suspended platform (zoola) may be used for white washing. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the floors and walls. For white washing of ceilings, proper stage scaffolding shall be erected where necessary.

30.2 Snowcem :

Finishing wall with water proofing cement paint (snow-cem) on undecorated wall surface (three coats) to gives an approved brand and manufacture and required shape even shade after throughly brushing to surface to remove all dirt and remains of loose powdered materials.

The surface shall be throughly scrapped clean, finishing walls shall be completely cleaned before applying snow-cem or water proof cement paint. The shed and quality must be approved by Engineer-in-charge of the work before starting the work. The snowcem shall be applied with the fine brush and allowed to set before second coat is applied. The rate shall include necessary scaffolding, tools and plants and sufficient watering etc. complete.

The work shall be carried out to the entire satisfaction of the Engineer-in-charge of the work and in best in workmanship like manner as per specification of manufacturer and P.W.D.H.B.Vol.I & II and as directed.

30.3 Oil Paint :

All doors, windows, vantilators, shutters, railing, all fabricated items, motors, pumps, all interconnecting piping above ground level etc shall be coloured with three coats of approved make oil paint strictly as directed by Engineer-in-charge.

30.4 Distempering :

1] Distempering shall be of the oil or water bound type as specified.

2] Material :

Dry distemper or oil bound washable distemper of approved brand and manufacture for water bound and oil bound respectively conforming to IS : 428 shall be used. The proportions of the mix shall be as per the approved manufacturer's instructions.

a) The dry distemper shall be stirred slowly in clean warm water using 0.6 litre of water per kg. of distemper or as specified by the approved makers. The mixture shall be well stirred before and during use to maintain an even consistency.

b) Thinner as stipulated by approved manufacturer shall be used in case of distemper for oil bound type.

c) Dry distemper shall not be mixed in larger quantity than is actually required for one day's work.

31.0 G.I.RALLING :

31.1 The railing shall be fabricated from G.I. (Class-B, Medium) pipes, conforming to IS . They shall consist of horizontal pipes welded at a spacing of not more than 450 mm to vertical balustrade pipes of 40 mm dia. The vertical pipes shall be spaced at 1.5 m c/c. The fabricated railing shall be installed using 6 mm thick M.S. base plate and 12 mm dia M.S.`J' bolts. The exposed faces shall be painted with three coats of enamel paint over one coat of red oxide primer of approved quality.

32.0 M.S.LADDER :

32.1 The M.S. ladder shall be used where access to elevated tanks is essential for operation and maintenance. It shall be fabricated from M.S. angles and channel

section.The span of the ladder shall be not less than 60 cms. The angles used shall not be less than ISA 25 x 25 x 6 mm. A chequered plate of thickness 6 mm shall be provided for every step. For ease in climbing the pitch of ladder shall be restricted to 60 degree. The rise of the steps shall be restricted to 25 cm. All M.S. surfaces shall be coated with epoxy to prevent the corrosion. The railing for the ladder shall be fabricated from 25 mm GI pipes.

33.0 C.C. PAVER BLOCKS:

(Paving work with Precast, Interlocking type, Delta shaped, Cement Concrete paver blocks)

33.1 C.C.Blocks :

The block shall be table vibrated 65 mm thick. Which shall be got approved by Engineer-in-charge prior to placing the order for the same.Testing of C.C. blocks shall be given as per instructions of Engineer-in-charge.Testing report include results of compressive strength test and Abrasion test.

33.2 Workmanship:

Cement Concrete paver blocks of Delta shape as shown in drawing (65mm th.) shall be supplied and stacked on site and preserved carefully, paver block in bulk as per requirement shall be supplied to site after complete curing at the manufacturing place. Broken pieces of C.C.paver block shall not be used.Before fixing/laying of paver blocks paving area shall be fillied with fine sand of approved quality in 135 mm thickness.

After filling fine sand in required thickness, it shall be levelled and campated by vibrating plate compactor. Sprinkling of water during this process shall be done,levelling and compaction of fine sand bedding shall be done to the satisfaction of engineer-in-charge.

Precast, Delta shape,C.C.paver block as per drawing or as directed shall be laid.(i.e.interlocking pattern of Delta Shape). The work of laying C.C. paver block in a inter locking pattern shall be in line and level. Necessary camber shall be maintained to drain out the water easily. After properly laying of C.C.paver block. It shall be again compacted by using vibrating plate compactor.All unevenness must be removed and same level must be achieved. Corners and the edges shall be filled with mortars. Good aesthetics view shall be achieved.

34.0 POLISHED KOTA STONE FLOORING :

34.1.0 MATERIAL

Water shall conform to M-1, Cement mortar shall conform to M-8, Polished kota stone shall conform to M-32.

34.2.0 WORKMANSHIP

34.2.1 Each slab shall be cut to the required size and shape and fine chisel dressed at all the edges. The sides thus dresses shall have a full contact if a straight edge is laid along. The sides shall be table rubbed with on coarse sand before paving. All angles and edges of the slabs shall be true square and free iron chipping and giving a plane surface. The thickness shall be as specified in the item.

Bedding for the koatah stone slabs shall be cement mortar 1:6 (1 cement : 6 coarse sand) or L.M 1:1.5 of thickness 30mm as given in the description od the item. Subgrade shall be cleaned wetted and mopped. Mortar of the specified mix and thickness shall then be spread on an area sufficient to receive one kotah stone slab. The slab shall be washed clean before laying. It shall be laid on top, pressed, tapped genetly to bring it in level with the other slabs. It shall than be lifted and laid aside. Top surface of the mortar shall then be corrected by adding fresh mortar in hollows or depressions. The mortar then be allowed to harden bit. Over this surface, cement slurry of honey like consistency shall be applied. The slab shall then be gently placed in position and topped with wooden mallet till it is properly bedded in level with and close to the adjoining slab. The joint shall be as fine as possible. The slab fixed in the floor adjoining the wall shall enter not less than 10mm. Under the plaster, skirting or dedo. The junction between the wall and floor shall be finished neatly. The finished surface shall be in true levels and slopes as directed.

The floor shall be kept wet for a minimum period of 7 days so that bedding and joints set properly.

Polishing shall be normally commenced after 14 days of laying the stone slab. First polishing shall be done with carborundum stone. Of 120 grade frit fitted in the heavy machine and then second polishing shall be done with carborundum stone 220 to 350 grade grit fitted in heavy machine. Water shall properly be used during polishing. The stone shall then be washed clean with water. When directed by the Engineer –in –charge wax polish of approved quality shall be appliede on the surface with the help of soft cloth over clean and dry surface then the polishing machine fitted with beds shall be run over it. The holes required for Nahni traps, piopes and any other fitting shall be made without extra cost.

35.0 COLLAPSIBLE STEEL SHUTTERS :

35.1.0 MATERIALS:

35.1.1 The collapsible gate shall confirm to M-24.

35.2.0 WORKMANSHIP:

35.2.1 “T” Rails shall be fixed to the floor and to the lintel at top by means of anchor bolts, embedded in cement concrete of floor and lintel. The anchor bolts, shall be placed approximately at 45 mm centers alternatively in the two flanges of the “T” iron. Iron bottom runner (T-iron) shall be embedded in the floor and proper groove shall be formed along the runner for the purpose. The collapsible gate shall be fixed at the sites

by fixing the end double channels in the T-Iron rail and also by hold – fasts bolted to the end double channel and fixed in the masonry at the side walls or the otherwise.

35.2.2 In case where the collapsible gate is not required at the lintel, beams a slope above a T-Iron suitably designed may be fixed at the top embedded in masonry and provided masonry with necessary clamps and roller arrangement at the top.

35.2.3 All the adjoining work damaged while fixing gate shall be made good to match the existing work without any extra payment.

35.2.4 All members of the collapsible gate including "T" iron shall be thoroughly cleaned to rust, scales, dust etc. and given a primary coat of red lead, before fixing them in position, and after fixing two coats of approved quality oil paint shall be applied.

36.0 PVC RAIN WATER PIPES :

36.1 MATERIALS:

The specified dia. PVC spigot and socket soil or waste pipe / Rain water pipe.

36.2 WORKMANSHIP:

36.2.1 The PVC spigot and socket soil or waste / rain water pipe shall be joined as following procedure. Cut the PVC pipe with a fine toothed saw to the required length pipe should be square.

Chamfer the edge of the pipe to be inserted at an angle of about 15 to about 1/3 the wall thickness, using a course file.

Make sure the spigot and socket are roughly clean and dry. Insert the pipe without the seal ring and mark along the pipe, when it is fully inserted. Fix the rubber ring into the groove without twisting it.

Apply jointing lubricant to the chamfered end of the pipe, mark made on spigot or to the socket end of the fitting. Push the pipe firmly into the socket till the gap between the mark on the spigot and socket is about 10 mm to allow for thermal expansion.

The pipe clips should be spaced at intervals of not more than ten times the outside diameter of the pipes for horizontal runs and for vertical lines are spaced at interval of one metre to a maximum of two metres according to pipe diameter.

All entry to main stacks should be protected with minimum 50 mm water seal traps, wherever there is a mixing of soil and waste lines. Smoke dust should be avoided and test plug or socket plug should be used for testing the lines.

All soil / Rain pipes shall be carried up above the roof and shall have a wire balloon guard or a cowl.

The ventilating pipe or shaft shall be carried out to a height of atleast one metre above the outer covering of the roof of the building or a case of windows in a global wall or a dormer windows. It shall be carried up to the ridge of the windows. In case of flat roof to which access for use is provided, it shall be carried up to a height of atleast two metres above the parapet or two metres measured vertically from the top of any windows or opening may be exits up to a horizontal distance of the five metres from the vent pipe in to such building and in no case shall be carried out to a height less than 3 metre.

The connection between the main pipe and branch pipes shall be made by using branches and bends with access doors for cleaning.

37.0 NON-TOXIC ANTI-CORROSIVE EPOXY INNER & OUTER COATING TO M.S. PIPES :

37.1 Inner & outer surface of the pipes shall be prepared for the application of paint by first cleaning the surface with wire brush. Sand blasting shall be carried out in the presence of an authorised representative of SMSS and as per the provisions of IS:1477 Part (I). All the mill scale and rust must be perfectly removed and inner bars metal surface of the pipe should appear neat, clean and fresh so that the paint applied afterwards should adhere it perfectly. Any trace of grease shall be removed carefully. Such clean, rough (roughness should be within 20 microns) bars metal surface will allow proper adhesion of the lining to the pipe. The Engineer-in-charge may exercise the right to examine the blast cleaned surface before application of priming coat. If the surface is rejected as not meeting the specification requirements, the contractor will be required to perform at his expense, such work as will be necessary to prepare the surface to the satisfaction of the Engineer-in-charge.

37.2 The compressed air used for blast cleaning shall be sufficiently free from oil or water contamination to ensure that preparation is not impaired. Adequate separators, traps and filters shall be provided which shall be cleaned and maintained regularly.

37.1 Inner & outer surface prepared as mentioned in (i) above shall immediately in no case beyond four hours be followed by an application of Zinc rich primer. Athe primer shall be applied by spray or brush. The application of the primer shall be as per the recommendation of the manufacturer.

The technical specifications of the primer shall be as under.

A two component heavy duty prefabricated primer based on Zinc Dust and epoxy resins shall be Di-ethlene glycol of Bispernol A and hardner shall be Adduct Hardner of Basic Liquid resin and acromatic amine. The primer shall be non-phenolic.
The preparation of paint shall be carried out as below.

		Part By Weight
Base	:	100
Hardner/Hardners	:	50

Mized paint(Primer) shall have properties:-

(a)	Visconsity	:	
(b)	Specific Gravity	:	1.70 + 3%

(c)	Pot Life mixture at 30 Degree	:	2 to 4 hours
(d)	Zinc dust content on D.F.T. base	:	92 +/- 3%
(e)	Finish	:	Smooth and matt.
(f)	Shade	:	Grey
(g)	Drying Time	:	Surface dry within 5 minutes and Hard dry within 1 hour. Overcoating can be done After 24 hours.
(h)	D.F.T.	:	25-30 microns
(i)	Compatiability	:	Compatible with all systems of paints like Bituminous, conventional and epoxy
(j)	Toxicity	:	Paints
(k)	Coverage	:	10 Sq.mt./kg.at 25 microns

37.2 Non-toxic anti corrosive Epoxy paint shall match the following

a)	Dry time	:	Surface dry not more than 4 hours. Hard dry not more than 18 hours.
b)	Covering capacity	:	2-2.5 Sq.mt. / Kg.
c)	Toxicity	:	Non-toxic
		:	300 micron (100 micron per coat).

Preparation may be carried out as under

Base	Parts by weight	100
Hardner	60	(45 + 15)

In order to obtain satisfactory adhesion between subsequent coats, the previous coat may be lightly abraded with fine sand paper, if it is already set hard. The paint may preferably be applied with brush.

Approximate lengths of 0.50 at both the ends of pipe shall be left uncovered with paint application as these ends are to be cield welded. After laying the pipe in the trench and properly completing the welding joint. Painting work left earlier should be completed in the manner stated as above.

The mode of application and materials shall conform to the following I.S. Standards.

(a)	IS:1477	:	Code of practice for painting
(b)	IS:6049	:	Code of practice for application of temporary corrosion preventatives.
(c)	IS:9197	:	Code of practice for Epoxy resion and Hardner.

37.3 Unless otherwise specified here in the concerned Indian Standards shall be followed to its latest revision or amendments.

37.4 In general, the requirements of IS:1477 "Code of practice for painting of Ferrous metals in buildings and allied products" (Part-I & II) and IS:6049" Code of practice for application of temporary corrosion preventives" shall be met in carrying out the painting and / or preparatory work.

37.5 The storage, mixing and application of paints shall strictly carried out in accordance with the paint manufacturer's printed recommendations very strictly, this is in addition to the fulfilling the specifications of this tender. Make of the paints / primer shall be Hindustan Ciba Geigy, Cibatul, SIP resins, or its equivalent companies only.

37.6 The thinning of all coatings shall only be carried when absolutely necessary, and then only in accordance with the paint manufacturer's instructions.

37.7 The painted surface shall be allowed to dry and cure in accordance with the paint manufacturer's open pot Life period and the required drying time between coats allowed in all cases. Under no circumstances shall the "Pot Life" be extended by the addition of new paint or other media.

37.8 The Consultant/Engineer-in-charge reserves the right to inspect the surface prepared and painting operations at any stage and to require any unsatisfactory workmanship to be remedied at the contractor's expenses.

37.9 Inadequate dry film thickness shall necessitate the application of a further coat or coats of paint to provide the full minimum dry film thickness specified.

37.10 An elcometer or similar instrument shall be used to determine dry film thickness. On micaceous from oxide coatings and on non-magnetic substrata, a non-magnetic measuring instrument shall be used.

37.11 If the quality of the protective coating is impaired by excess dry film thickner showing wrinkling, cracking, or softness, the contractor shall reserve the defective coating and repaint the effected area to the satisfaction of the Engineer-in-charge.

37.12 Pipes when painted shall not be handled, stacked, or exposed to condensation, or rain, until the last applied coat is completely dry and in the case of two pack – materials the coating has thoroughly cured.

37.13 The contractor shall furnish and install the necessary scaffolding, runaways etc. required to complete the work include in this specified.

37.14 The painting shall be carried out against welding parts of piping after it is confirmed that all tests for piping have passed.

37.15 All paints in a particular paint system shall be from one paint manufacturer unless agreed otherwise.

37.16 Damaged areas shall be cleaned down and retouched with compatiable primer before overpainting.

37.17 On surface preparation, painting shall be carried out in claimatic condition which will result in inferior protection to metal surface. The paint must be applied to dry surfaces in a dust-free atmosphere. Preparation and painting shall not take place in open during rain or fog or when condensation is likely to affect the paint film before it is dry.

NOTE:-Contractor shall have to submit test certificates of anti corrosive epoxy paint and food grad quality epoxy paint from the authorized laboratory.

SAFETY:

37.18 All safety regulations and requirements in force at the job site shall be adhered to by the contractor. Prior permission to proceed with the painting shall be obtained from the Consultant/Engineer-in-charge for coating areas in which painting work will be done.

37.19 Any spillage of volatiles shall be wiped up immediately, oily or solvent rage and waste shall not be allowed to accumulate, anywhere within the job mite and shall be kept in closed containers and in minimum quantity.

37.20 No painting shall be done adjacent to fire hazard, such as welding, open flame or sparkle metal fabrication. No smooking shall be allowed within the plant premises.

37.21 Materials shall be stored in a location approved by the Consultant / Engineer-in-charge. Storage space shall be kept clean and free from fir hazards.

38.0 PRE-CAST CHEQUERED TILES 28 MM THICK - WITH MARBLE CHIPS:
(A) Dark shades using ordinary grey cement

38.1.0 MATERIALS

Water shall conform to M-1 Cement shall conform to M-3. Lime Mortar shall conform to M-7. Cement mortar shall conform to M-8. the precast chequered tiles of 28 mm. thick shall be of Dark shade using white cement and conform to M-30.

38.2.0 WORKMANSHIP

The work shall be carried out as per I.S. 1443 – 1972.

38.2.1 Bedding:

Before spreading the mortar, the sub-base of the floor shall be cleaned of all dirt, scum and loose materials and then well wetted without forming any pools of water on the surface.

In case of R.C.C. floors, the top shall be left a little rough, all points of level for the finished surface shall be marked out. The lime water of proportion 1:6 (1 cement : 6 coarse sand) jointed with neat cement slurry mixed with pigment to match the shade of the tiles as directed shall be then evenly and smoothly spread

over the base. Bedding layer or mortar shall be not less than 10 mm and average thickness of bedding shall be 12 mm.

38.2.2 Laying:

Before laying the terrazzo (Marble / Mosaioc) tiles, the tiles shall be thoroughly wetted with water. Neat cement grout of required consistency at 4.4 kg cement / sq.mt. shall be spread on the mortar bed. The tiles shall be laid on the neat cement float and shall be evenly and firmly bedded to the required level and slopes. There shall be no hollows left. The joints shall be of uniform thickness and in straight line as per the pattern.

The surface of flooring shall be checked frequently with a straight edge at – least two metres long so as to obtain a true surface with required slope.

The tiles which are fixed in the adjoining the wall shall go about 10 mm under plaster. Skirting or dedo shall be left unfinished for about 50 mm above finished floor level and unfinished strip then left earlier shall be finished.

In places where full tiles can not be fixed. The tiles shall be cut to the size and smoothened at edges to give straight and true joints.

After the tiles have been laid, the surplus cement slurry and the joints shall be cleaned and washed fairly deep before cement hardens.

The day after tiles have been laid, the joints shall be cleaned of every cement grout with a wire brush to a depth of about 5 mm and then grouted with white cement with or without pigment to match the shade of the topping of tiler.

38.2.3 Curing:

The flooring shall be kept wet with damp sand or water for seven days. It shall be kept undisturbed atleast for 14 days. The grinding shallnormally be commenced after 14 days.

38.2.4 Polishing:

After the tiles are properly cured, first grinding shall be done with carborundum stone of 48 to 60 grade grit fitted in machine. Water shall be properly used during grinding. When the chips show up and the floor has ben uniformly rubbed, it shall be cleaned with water, baring all pin holes. It shall then be covered with a thin coat of white cement mixed with or without pigments to matchthe colour of the topping of the tiles. Pin holes if any shall thus be filled. This grout shall be kept moist for a week. Thereafter second grinding shall be started with carboundum of 120 grit. Grouting and curing shall follow again. Final grinding shall be done when other works are finished. The machine shall be fitted with carborundum of grit 220 to 350 using water in abundance. The floor shall then be washed clean with water. Oxalic acid powder shall than be dusted at 33 grams per square metre on the surface and the surface rubbed with machine fitted with hessian bobs or rubbed hard with pad of wooden rags. The

floor shall then be washed clean and dried with a soft cloth or Linen. The finished floor shall not sound hollow when tapped with a mallet.

If any tiles is disturbed or damaged it shall be refitted or replaced properly jointed and polished.

Testing of the tiles shall be carried out by the contractor at his own cost as per I.S. requirement for required tests.

39.0 PROVIDING SPIRALLY WELDED M.S. PIPES:

39.1 The manufacturer (of approved Vendor list) should have registration/license of I.S.I. (Indain Standard Institute) for the manufacturing unit from where the pipes are to be manufactured and supplied. The true and certified copy of license should be submitted with the tender.

39.2 Octroi :
The rates are inclusive of octroi. Successful tenderer will have to pay octroi at Surat at the prevailing rate and an original octroi receipt must be submitted along with each bill/invoice, without which payment shall not be made. In absence of documentary evidences, any delay in releasing the payment, SMSS will not be responsible.

39.3 Insurance :
The materials to be despatched by the supplier shall be duly insured at the contractor's cost and transit claims if any for losses/charges are required to be lodged and settled by the contractor directly with the insurance company.

39.4 All the pipes shall be unloaded by crane only. Due care must be taken while unloading, in order to avoid any possible damage to the pipes.

39.5 No Price Variation shall be paid in any case.

39.6

Size of pipe in mm	Unit Weight per Rmt.length in kg.
As per design	As per IS

39.7 The H.R.Coil must be purchased from the companies having ISO 9002 certifications.The vendors for H.R. Coil are ESSAR STEEL, ISPAT, TATA IRON & STEEL CO., and STEEL AUTHORITY OF INDIA LTD. Test cerificate of the H.R. Coil should be attached along with bill.

39.8 An authorised representative of SMSS shall inspect the pipes or pipe material and attend various tests to be carried out in the premises of the manufacturer.In such cases, travelling expenses of the representative of SMSS, testing facility as well as testing charges shall be on account of the contractor. The contractor shall have to inform SMSS atleast before 15 days regarding readiness of the lot of the pipes. The required test certificates should invariably be attached along with the concerned invoices, without which SMSS will not release the payment.

39.9 DETAILED SPECIFICATIONS OF M.S. PIPES:

1.0 All the pipes are intended to be used for proposed Sewage Treatment Plant and Tertiary Sewage Treatment Plant.

2.0 Material:-

2.1 Spirally submerged arc Welded Pipes shall be manufactured from steel produced by the open hearth or electric or one of the basic oxygen process.

2.2 Steel to be used in manufacture of spiral welded pipe shall be conforming to IS:2062:1992 and to its latest amendments also. Steel should be of Grade-`A' , designated as Fe 410 WA in IS:2062: 1992.

2.3 Sampling of pipes shall be as per IS:4711:1994.

3.0 Manufacture :-

3.1 The pipes shall be manufactured from steel strips by spirally submerged arc welding. The weld must be automatic and continuous. All the edges of the plates/strips should be prepared suitable prior to the welding of pipes.Weling joints and its manufacturing process shall conform to IS:3589:2001.

3.2 Length :-
The Surat Smart City Development Limited intends a speedy as well as easy laying work of the pipes procured through this tender. Accordingly, the pipes shall be supplied in single random lengths i.e. from5.00mt.to 6.00mt. or as required by SMSS However irrespective of the lengths, payment shall only be done on the single per Rmt. rate only.

3.3 Size :-
The term 1324mm. expresses the clear outisde (external) diameter of the pipes.

3.4 Wall Thickness :-
Wall thickness of the pipes shall be as per IS.
Tolerence in wall thickness shall be within + or - 5.0 % limit.

3.5 Finished pipes shall not deviate from straightness by more than 0.1% of the total length. Straightness shall be checked out by using a taut string or wire from end to end, along the side of the pipe to measure, the greatest deviation.

4.0 Hydraulic Pressure Test:-

4.1 Each and every pipe shall be hydraulically tested at the manufacturer's work at a test pressure of 1.7 MPa. Testing shall be carried out as specified in IS:3589:2001.

5.0 Mechanical Test:-

5.1 Tensile Test:-

5.1.1 Tensile test shall be carried out as mentioned in IS:1894:1972 or its latest version as well as IS:3589:2001.The tensile strength & percentage elogation of the pipes shall strictly conform to the provision of IS:3589: 2001. The manufacturer shall submit the required test certificates at free of cost, both for the pipes as well as steel strips also.

5.1.2 Guided Bend Test:-

5.1.3 Guided Bend test shall be carried out as per the provisions of IS:3589:2001 and necessary test certificate shall be submitted by the manufacturer at free of cost.

6.0 Chemical Composition :-

6.1 As mentioned earlier in 2.2, the steel used for manufacturing shall strictly conform to IS:2062:1992 having grade designation Fe 410W A. Chemical composition should be conforming to IS:2062: 1992. Laddle analysis shall be carried out as mentioned in IS:2062:1992 and various constituents viz. Carbon, Manganese, Sulphur, Phosphours, Silicon, copper etc. shall be within prescribed permissible limits. The manufacturer shall submit the required test certificates at free of cost, both for the pipes as well as steel strips/H.R.Coils also.

7.0 Pipe Ends :-

7.1 All the pipes shall have one end swelled/sewaged and other end plain suitable for field welding. The edge of each pipe must be truely vertical. The swelled/swaged end shall be formed, strictly as per the dimentions and process mentioned in IS:3589:2001. Normaly the dimension of the swelld/swaged end shall be such that the plain end can be inserted easily at the time of laying on site.

8.0 Mass :-

8.1 The mass of steel shall be 7.85 g/cm3.

9.0 Workmanship:-

9.1 All the pipes shall be clearly finished and when visually inspected, shall be free from defects such as cracks, surface flaws, laminations etc. The ends of the pipes shall be cleanly cut as mentioned in 7.0 and truely vertical with the axis of the pipe.

10.0 The copy of the ISI License for manufacture of pipes for the particular unit from where the pipes will be manufactured shall also be submitted.

11.0 Marking :-

Each pipe shall be legibly marked at free of cost with the following details.

(a) Manufacturer's name or trade-mark.
(b) Outside diameter in mm.
(c) Wall thickness in mm.
(d) ISI mark.
(e) Pruchaser's Name - SMSS.
(f) Last two digits of the year of Manufacture.
(g) Length of pipe in meter upto two digits (i.e.0.00)

(h) Heat number of the H.R. Coil used for manufacturing the particular pipe

40.0 CONVEYING & LAYING OF SPIRALLY WELDED M.S. PIPES:

Conveying, lowering and laying in position sleeve/sweaged ended inner & outercoated Spiral Welded pipes as of sizes mentioned below with specials in line, gradient and level by using sight rails, bonning rods etc. including marginal cutting of pipes and specials, accomodating specials, valves etc.in correct position as per specification and including dewatering the trench by means of pumping, making branch and end connection etc.complete as directed by the Engineer-in-charge.

40.1 CONVEYING OF OF PIPES, SPECIALS ETC :

The pipes and specials shall be transported and laid by using timber sticks. Peddy shall be provided by the laying contractor between coated pipes and timber sticks to avoid damage to the coating maintain the diameter..

If due to certain site conditions, it is not possible to use the standard specials as provided in the tender, and if the faces of the pipes or specials have to be suitably cut, the same shall be done with permission of the Engineer. Such cutting shall not be paid extra.

Loading, unloading, lowering and laying of pipes and specials shall be done by the crane only. Rubber packing,slink of canvas or non-abrassive material or any such protective material should invariably be used during the handling activity in order to protect the outer coating and edges of pipes and specials. Any damage or deformation or defect occurred during these activities shall be rectified and made good by the contractor at his own cost.

The pipes and specials shall be stacked with help of cranes and along the site in a manner as shall be directed by the Engineer from time to time. Pipes and Specials shall not be stacked under any circumstances in manner as would cause inconvenience or damage or injury to traffic or pedestrains. The pipes and specials before laying shall be brushed internally throughout the length to remove any rubbish, soil or stones that may have accumulated therein.

40.2 MAINTAINING ACCOUNT OF PIPES, SPECIALS ETC :

The pipe laying contractors shall maintain a register showing the receipts of pipes from day to day with details of the number etc. painted on pipes and specials the total receipts to date the total tocks on hand and such other information as may be required by the Engineer. The contractors shall furnish the Engineer the details of the receipts and challan numbers.

40.4 LOWERING PIPES IN TRENCHES & ASSEMBLING THEM :

After the end of approach bridge, the pipes shall be lowered into the trench gently by removing one or two struts at a time only. It shall be seen that no part of the shoring is distrubed or damaged during this operation. It will also be necessary to see that the outercoating if any is not damaged in any way. Care should also be taken to see that the shape of the pipe does not change even momentarily, and to maintain a rigid circular shape, spiders shall be provided at both faces if necessary. After the pipe is lowered in the trench, it shall be laid in correct line and level by the use of levelling instruments, sight rails, theodolites etc. In the case of steel pipes and specials, care shall be taken to

see that the longitudinal joints of two consecutive pipes at each joints shall be staggered by 90 degrees so that no two consecutive strakes have coincident longitudinal joints. No extra payment will be made for any difficulty encountered at particular points in the alignment.

While assembling the pipes, the ends shall have to be brought close enough so as to allow proper jointing either by welding for steel pipes, spun yarn and lead for C.I.pipes. There shall be lateral displacement between the pipe faces to be jointed. If necessary, spiders from inside and tightening rings from outside shall be used to bring the two pipe ends in perfect contact and alignment. Circumferential cutting of the face of the pipe without any extra cost to the Surat Smart City Development Limited may be permitted in special cases by the Engineer, provided that the work is executed by experienced cutters capable of taking straight and uniform cuts when the pipe is properly assembled and checked for correct line and level, it shall be supported on wooden wedges, firmly so as not to get disturbed subsequently. Some earth filling in the middle of the pipe may also be carried out at this site so as to avoid the pipe losing its alignment.

Reference bench mark at least two per kilometer shall be fixed before the work of laying the pipelines is started. These bench marks should be fixed a little away from the field works and should be securely fixed in cement concrete.

The pipes and specials shall be inspected before laying and defects noticed if any such as portrusions, grows, dents, notches etc. shall be rectified. Repairs by hammering with or without heating shall not be permitted. Any damage to the coating shall also be carefully examined and rectified. The pipes and specials shall be handled carefully to avoid damage at all stages and in such a manner as not to the distort their circularity or not to cuase any damage to the inner lining or outer coating. Pipes shall not be thrown down from the trucks nor shall they be drained or rolled along hard surface. Slinks of canvas or equally non abrasive material of suitable width or special attachment, shaped to fit the pipes ends shall be used to lift and lower the pipes and specials. Before alignment, assembling and welding, the pipe faces shall be cleaned by scraping, using wire brushes or any other method as directed by the Engineer.

40.5 STARAPS & DISTANT PIECES :

Where work is done from two faces and the connection has to be made, straps may have to be instroduced. Such straps shall be fabricated in the field by cutting pipes, slitting them longitudinally and slipping them over the ends to be connected in the form of a collar with make-up piece inserted to increase the circumfrence. Minimum lap of 3" on either end of the pipe shall be kept. Filter welds shall be run extrenally along the circumference of the strap and the joints of the make-up piece shall be of butt weld type.

Cutting of such straps shall not be paid for seprately but shall be treated as part of the pipeline, the two ends of which are to be connected.

If any distance pieces (i.e.pieces shorter than a full pipe length) are required to be used in conjuction with straps or elsewhere, they shall also be treated as part of the pipeline

40.6 SPECIALS :

Specials such as bends, single or composite, tappers shall be laid in the same way as the pipes and therates for the same shall be on the basis of running of the respective sizes.

41.0 FIELD WELDING OF M.S. PIPES:

Field welding of the joints of sleeve/sweaged ended spirally welded pipes and specials including, cutting the marginal space and shapping the ends if required including initial tacking and final sealing subsequent chipping using approved make of electrodes etc. comp.as directed. The item includes the required chipping,grinding work on the welded surface. Outer coating by themofusible material shall be completed, which also is included in this item.

The welding and joints of the pipes in the field shall comply with I.S.816-1965 or its latest amendments. The welding of joints shall be paid seperately per No. and the contractor shall quote for the same for various sizes of pipes as arranged for in the bill of quantities.

The welds shall be run in three runs of welding. Out of three weld two weld shall be run outside the pipe and one weld shall be run inside the pipe. The welding and testing of the weld shall also be done as per the procedure laid down in I.S.S. 823-1964 or its latest amendments. Experienced welders whose performance shall be tested from time to time, shall only be permitted to carry out the welding work. No apprentices or helpers shall be allowed to do any welding whatsoever. If any unauthorised person is found to do welding work, he shall be removed from the work and the work carried out by him will have to be redone after guaging out the same. The following points shall be borne in mind by the contractors.

ELECTRODES :

The contractors shall use standard electrodes its number (i.e.type) depending on the thickness of plate and the type of joint. They shall also use standard current and voltages required for the machine in use. Electrodes shall conform to I.S.814-1974,and I.S.815-1966. Electrodes used must be of ESAB-INDIA,ADVANI and D&H only.

41.1 TESTING OF WELDED JOINTS :

(i) GENERAL :

The welded joints shall be tested in accordance with Indian Standard Specifications I.S.823-1964 and I.S.3600-1973 or to its latest amendments.

The test pieces shall be taken out from the pipes pointed out by the Engineer without any delay. They shall be immediately delivered at the Engineer's Office for being numbered, machined and tested.

The shape of the test pieces removed from the pipes shall be such that it will give a specimen of the required dimension and at the same time leave a hole in the pipe with rounded corners. This hole shall be closed up by patch plating from the outside so as to have over lap of 3" on all sides of the opening Grant care shall be taken in preparing these plates so as to get a good lap weld. The cost of providing the required M.S. Plates for this, is included in the item. After the jointing is completed, all protruding portions shall be chipped off, and the portion of the pipeline near the field joint shall be thoroughly scrapped and cleaned to receive the guinite.

(ii) DETAILS OF TESTS

The following test shall be made.

TENSILE TEST :

The test specimen taken perpendicularly across the weld shall be shaped in accordance with the I.S.S.No.1663-1962.The specimen shall be taken from the end of the pipe or at any joint in the pipe as directed by the Engineer and shall be cut with the weld approximately in the middle of the specimen. The tension test specimen shall be machined. The protruding welding portions from both inside and outside shall be removed by machining or grinding before the specimen is tested.

At least one field joint out of every 100 shall be subjected to test by taking out a specimen. If a test specimen shows defective machining or develops flaws not associated with welding, it may be discarded and another specimen substituted.

The weld joint shall show a strength not less than the minimum tensile strength specified for the plate.

BEND TEST :

The bend test specimen shall be prepared in the same way as for tensile test and tested in the presence of the Engineer. The specimen shall be taken from the same pipe selected for tensile test. The specimen shall stand being bent cold through 180 degress around a pin, the diameter of which is equal 4 1/2 times the thickness of the plate without developing cracks. In making the bend test, the side of the specimen representing the inside of the pipe shall be placed next to the pin.

41.2 PROCEDURE IN CASE OF FAILURE OF THE TESTS :

A failure of the joint will indicate that the operator is not careful as other factors such as current, voltage, electrodes, etc. are already determined. For the first failure, the operator shall be warned and if a second failure takes place, he will be removed from the work and another suitable operator substituted. Joints or the portion thereof shall be gauged and repaired to the satisfaction of the Engineer. In order to maintain a good standard in welding welder shall be tested before they are entrusted with the job.

A record shall be maintained showing names of welders and operators who have worked on each individual joint. The work should preferably be carried out by a pair of welders so that, by observing proper sequence, distoration can be avoided. A joint entrusted to a particular individual or pair shall be as far as possible be completed by them in all respects, including, sealing run. No helper or other unauthorized welder

shall be permitted to carry out any welding work whatsoever. In case of infringement of above, the person concerned shall be removed as directed by the Engineer.

41.3 RE-TEST :

If the results of tensile or bend test or any test do not conform to the requirement specified, retest of two additional lengths from the same section shall be made, each of which shall conform to the required specification. In case of failure of one or both, extensive gauging and repairing shall be carried out as directed by the Engineer before the section can be accepted.

41.4 EXPENSES FOR TESTING :

All expenses in connection with taking out test samples machining and testing them in a laboratory, transporting etc. shall be borne by the contractor. The tensile and bend test shall be carried out in some Goverrntment or Semi-Government institute by paying the necessary fees. This will be arranged by the Municipality at the contractor's cost.

41.5 ARREARS OF WELDING WORK :

It is necessary for the contractor to see that the welding work is done systmatically leaving no arrears to be done subsequently. The contractors shall provide sufficient number of plants for this purpose including stand by and shall have enough personnel on the welding job, so as to maintain steady progress. A proper sequence of operation is very necessary in the pipe laying work and the contractor shall see that the work as per schedule is carried out from day to day. Unless this is done, the Engineer may suspend pipe laying operation until arrears have been tackled to his satisfaction. No compensation for extension of time shall be given for any stoppage of work owing to such causes.

Where the work is to be done in roads and thorough fare, long trenches should not be always left open number any circumstances. It is, therefore, incumbent upon the contractors to follow a planned procedure of work so as not to leave any arrears of work. The daily progress of excavation work for preparing trenches shall met with the refilling of the trenches in the completed portion.

41.6 Innner and Outer Lining on the Pipes

Inner lining:-

The inner exposed welded steel surface shall be covered by providing & applying cement mortar lining in 25 mm thickness, as per relevan IS. The inner lining shall be provided after testing the pipe at specified pressure.

Outer coating:-

The outside exposed welded steel surface shall be covered by providing & applying cement mortar guniting in 40 mm thickness, as per relevan IS. The outer coating shall be provided after testing the pipe at specified pressure.

41.7 M.S. PIPE SPECIALS

Providing, manufacturing and supplying at site the M.S. Specials in the following sizes with the ends bevelled (where not flanged) suitable for field welding at site, the size and dimensions shall be conforming to IS:7322, with outer coating anti corrosive non toxic epoxy paint of zinc rich primer of RDSO specification No. M&C/PCN/111/88 (Food grade) of Berger, Shalimar or Asian paints only with aggregate 325 to 300 microne

incl. sand blasting as directed by the Engineer-in-charge inclusive of the cost of the M.S. Plates, fabrication, outercoating. Conveyance etc. complete.

Note:-

(1) All the dimensions of the specials as well as flange shall be conforming to IS:7322.

(2) Quantities of the specials stated in Schedule-`B' of the tender are very approximate and orders will be placed as required according to exigency/requirement during progress of work. Thus, the quantity may vary as per the requirement and contractor shall have to carry out the work at the quoted rates only.

(3) Pipes having 8 to 14 mm wall thickness are of the 914 to 1626mm dia.outer diameter. Specials except the flanges shall be made of 8 to 14 mm thick M.S.Plate & M.S.Plate thickness of flanges shall be as specified in IS:7322. Required M.S. Plates shall be provided by the Contractor.

Unless otherwise specified elsewhere, all the M.S. specials shall be provided outercoating of Corrosion & Chloride resistent treatment of "EPOXY PAINT".

The M.S. Plate required for manufacturing of the specials shall be provided by the contractor. The M.S. Plates shall conform to IS:2062 with its latest amendments. The contractor shall provide all the required test certificate at free of cost for each and every lot of the plates. The thickness of M.S. Plates shall be within the permissible limits of IS:1852 with its latest amendments. Any kind of wastage of M.S. Plates shall be on account of the contractor only.

Pipes/specials not conforming to the specifications and not serviceable in the opinion of the Engineer-in-charge, shall have to be removed from the site by the Contractor at his own cost.

The welding shall be done by using the submerged Arc welding process using approved electrodes by the Engineer-in-charge.

Manufacturing of the specials shall be done at the own premises/factory of the Contractor at Surat only. Surat Municipal Corproation will not allot any space for the same. Alternatively, contractor may manufacture the specials at site in such a manner that it does not obstruct the vehicular traffic or pedestrains on road.

The steel core shall be formed by shaping and welding together steel plates of specified thickness.But welding shall be adopted for all longitudinal and circumferntial welds. All welds shall be made down hand by the automatic shielded submerged are welding process. Welding shall be done so that there shall be thorough fusion and complete penetration. Prior to welding the plates shall be fitted closely and during welding they shall be held firmly. The metal arc welding shall be done as per I.S.816/1969 code of practice for use of metal ARC welding for general construction in mild steel and I.S. 823-1964 code of procedure for manual metal are welding of mild steel.

FRP (FIBRE REINFORCED PLASTIC) ITEM

Fabrication, supplying and erection of FRP items confirming to IS 6746 – 1972 or latest relevant code and as per detailed specification and as directed by Engineer in charge.

1. Specification

1.1 Technical Details

Fibre Reinforced Plastic (FRP) products shall be used in the UASB reactor wherever the environment is highly corrosive, and where alternative materials like concrete, cast iron, etc. are not recommended. FRP will be used for the construction of feed inlet boxes, effluent gutters, baffle plates, gas hoods, gas pipes and special etc. At some places, pipes and flanges of FRP will also be used.

The FRP products shall be manufactured using contact moulding process being proposed for construction of the various components in the UASB reactor. The isophthalic acid resin shall be used along with the E-glass reinforcement as specified in the specifications. The compound structure is cured under heat and pressure to a solid material, which is lightweight, strong and shatter resistant. The resin rich surface texture gives the sheet weather resistance as well as resistance to corrosive substances. The moulding of FRP products shall be done using the contact moulding process.

The FRP products shall also be of thermal stability and low heat transmission. The uniform thickness of FRP products facilities even and uniform construction of gutters and boxes as well as the V-notches used for even distribution of flow. One piece moulding of each item shall be done at factory. The minimum thickness of sheet for all the FRP items shall be 8 mm and the pipes should be designed for minimum 6kg/cm^2. The curing shall be done by heat to obtain absolute polymerization of the resin and also a better composite laminate integrating the fiberglass in the resin. There shall be no patches, resin rich areas and other surface defects. Care shall be taken during fabrication that the whether is not very hot and the sunlight is not strong. In such a case the area will be properly covered during fabrication.

1.2 The Material Specifications

1. Resin system to be used throughout shall be Isophthalic grade resin
2. Top and bottom layers will be of surface tissue to provide resin rich surface for increased chemical resistance.
3. Intermediate layers will be a sequence of women roving and chopped strand mat fully impregnated with resin.

1.3 FRP fabricated items

The material for FRP fabricated items shall consist of FRP sheets having required thickness as mentioned on drawings.

The FRP with UV stabilizer to be used for fabrication shall essentially consist of following:

- Resin Unsaturated Polyester (UP) based on Isophthalic

- Glass Alkali free (Aluminium boro silicate) glass (E-glass) with a Reinforcement chromium bending agent. Alkali percentage to be less than 1%

- Filler Substances to improve viscosity of laminate. Resin is permitted to have maximum of 5% by weight of the Thixotropic agent. The substance must not have any harmful effects on other components

- Gel coat — Resin – rich layer at the mould side
  Resin must be unsaturated polyester based on Isophthalic
  Reinforcement : 2 layers of E-glass
  Type : fibre mat or roving
  Total Thickness : 0.6 mm

- Top coat — Same as gel-coat

- Filter of top Resins for top and gel coat have to be coated with substances which will improve the resistance against aggressive fluid, mechanical damages or aging by UV-radiation.

1.4 Guidelines for Fabrication of FRP items

1. Thickness shown on drawings are minimum values. The contractor may increase the same if required with the approval of Engineer-in-Charge considering the function of each item.

2. All items shall be finished smooth with glass like surfaces.

3. All fixtures, specials like sockets, feeds and nipples etc shall be moulded monolithic with the main unit.

4. Exact and uniform dimensioning is essential, in order to erect the FRP items in their places correctly.
IS codes for FRP specification are give in Table 1.4.1

Table 1.4.1 : IS codes for FRP specifications

IS : 6746-1972	Unsaturated polyester resin systems for low pressure fibre reinforced plastic
IS : 9845-1986	Method of analysis for the determination of specific and/or overall migration of constituents of plastic materials and articles intended to come into contact with foodstuffs
IS : 11273-1985	Woven roving fabrics of 'E' glass fibre
IS : 11320-1985	Glass fibre roving for reinforcement of polyester and of epoxide resin systems
IS : 11551-1986	Glass fibre chopped strand mat for the reinforcement of polyester resin systems
IS : 12709-1989	Specifications for glass fibre reinforced plastics (GRP) pipes for use for water supply and sewerage.

Approved Makes of Fibre Glass : **Owen Glass ecg ltd., Owen Corning jushi group, Goa glass**

Approved Makes of Resin : **Network Polymers, Viscous Oils, Critics Resin, GPK International Pvt. Ltd.,**

Approved Makes for Outside Epoxy Pigment for UV Stabilizer:
Colourtex Products, Kerox or equivalent

1.5 Fabrication & Erection

All items shall be finished with smooth like surface.

All the dimensions shall be exact and uniform in order to erect the FRP items in their places correctly with respect to location, verticality etc.

All FRP edges or cuts have to be covered immediately after cutting with Resin

In case this precaution is not taken the fabricated FRP item will start to disintegrate and loose strength.

A fabrication workshop may be set up for FRP items at site during erection and commissioning of the prefabricated FRP products. However the contractor shall have to make all arrangements including electricity, water etc., on his own. All testing facilities shall be properly laid out in the field workshop.

HDPE PIPES AND FITTINGS

Providing and laying HDPE pipes with necessary fittings, specials, tee, bends, gaskets, etc. as required and as per the direction of Engineer-in-charge.

1. Specification

These pipes have been used for carrying the effluent form distribution boxes to Feeding boxes of the Reactors. These pipes shall be confirming to IS:4984. GI fasteners shall be used for erection purpose whereas SS 304 fasteners shall be used for under water body and shall be paid separately.

1.1 Jointing

HDPE pipe shall be jointed properly with HDPE socketted specials to get smooth inner side surface without any extrusion to avoid any obstruction to the flow of wastewater. If in any particular case butt welding has to be done, smooth inner surface of pipe without intrusion inside shall be ensured.

SS FASTENERS

Supply and delivery of SS 304 fasteners confirming to relevant IS specifications including cost and conveyance of all materials such as SS bolts, SS nuts, washers etc. complete.

GI FASTENERS

Supply and delivery of GI fasteners confirming to relevant IS specifications including cost and conveyance of all materials such as GI bolts, GI nuts, washers etc. complete.

NYLON REINFORCED PLASTIC PIPES

Supply and fixing of nylon reinforced plastic pipe of size 50 mm OD confirming to relevant IS specification and fixing the same to FRP Gas Dome nipple on one side and FRP Gas pipe on other side including cost and conveyance of all materials to side such as pipe, SS clamps etc. complete.

PVC ITEMS

Supply and erection of PVC items as per following specification

A PVC Angle

1.1 Specification

PVC gas domes supported over an arrangement of PVC trusses and pipes shall be provided in the UASB reactor. The PVC gas domes are made up of 6 mm thick rigid PVC sheets produced by extrusion or calendaring. These sheets are supported at the ends and at the centre by 'A' shaped PVC frame which has extruded PVC angle braces in X and Y direction. These frames are further supported over the deflector beam through rigid PVC pipe. The angles of 6 mm thick, 60 mm x 40 mm shall be made of rigid PVC extruded angles. Care shall be taken during fabrication that the weather is not very hot and the sunlight is not strong. In such a case during summer a covered fabrication shall be carried out. The fabrication of these elements can be carried out at site in the contractor's workshop.

1.2 MODE OF MEASUREMENT AND PAYMENTS

1.2.1 The rate includes cost of material and labour required to complete the item.
1.2.2 The rate shall be for a unit of R. Mtr.

B. PVC Sheets

2.1 Specifications

2.1.1 General

These specifications cover the guideline for general-purpose rigid PVC sheets.

2.1.2 Material

Rigid PVC sheets confirming to IS: 6307 – 1985 shall be used.

It shall essentially consist of polyvinyl chloride and a copolymer of which major constituent in vinyl chloride compounded with other ingredients.

The PVC sheet may be transparent, opaque, colored or colorless as directed

The sheet shall be uniform in color (if coloured) and finished (transparent or opaque) and shall be free from scratches, creases, streaks, dents, holes etc.

The thickness of Sheet shall be as specified on the drawings. The thickness shall be measured with a micrometer. The tolerance in thickness of plate shall be nil for calendered sheet and plus or minus 10% of thickness for extruded sheet.

2.1.3 Stacking

The rigid PVC sheets shall be stacked horizontally on clean, firm and level ground and in accordance with the manufacturer's instructions. On uneven grounds timber sleeper shall be used. The sheets shall not be stacked above 15 cm in full height.

The sampling of sheets shall be done as per IS: 6307 – 1985.

2.1.4 Cutting and Fabrication

For the purpose of fabrication approved fixtures & fastening as specified on drawings shall be used.

The sheets shall be cut true to sizes as shown in drawings with a tolerance of +5 mm is length or width.

C. 75 OD mm PVC Pipes

3.1 Specifications

3.1.1 Material

The pipes shall be conforming to IS: 4985 – 1981 with a working pressure of 6 kg/cm^2.

Tolerance in dimensions shall be as specified in IS: 4985 – 1981. Physical and chemical characteristics and mechanical properties shall be as per IS: 4985 – 1981.

3.1.2 Testing

For testing of pipes for hydrostatic characteristics, Appendix 1 of IS: 4985 – 1981, shall be followed.

All the PVC items should be protected from the direct sun light exposure during storing & erection at site until the reactor is filled with water / sewage.

GLASS FIBER FEINFORCED PLASTICS (GRP) PIPES

Providing, Supplying, Lowering, Laying to Line, Level and Slope, GRP Pipes confirming to relevant IS and Jointing with specials such as Tees, Bends, Reducers, Valves including and other safety provision, cutting the pipes and making joints and hydraulic testing after laying etc. completed.

1.1 SPECIFICATIONS FOR GLASSFIBRE REINFORCED PLASTIC PIPES AND FITTINGS:

1.1.1 General:

The Glassfibre Reinforced Plastic (GRP) pipes, joints and fittings shall be suitable for conveying industrial effluent confirming to IS: 14402 (1996) / BS: 5480 / ASTM: D3754 / ASTM: D3262 standards with latest amendments. The pipes and fittings shall be of required pressure class and

stiffness class as specified elsewhere in the document. The manufacturing process adopted for GRP pipes can be either continuous filament winding method (continuous advancing mandrel method) or reciprocal method (dual helical winding method). The composite structure shall contain aggregates, fillers, thixotropic agents, pigments or dyes. Thermoplastic or thermosetting inside liner and outside surface layer shall be included.

The resin material for inner liner shall be vinyl ester resin suitable for application in highly acidic / alkaline environment and shall have resistance to chemical attacks. The minimum thickness of inner liner inside the pipe laminate shall be 1 mm.

The pipes shall be manufactured in accordance with good practice and shall be free from chip, crack, crazing, edge de-lamination, fracture, pit, resin rich edge, shrink, wrinkles, scratch etc. The workmanship shall be as specified in IS: 14402 and shall meet the acceptance criteria as specified in Table - 3 of above IS.

CODES AND STANDARDS

All pipes, joints and fittings supplied under this specification shall as a minimum meet the requirements of AWWA C950, other standards as applicable may be used.

IS 14402: 1996 IS standard for GRP pipes for applications other than portable water.
IS 13916 : 1994 IS standard for laying of GRP piping system.
ASTM D 3517 Standard specification for fibre glass (Glass Fiber Reinforced Thermosetting Resin) Pressure Pipe in the case of pressure pipe.
ASTM D 3262 Standard specification for fibre glass (Glass Fiber Reinforced Thermosetting Resin) Sewer pipe in the case of gravity sewer line
ASTM D 3754 Standard specification for fibre glass (Glass Fiber Reinforced Thermosetting Resin) Sewer and Industrial Pressure Pipe.
ASTM D 4161 Standard specification for fibre glass (Glass Fiber Reinforced Thermosetting Resin) Pipe joints using flexible elastomeric seals

1.1.2 Material:

The specifications for different materials used for pipe construction shall be as below;

- **Resins**

The resin used shall be unsaturated thermosetting polyester resin confirming to IS: 6746 - 1993 standards or equivalent BS / ASTM standards. The resin used shall be tested for relative density, viscosity, acid value, volatile content, gel time, other tests as per standards etc., and the test results shall confirm to prescribed limits as specified in relevant IS / BS / ASTM standards.

- **Glass Fibre Reinforcement**

Glass fibre reinforcement shall be of commercial grade “E” type and shall confirm to IS: 11273 (1992), IS: 11320 (1985) or IS: 11551 (1986) or equivalent BS / ASTM standards as appropriate. The glass fibre reinforcement used shall be tested for roving weight (TEX), moisture content, loss on ignition, conductivity, other tests as per standards etc., and the test results shall confirm to prescribed limits as specified in relevant IS / BS / ASTM standards.

- **Aggregates**

The aggregates used in composite structure shall be siliceous sand of size range between 0.05 mm and 0.80 mm and shall confirm to relevant standards. The sand used shall be tested for moisture content, loss on ignition, wettability, carbonate content, other tests as per standards etc., and shall be subjected to

sieve analysis and microscopic observation. The test results shall confirm to prescribed limits as specified in relevant standards.

- **Fillers**

Fillers used shall be of inert material with particle size below 0.05 mm and shall confirm to relevant standards. The filler used shall be tested for moisture content, loss on ignition, other tests as per standards etc., and shall be subjected to sieve analysis and microscopic observation. The test results shall confirm to prescribed limits as specified in relevant standards.

1.1.3 Dimensions:

The inside diameter of all pipes shall be as specified and variation in diameter shall be within the tolerance limits as given in IS: 14402. The measurement of inside diameter shall be done in accordance with Section A-1.1, Annexure "A" of above IS. Pipes shall be supplied in effective lengths of 6 m, 9 m or 12 m as per the requirement. A maximum of 10% of the pipe section may be supplied in random lengths. The measurement of length shall be done in accordance with Section A-2.1, Annexure "A" of above IS: 14402. The tolerance on effective lengths shall be within ± 15 mm.

The tolerance limits for out of squareness of pipe shall be as specified in IS: 14402 when measured in accordance with Section A-3.1 of above IS. The wall thickness of pipe shall be as per the design class of pipe and shall have zero negative tolerance. Wall thickness shall be measured to an accuracy of 0.10 mm in accordance with Section A-4.1 of IS.

1.1.4 Joints:

The pipe joints shall be either socket and spigot type or double socket (REKA) coupling type. The socket and spigot joints and double socket coupling joints shall be with double rubber gaskets as shown in detailed drawing. The elastomeric gaskets used for joints shall be of approved make and shall confirm to IS: 5382 (1985).

1.1.5 Fittings:

The GRP fittings such as bends, tees, junctions, reducers, tail pieces, etc, shall be equal or superior in performance to pipe of the same classification and shall be smoothly finished both internally and externally.

- **Fittings Made from Straight Pipes**

Fittings made from straight pipes shall be fabricated from complete pipes or portions of straight pipe complying with IS: 14402 as applicable for the pipe classification. The fittings shall comply with the declared design requirements and suitably mitred. The mitre shall be overwrapped externally and if practicable internally with woven roving and / or chopped strand mat to ensure the longitudinal and circumferential tensile strength is at least equal by design to that of the pipe with which the fitting is to be used.

- **Fittings Made by Moulding**

Moulded fittings shall be made by hand lay-up method by applying surface mat and alternate layers of chopped strand mat and saturated woven roving mat with resin on mould.

- **Tolerance for GRP Fittings**

Except for flanged pipe work, the permissible deviations from the stated value of the angle of change of direction of a fitting such as a bend, tee or junction shall not exceed ± 1° and the permissible deviations on the manufacturers declared length of a fitting, exclusive of the socket where applicable, shall be ± 25 mm taken from the point of intersection to the end of the fitting. The tolerance limits for flanged fittings shall be as per relevant standards.

1.1.6 Pipe Stiffness Test:

Each length of pipe shall have sufficient strength to exhibit the minimum pipe stiffness as specified in IS: 14402. The tests shall be carried out in accordance with Annexure "B" of above code. Pipes not passing the testing criteria as specified shall be rejected.

1.1.7 Hydraulic Test at Factory:

The pipes shall be tested for internal hydrostatic pressure for test pressures as specified in IS: 14402. The tests shall be carried out in accordance with Annexure "C" of above code. Pipes not meeting the testing criteria as specified shall be rejected.

1.1.8 Longitudinal Strength:

The pipes shall be subjected to longitudinal strength test as specified in IS: 14402. The tests shall be carried out in accordance with section D-1 and D-2 of above code as applicable. The minimum tensile strength shall be as specified in above code and pipes not meeting the criteria shall be rejected.

1.1.9 Hoop Tensile Strength:

The pipes shall meet or exceed the hoop tensile strength shown for each size and class as specified in IS: 14402. The tests shall be carried out in accordance with Annexure "E" of above code. The pipes not meeting the minimum hoop tensile strength criteria shall be rejected.

1.1.10 Chemical Requirements / Tests:

The pipes shall be subjected to chemical requirements and tests as specified in Annexure "F" of IS: 14402.

1.1.11 Delivery Schedule :

The delivery schedule shall be governed by the SMC and shall be specified in individuals supply orders.

1.1.12 Test Certificate:

1. The supplier (manufacturer) shall always provide manufacturer's test certificate in accordance with every batch/lot of goods so manufactured and supplied.
2. The supplier (manufacturer) shall also produce in addition to manufacturer's test certificate as per tender specification and classification, the inspection certificate issued by the authorized third party inspection agency / person appointed by SMC for the same purpose.

1.2 SPECIFICATIONS FOR LAYING AND JOINTING OF GRP PIPES AND FITTINGS:

1.2.1 General:

The laying, lowering and jointing of GRP pipes and fittings shall be carried out as per IS: 13916 (1994). The work shall be carried out using sound engineering practice and good workmanship. Pipe laying should take place only after the trench and the surface supporting the pipes have been prepared according to specifications as specified in above code.

1.2.2 Handling of Pipes:

- **Transportation**

All pipe sections and fittings shall be supported on timber saddles spaced at 4 m centers with a maximum overhang of 2 m. Stock height should not generally exceed 2 m. Pipes shall be strapped to the vehicle over the support points using non metallic pliable straps or ropes only.

- **Storing**

Pipes and fittings with diameters of less than 1.0 m may be stored directly on sandy soil, the ground should be flat and free from sharp projection and stones / rocks bigger than 40 mm in diameter or of other potentially damaging debris. Pipes with diameters greater than 1.0 m may be stored on their delivery cradles at a maximum distance of 6 m c/c.

If the surface is not flat or is sloping, then all the pipes shall be checked to prevent rolling. All rubber rings, gaskets and other items shall be stored in a cool, dry and dark place to avoid damage of any kind. The containers of lubricants should be kept tightly closed to avoid entry of dirt. Stacking of different diameter pipes by nesting smaller diameter pipes in bigger diameter pipes is not permitted.

Contractor shall identify suitable place near the project site for stacking the pipes and housing the labour camp. Pipes shall be stacked in open yards away from work site and adequate security arrangements shall be made for the yard. Pipes shall be stacked as per manufacturers recommendations / guidelines. Stacking of pipes along the work site / pipeline alignment will not be permitted.

- **Unloading, Lifting and Lowering**

All the pipes and fittings shall be lifted with pliable straps, slings or ropes. These may be canvas or polyester belts with a minimum width of 10 cms. or nylon ropes with a minimum diameter of 30 mm. Steel cables or ropes shall not be used for lifting and transportation of pipes and fittings. Ropes shall not pass through the section of the pipe end to end.

Straight continuous lengths of pipe may be lifted at one point. However owing to its smooth surface, it is safer for the pipe to be lifted at two points. Pipe assemblies fabricated in multiple sections or special places shall be lifted with two or more lifting points.

Pipes shall not be dropped to avoid impact or bump. If any time during handling or during installation, any damage, such as gouge, crack or fracture occurs, the pipe shall be rejected.

1.2.3 Pipe Jointing:

The pipe joints shall be either socket and spigot type or double socket (REKA) coupling type. The socket and spigot joints and double socket coupling joints shall be with double rubber gaskets.

Cleaning, lubrication and installation of rubber ring gasket shall be as specified in IS. The pipe to be connected shall be placed on the bed with sufficient distance from previously joined pipe to allow lowering of pipe with the coupling into position. The pipe to be joined shall be pulled with coupling onto the previously laid pipe by means of jack after clamping the same. The coupling shall be aligned inline with pipes being joined.

1.2.4 Excavation and Preparation of Trench:

The surface at the trench grade should be continuous, smooth and free of big rocks more than 1.5 times the thickness of the pipe if rounded, or more than 1.0 times the thickness of the pipe if they have sharp edges. The minimum trench width at bottom for different diameter pipes and depth of laying shall be as specified in drawing.

Earthwork excavation quantity for pipeline trenches will be measured only for a minimum width of trench horizontally and upto required depth vertically as shown in the detailed drawing. Any excavations carried out in excess of this width or more than the required depth will not be paid for. Also the depth will be measured vertically for all the depths.

1.2.5 Bedding, Backfilling and Compaction:

The pipe shall be uniformly and continuously supported through its whole length with firm stable bedding material as specified. The bedding should be placed so as to give complete contact between the bottom of the trench and the pipe and should be compacted to provide a minimum compaction corresponding to 90% maximum dry density.

The pipe zone area shall be backfilled with pipe zone fill material as specified and remaining portion shall be backfilled with selected excavated earth. Backfilling should be placed in layers not exceeding a depth per layer which can be compacted to a minimum of 85% maximum dry density. Lift should normally not be greater than 30 cms. in height and the height differential on each side of the pipe should be limited to 30 cms. to prevent lateral movement of the pipe. Heavy earth moving equipment for backfilling should not be brought until the minimum cover over the pipe is 90 cms. in case of wide tracked bulldozers or 120 cms. in case of wheeled roaders or roller compactors.

Compaction shall be done preferably using vibratory methods. Compaction within distances of 15 cms. to 45 cms. from the pipe shall be done with hand tempers.

1.2.6 Laying of Pipes:

Lowering, laying and jointing of pipes shall be carried out as per the guidelines specified in Section - 8.0 of IS: 13916 (1994). Before placing a pipe in the trench, the pipe shall be cleaned to remove any remains of earth, sand or mud from the inside of the socket and from the opposite end bearing the rubber ring gasket / packing. Any residues of hardened resin if found inside the socket, the same shall be removed with a chisel. Also it shall be ensured that the groove where rubber gasket sits is having uniform depth for placing the gasket.

Before fixing the gaskets, lubricant shall be applied over the entire gasket surface to ensure good insertion of pipe inside the socket or coupling. After insertion of the lubricated gaskets, it shall be checked that the gasket is fixed properly covering the entire seating area by running the hands around the pipe. After the joint has been coupled, the rubber ring gasket / packing shall be checked thoroughly for its correctness. This shall be performed by inserting a blade of steel or of any other material into the angular space between the socket and the spigot. The blade shall have a thickness of 0.40 / 0.50 mm, width of 15 mm and length shall be greater than 200 mm. The laid joint shall be checked for any miss alignment and the same shall be rectified.

1.2.7 Hydrostatic Testing:

The entire stretch of completed pipeline shall be hydrostatically tested for leakage prior to acceptance and service. This shall be carries out regularly stretch wise as the installation proceeds. Installation should never exceed testing by more than 1.0 Kms. The field hydrostatic test pressures and procedure to be adopted for gravity sewers and pumping main shall be as specified below.

- **Hydro Testing of Gravity Sewers**

After the jointing process is complete and before backfilling the trenches, the entire section of the gravity sewers shall be proved by the Contractor to be water tight. Before commencing the hydraulic test, the pipelines shall be filled with water and maintained full for 24 hours by adding water, if necessary, under a head of 6.00 m of water. The test shall be carried out by suitably plugging the low end of the sewer and the ends of connections, if any, and filling the system with water. A knuckle bend shall be temporarily jointed at the top end and a sufficient length of vertical pipe jointed to it so as to provide the required test head or the top end may be plugged with a connection to a hose ending in a funnel, which could be raised or lowered till the required head is obtained and fixed suitably for observation. The pipeline shall be subjected to a test pressure of at least 3.0 m head of water at the highest point of the section under test.

During testing period, any leakage including excessive sweating, which causes a drop in the test water level will be visible and the defective part of the work should be removed and made good. If any damage is caused to the pipeline during the execution of work or while cleaning / testing the pipeline as specified, the Contractor shall be held responsible for the same and shall replace the damaged pipeline and re-test the same to the full satisfaction of the Engineer-in-Charge.

- **Hydro Testing of Pressure Main**

After laying and jointing process is complete, the entire section of the pumping main shall be proved by the Contractor to be water tight for the specified test pressure. Leak detection testing shall be carried out at a test pressure corresponding to 1.5 times the pressure class of the pipe / fittings. The test pressure shall be maintained for a period of 24 hours. Each full length pipe section, fittings and joint shall be leak tight.

GRP FITTINGS AND SPECIALS

Specifications.

Providing and fixing GRP fittings / specials confirming to relevant IS with latest amendments including freight, loading, Unloading with all tax, insurance etc. complete as specified in the pipe specifications above.

D.I. PIPES

1.0 Material:

1.1 The material in general shall be conforming to IS:1387:1993.

1.2 Method for Brinell Hardness test of material shall conform to IS:1500:1983.

1.3 Sampling criteria for the various tests, unless specified in this specification shall be as laid down in IS 11606:1986.

1.4 Pipe shall be suitable for push on joint rings conforming to IS:5382:1985 and IS:12820:1989.

2.0 Manufacture :

2.1 The metal used for the manufacture of pipe shall conform to the appropriate as grade specified in IS 8329:2000. It shall be prepared at the discretion of the manufacture in a cupola, an active mixer of other suitable furnace or any other suitable standard method.

2.2 The pipes shall be stripped with all precautions to avoid warping shrinkage defects, detrimental to their good quality. The pipes showing shall be sound and free from surface or the defects. Pipes showing shall imperfections which result from the method of manufacture and which do not affect their serviceability shall not be rejected on that account alone. Minor defects arising out of manufacturing process may be rectified with the consent of the purchaser.

2.3 The pipes shall be such that they could be cut, drilled or machined. In case of dispute the pipes may be accepted provided hardness measured on the external unmachined surface does not exceed 230 HBS.

2.4 Pipes centrifugally cast shall be heat treated in order to achieve the necessary mechanical properties and to relieve casting stresses; accordance with IS:13655:1993.

2.4.1 If necessary, the pipes may be subjected to reheat treatment to ensure that Brinell hardness does not exceed the specified value.

2.5 In case of push-on joint, the spigot ends shall be suitably chamfered for smooth entry of pipes in the socket fitted with the rubber gasket. Socket and Spigot dimensions including chamfer must be checked and a test certificate to the effect shall be submitted for each and every pipe without which payment will be released for the same.

3.0 The socket dimensions shall be perfectly suitable for Rubber Gaskets conforming to IS 12820:1989.

3.0.1 The socket and spigot dimensions including chamfer shall be strictly as per Table-2 of IS:8329:1994.

4.0 Sampling:

4.1 Sampling criteria for the various tests, unless specified shall be as laid down in IS 11606:1986.

5.0 Mechanical Test:

5.1 Mechanical tests shall be carried out during manufacture. Two tests shall be conducted for every batch of production. Total no. of pipes for each batch would be as per Clause 9.2 of IS 8329:2000.

5.2 Ring Test and Tensile Test :

Two test pieces obtained by cutting rings or bars from the spigot end of two pipes selected for testing except for pipes manufactured under controlled cooled process described in 10.1.1 when tested in accordance with the methods specified in IS: 8329 shall satisfy the requirements mentioned in it.

5.3 Brinell Hardness Test :

When tested in accordance with IS:1500:1993, the Brinell Hardness shall not exceed 230 HB on the external unmachined surface.

5.4 Retest :

If any piece representating 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 results satisfy the specified requirement, the lot shall be accepted. Should either of these additional test pieces fail, the lot shall be deemed as not complying with IS: 1536:1989 and shall be liable for rejection.

5.4.1 In the event of lot not found conforming to this standard, the same may be reoffered for inspection after reheat treatment.

6.0 Hydrostatic Test :

6.1 All Pipes shall be tested hydrostatically at the pressure specified in Table 1 of IS 8329:2000 as appropriate. To perform the test, the pressure shall be applied internally and shall be steadily maintained for a period of minimum 15 seconds during which pipes may be struck moderately with a 700 g hammer. The pipes shall withstand the pressure test and shall not show any sign of leakage, sweating or other defects. As far as possible the hydrostatic test shall be conducted before coating the lining of pipes.

6.2 Works Test Requirements :

Socket and spigot pipes shall withstand hydrostatic test pressure as specified in relevant IS codes.

7.0 Sizes and mass :

7.1 The range of nominal diameter, DN, of pipes and flanges is as follows:

100, 150, 200, 250, 300, 400, 450, 500, 600,700, 750 and 800 mm or as specified in Schedule-`B'

NOTE :

Nominal diameter is a number used to classify pipes and corresponds approximately to their clear internal diameter.

7.2 Working lengths `L' of socket and spigot pipes.

(a) Socket and Spigot Pipes: 4.00, 5.00, 5.5 and 6.0 m.

NOTE:

Approximately 90% of the ordered quantity of pipes ranging from 100 mm dia and above shall be of 5.5 mts.

7.3 Dimensions and mass of uncoated socket and barrel of the pipes shall conform to IS:8329.

7.4 Mass for sockets and pipes barrels as specified in IS 8329 shall have density of Cast as 7050 Kg/Mt3.

8.0 Tolerance :

8.1 Tolerance in Diameter :

8.1.1 The tolerance of external diameter of Barrel for all type of pipes unless specified shall be as per Table-7 of Clause 15.1.1 of IS:8329:2000.

8.1.2 For requirement of interchangeability all pipes should be within the tolerance specified. Push-On flexible joints may need closer tolerance for its effective performance.

8.2 Tolerance on Ovality:

8.2.1 Pipes shall be as far as possible circular internally and externally. The tolerance for out of roundness of the socket and spigot ends in the jointing zone for Push-on joint are given in Table below:

8.2.2 In case of oval spigot ends for push-on joints (DE), the minor axis is permitted to be less than the minimum allowable diameter by the value given below provided the mean diameter DE measured by circumferential tape, comes within the minimum allowable dimensions of DE (Table-2) after applying the tolerance:

Table Allowable Ovality for Push-on Joint Pipes

Nominal Diameter DN mm	Allowable Difference Between Minor Axis and DE min mm
1	2
80 to 300	1.0
350 to 600	1.75
700	2.0
750 to 800	2.4

8.3 Tolerance on Thickness

The tolerance on the wall thickness `e' and of pipes shall be as follows :

Dimensions	Tolerance in mm
Wall thickness	- (1.3 + 0.001 DN)
*.No limit for the plus tolerance is specified.	

8.5 Tolerance on length

The tolerance on length of pipes shall be as follows :

Type of Casting	Tolerance in mm
Socket and spigot end	+ 100

8.6 Permissible Deviation from a Straight Line :

The pipes shall be straight. When rolled along two gentries separated by approximately two-thirds the length of the pipe to be checked, the maximum deviation from a straight line in mm shall not be greater than 1.25 times the length `L, in metres of the pipe, thus:

$fm \leq 1.25\ L$

Where

fm = maximum deviation from straight line, and

L = length of the pipe.

8.7 Tolerance on Mass

8.8 The permissible tolerance on standard mass of pipe shall be +8 percent for sizes up to and including 200 DN and + 5 percent for sizes above 200 DN

8.9 The pipes of heavier mass than the maximum shall be accepted provided they comply in every other respect with the requirements of the specifications.

9.0 Coating : Pipe shall be supplied with internal and external coating.

9.1 External protection:-

Each pipe shall be coated externally with metallic zinc coating with finishing layer as mentioned in Annexure-A of IS:8329-2000.

9.1.1 Coating shall not be applied to any pipe unless their surface is clean, dry and free from rust.

9.1.2 The pipes shall be coated by spraying process in which metallic zinc material is heated to a molten state and projected in small droplets.

9.1.3 The coating material shall set rapidly with good adherence and shall not scale off.

9.1.4 The metallic zinc coating shall cover the outside diameter of the pipe end and shall be free from such defects as bare patches or lack of adhesion.

9.1.5 Damaged area of zinc coating caused by handling are acceptable provided that the damaged is less than 5 cm2/m2 of coated surface and provided that the minor dimensions of the damaged area do not exceed 5 mm.

9.1.6 The average mass of zinc coating shall be not less than 130 g/m2 with a local minimum of 110 g/m2.

10.0 Internal Coating:

When the pipes are to be used for conveying sewage water the inside coating shall not contain any constituent soluble in such water or any ingredients which could impart any taste or whatsoever to the sewage water and suitable washing of the mains.

10.1 All the pipes must be supplied with internal cement mortar of Ordinary Portland Cement / Pozzalona Portland Cement lining strictly conforming to provision of IS:8329:2000.

10.1.1 Cement used for centrifugal lining must be of the best brand available conforming to relevant Indian Standard.

10.1.2 The sand used for preparation of mortar shall have controlled granulameric distribution from fine to coarser elements, it shall be clean and free from dust, clay or any kind of impurities.

10.1.3 The water used for preparation of the mortar shall not contain substances deterious to the mortar nor to the water as it is eventually intended to transport in the pipe.

10.1.4 The mortar of the lining shall be composed of cement, sand and water.

10.1.5 The mortar shall be thoroughly mixed and shall have a consistency which results in dense and homogeneous lining.

10.1.6 Condition of the interior surface of the pipe before application of the lining.

All foreign bodies, loose scale of any other material which could be detrimental to good contract between the metal and the lining shall be removed from the surface which the lining is to be applied.

The inner surface of the pipe shall also be free of any metal projections likely to project beyond 50% the thickness of the lining.

10.1.7 Application of the lining.

The mortar of the lining is cast centrifugally inside the pipes.

Apart from the inner surface of the joint, the parts of the pipe coming into contact with transported water shall be entirely covered with mortar.

The mortar shall be free of any cavities or visible air bubbles, and care shall be taken to ensure maximum density at all points. The centrifuging the pipe shall be controlled so that segregation of the sand in the lining is reduced to a minimum.

Once centrifuging is finished, the lining shall be cured at temperatures greater than O degree C. Any loss of water from the mortar by evaporation shall be sufficiently slow that hardening is not impeded.

Repairs to damaged or defective areas are allowable. The damaged mortar shall first be removed from these areas. The the defective part shall be repaired by using, for example, a trowel within fresh mortar so that a continuous lining having a constant thickness is again obtained.

For the repair operation, the mortar shall have a suitable consistence. If necessary, additives may be included to obtain good adhesion against the side of the existing under-aged mortar.

10.1.8 Thickness of the lining.

The normal thickness of the lining and the minimum permissible mean and local values are given in the table.

At the pipe ends, the lining may be reduced to values below the minimum thickness. The length of the chamfer shall be as small as possible but. In any case, shall be less than 50 mm.

10.1.9 Determination of lining thickness

The thickness of the lining will be checked on the frestily centrifuged mortar by the insertion of a steel pin, or on the hardened mortar by means of a non-destructive method of measurement.

The thickness of the lining shall be measured at both ends of the pipe in at least one section perpendicular to the pipe axis.

In each, section, which shall be at least 200 mm from the pipe 0 end measurements shall be taken at four points spaced at 90

The values for the thickness of the lining shall be reported to the nearer 0.1 mm.

The lining thickness measured at any one point in the pipe shall not be smaller than the minimum value given in the table.

The arithmetic means of the four measurements in each section shall not be less than the minimum mean value specified in the IS:8329:2000.

10.1.10 Surface condition of the hardened lining

The surface of the cement mortar lining shall be uniformly smooth. Only isolated grains of sand are allowed to appear on the surface of the lining.

The lining shall not be friable and shall be free from corrugations or ridges that could reduce the thickness of the lining to less than the minimum value at one point, as specified in the table.

On contraction of the lining, the formation of cracks cannot be avoided. These cracks, together with other isolated crack which may result from manufacture or any develop during transportation, are acceptance up to a width of 0.8 mm.

The structure of the lining is related to the centrifuging process.

On the inner surface of the lining, a thin layer of fine sand and cement is formed which may extend up to approximately one quarter of the total thickness of the mortar.

10.1.11 Thickness of the lining

The thickness of the lining shall be inspected on at least one pipe per section and per centrifuging installation, for each diameter manufactured, which is as per Table-15, Clause B-5 of IS 8329:2000.

10.1.12 Appearance of the lining

Each pipe shall be inspected for the appearance of the lining with special reference to the surface condition and the finish of the ends.

Any repairs considered to necessary after this examination shall be carried out in accordance with the method described in Clause B-4 of IS:8329:2000

Table-Thickness of the cement mortar lining

All dimensions are in millimeters

DN	Thickness		Maximum Crack Width/Radial Displacement
	Nominal Value	Tolerance	
1.	2.	3.	4.
80 to 300	3.0	-1.5	0/8
350 to 600	5.0	-2.0	1/0
700 to 1200	6.0	-2.5	1/2
1400 to 200	9.0	-3.0	1/5

NOTE:- Fittings ends may have a chamfer of maximum length 50 mm.

11.0 Marking:

11.1 Each pipe shall have cast, stamped or indelibly painted on it the following appropriate marks:

(a) Manufacturer's name, initials or identification mark;

(b) The nominal diameter;

(c) Class reference;

(d) Mass of pipe;

(e) The last two digits of the year of manufacture.

(f) Name of the purchaser: SMC.

(g) ISI Certification Mark.

11.2 Marking may be done On the socket faces of pipe centrifugally cast in metal mould.

D.I. FITTINGS

Manufecture,Supply & delivery of Ductile iron flange socket spigot bends, tees, reducer or any other specials as per BS-EN 545/1995 class-A series K12 suitable for use with D.I. Pipes manufectured as per IS: 8329/1994 delivery of specials is to be made to SMC store or site of works including, all taxes. loading, unloading, carting, stacking, insurance, inspection charges, octroi etc. complete with external bitumen coating and internal cement coating.IS 9523/2000.

1.1 The contractor shall have to procure required ductile iron specials such as Tees, Bends of required degrees, reducers, collars, caps, plugs, tail pieces, etc. necessary for completion of this item as per site conditions.

1.2 The D.I. fittings and specials shall conform to BS-EN 545/1995 class-A series K12 suitable for IS: 8329/1994 with latest amendments.

1.3 The fitting shall be stripped with all the precautions necessary to avoid warping or shrinking defects. The fitting shall be free from defects other than any unavoidable surface imperfection which results from the method of manufacture and which do not affect the use of the fittings.

1.4 The fittings shall be such that they could be cut, drilled or machined.

1.5 The mass of D. I .Fittings / Specials shall be strictly confirm to IS: 8329/1994 with latest amendments shall have density of Cast as 7050 Kg/mt^3.

1.6 The rates shall be inclusive of all the taxes, duties, loading, unloading, inspection and testing charges, octroi etc. comp. The rates shall be for free delivery at site.

1.7 The contractor shall have to procure the required D.I. fittings or specials as per the site conditions and as per direction of Engineer-in-Charge. Excess or Damaged or Broken D.I. fittings/specials shall be removed by the contractor at his own cost and such D.I. fittings/specials will not at all be admitted for its payments.

MOVING BED BIOFILM CARRIER / BIO MEDIA

In MBBR the plastic carries shall build a floating bed inside the reactor volume. The floating bed shall be stirred by MBBR bottom aeration system. In traditional fixed-film systems, clogging caused by excess sludge growth has been a risk. In MBBR this risk shall be mitigated by optimized design of a carrier size and shape and by having efficiency mixed reactor conditions. Sufficient turbulence i.e. mixing shall be ensured by the properly designed and

implemented aeration system. The reactor volume shall be totally mixed and consequently there shall not be any "dead " or "unused" space in the reactor. In addition, there shall not be any need for backwashing.

The MBBR tank shall be of concrete and shall operate at minimum ____ m liquid level. it shall be filled with PE based plastic carriers of conical shape and of back, UV resistant color. The carrier height and diameter shall be between 9 mm and 15 mm. The filling ratio for carriers in the MBBR tanks shall be minimum of 30% in the first stage and 30% in the second stage.

There shall be dissolved oxygen measurement inside MBBR, which shall continuously adjusts the aeration capacity and optimize the energy consumption. The bottom diffuser system shall be designed to provide even and proper mixing of carrier elements under every operational condition. pH measurement shall also be provided and used to make sure that pH stays at the optimum level for nitrification (7.0 – 8.0).

MOVING BED BIOREACTOR SPECIFICATION			
Sr. No.	**Description**	**Unit**	**Particulars**
I	**MBBR MEDIA**		
1	Media material		PE
2	Color		Black-UV resistant
3	Total surface area	m2 / m3	600
4	Shape of diffuser		Conical type (Non similar upper and lower end)
5	Density	g/cm3	0.94-0.97
6	Media retention in the tank		Media retention screen to be provided

VITRIFIED TILES :

1 The tiles shall be of best quality as approved by the Engineer-in-charge. They shall be flat and true to shape. They shall be free from cracks, crazing, spots, chipped edges and corners. The glazing shall be of uniform shade.

2 The tiles shall be of nominal size of 24" X 24" unless otherwise specified. The maximum variation from the stated sizes, other than the thickness of tile, shall be plus or minus 1.5 mm. The thickness of the tile shall be 8 to 10 mm. the tiles shall conform to I.S. 777-1988.

Details Specifications:

Providing & laying Vitrified tiles of 8mm to 10 mm th. of orient, somani or jhonson, kajaria, Bell, Asin or Euro make at all floor levels in flooring, treads of steps and landings laid on a bed of 20mm. average Base of cement mortar 1:8 (1 cement : 8 coarse sand) or lime mortar 1:1½ laid and finished with flush pointing in white or colour cement etc. comp. (size : 24" X 24")

1.1.0 MATERIALS

Water shall conform to M-1. Cement mortar shall conform to M-8. Tiles shall conform to M-54.

1.2.0 WORKMANSHIP

1.2.1 Bedding - The sub-grade shall be cleaned, wetted and mopped. The bedding shall then be laid evenly over the surface tamped and corrected to desired levels and allowed to harden enough to offer a rigid cushion to tiles and to enable the mason to place wooden planks across and squat on it. The tiles shall be laid on cement mortar bedding of 12mm. thick in C.M. 1:3. The mortar shall have sufficient plasticity for laying and there shall be no hard lumps that would interfere with the evenness of bedding. The base shall be cleared and well wetted. The mortar

shall then be spread in thickness not less than 10mm. at any place and on an average 12mm. thickness. The proportion of the cement mortar shall be as specified in the item.

Fixing Tiles - Neat grey cement grout at 3.3 Kgs./Cement/Sq.Mts. of honey like consistency shall be spread over the mortar bedding as directed. The edges of the tiles shall be well pressed and gently tapped with a wooden mallet till they are properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints between the tiles shall be as thin as possible in straight line or as per pattern.

The tiles shall not have staggered joints. The joints shall be thereto centre line both ways. The nahni trap coming in the flooring shall be so positioned that its grating shall replace only one tile as far as possible. Where full size tiles cannot be fixed, they shall be cut (swan) to the required size and the edge rubbed smooth to ensure straight and true joints. The joints shall be filled with grey cement grout with wire, brush or trowel to a depth of 5mm. and loose material removed. White cement shall be used for pointing the joints. After fixing the tiles finally in an even plane the flooring shall be kept wet and allowed to stay undisturbed for 7 days.

Cleaning - The surplus cement grout that may have come out of the joints shall be cleared off before it sets. Once the floor has set, it shall be carefully washed, cleared by dilute acid and dried. Proper precautions and measures shall be taken to ensure that the tiles are not damaged in any way till the completion of the construction.

Providing and fixing hot dip concertina coil of 610mm dia made out of 2.59mm (12SWG) hot dip galvanised (G.I coating not less than 200 grams per sqm) thick wire having 80 nos of spikes and 200 nos of clips made out of stainless steel (AISI 304) 1.5mm thick dia, G.I. strips 0.5mm thickness (G.I. coating not less than 120 gms per sqm) weight of one coil should not be less than 15kg. etc complete at the top of the compound wall fixed with S.S. clips and binding wires wherever necessary etc complete. (NOTE : streching length of one coil should not be more than 9 meter).

Fixing of hot dip concertina coil of 610mm dia. on 1.05 meter long M.S. angles of 50mm x 50mm x 6mm thick, bent at 45 degree. The angles shall be anchored in the RCC column and spaced at minimum distance of 3.0 metres at the top of the compound wall. concertina coil shall be fixed with S.S. clips and binding wires whenever necessary etc. complete. At every 6th post shall be strutted on both sides and end post with one side only. Also providng barbed wire 14x14 gauge with three horizontal lines both sides. The exposed steelwork shall be painted with 1 coat of red oxide and 2 coats of approved oil paint. The concertina coil and barbed wire fencing shall be fixed as per the drawing and in good workmanship as directed by Engineer in charge.

Providing and fixing and fitting TATA or equivalent make GI barbed wire fencing with necessary barbed wire 12x14 guage , weight not less than 0.14 kg/mt, pins, hooks, excluding MS angles etc. complete as per relevant IS specification & directed by engineer In charge.

Barbed wire fencing of required height shall be constructed of 12x14 gauge galvanised barbed wire on M.S. angles of 50mm x 50mm x 6mm thick. The angles shall be anchored in the RCC column and shall be spaced at minimum distance of 3.0 metres. The galvanised barbed wires shall be fixed at vertical spacing as mentioned in the details and with necessary cross wires and circular periphary etc. as directed by engineer In charge. The exposed steelwork shall be painted with 1 coat of red oxide and 2 coats of approved oil paint.

Providing & applying white washing with lime (two coats) at all floor levels to give an even shade incl. thoroughly booming the surface to remove all dirt, dust mortar droppings & other foreign matter etc. complete including Prov. & mixing in required proportion, binding agent like '' Fevicol dh'' or equivalent approved brand etc. For all Floor.

1. MATERIALS

1.1 The clear colour shall be made from glue and boiling water. The mixture shall be suitably tinted where required for use under coloured distemper if directed. Glue shall conform to I.S. 852 - 1969 (Specifications of animal glue).

1.2 Lime used shall be freshly brunt class 'c' lime 9 fat lime) and white in colour conforming to I.S. 712-1973. Water shall conform to M-1. Best quality of gum shall be used in the preparation of white wash. Ultramarine blue or indigo shall conform to I.S. 55-1970 for points, and shall be used for preparation of white wash. Pigments, mineral colours, not affected by lime shall be used in preparing colour wash.

2. WORKMANSHIP

2.1 Preparation of white wash solution :
The fat lime shall be slaked at site and shall be mixed and stirred with about five liters of water for 1 Kg. of unslaked lime to make a thin cream. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth. 4 Kg. of gum dissolved in hot water shall be added to each cubic meter of lime cream. Small quantity of ultramarine blue (upto 3 gms. per Kg. of lime) shall also be used, the solution shall be stirred thoroughly before use.

2.2 Preparation of Surface :
The surface shall be thoroughly cleaned of all dust, dirt, mortar droppings and other foreign matter before white wash is to be applied. The surface spoiled by smoke soot shall be scrapes with steel wire brushes or steel scrapers or shall be rubbed with over burnt surkhi or brickbats. The surface shall be then boomed to removed all dust and shall be washed with clean water.
Oil or grease spots shall be removed suitable chemical and smooth surface shall be rubbed with wire brushes.
All unsound portion of the surface plaster shall be removed to full depth of plaster in rectangular patches and plastered again after raking the masonary joints properly. Such given one coat of white wash.
All unnecessary nails shall be removed the holes, cracks, patches etc. shall be made good with materials similar in composition to the surface to be prepared.

2.3 Scaffolding :
Where scaffolding is necessary it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be white or colour washed. A properly secured strong and well tied suspended platform (zoola) may be used for white washing. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the floors and walls. For white washing of ceiling, proper stage scaffolding shall be erected where necessary.

2.4 Application of White/Colour Wash :
On the surface so prepared the white wash shall be applied with 'moon' brush. The first stroke of the brush shall be from top downwards, another from bottom upwards over the first stroke and similarly one stroke from the right another from the left, over the first stroke brush be allowed to dry before the next coat is applied. The number of coats as specified in item shall be applied. It shall present a smooth and uniform finish free from brush arks and it should not come off easily when rubbed with fingers.
Splashing and dropping if any on the doors and windows, Ventilators etc. shall be removed and the surface cleaned. Priming and alkali resistant treatments, scrapping of surface, washing etc. surface spoiled by smoke & soot, removing of oil and grease spots treatment for infection with

effloresce moulds, moss, fungi, algae and lichen and patch repairs to plaster wherever done shall not be paid extra.

SPECIFICATIONS OF GALVALUME ROOFING SHEET:

a. Thickness : 0.5 mm
b. Width : 1060 – 1110 mm
c. Usable Width : 1000 – 1010 mm
d. Length : As per requirement

MISCELLANEOUS CIVIL WORKS FOR REPAIRS AND RETROFITTING:
The following civil repairing and retrofitting works shall be carried out at various existing units of STP. The quantity described under tentative only. The contractor shall have to approve the schedule of repairing before starting of any repairing work. The said repairing work shall be done in accordance with the specifications provided in this tender elsewhere and as per the relevant IS codes.

Sr.No.	DESCRIPTION	UNIT	ESTIMATE QUANTITY
	Excavation		
1	(a) 0.0 to 1.5 mtr.	C.M.	100.0
2	(b) 1.5 to 3.0 mtr.	C.M.	100.0
3	P.C.C. (1:2:4)	C.M.	25.0
4	R.C.C. (M30)		
	(a) Footing / Base Slab	C.M.	25.0
	(b) Beam	C.M.	25.0
	(c) Column	C.M.	25.0
	(d) slab	C.M.	50.0
	(e)Chajja/Lintel	C.M.	5.0
	(f) Staircase	C.M.	5.0
5	TMT steel (fe - 415 CRS)	M.T.	21.0
6	20 thk Sand face	Sq. Mt.	1500.0
7	20 thk w.p. plaster	Sq. Mt.	1500.0
8	Backfilling	C.M.	150.0
9	Sand filling	C.M.	100.0
10	Rubble soling	C.M.	100.0
11	Distemper	Sq. Mt.	1500.0
12	Ace Exterior Emulsion	Sq. Mt.	1500.0
13	I.P.S.	Sq. Mt.	400.0
14	Railing	RMT	100.0
15	Brick Masonry	C.M.	50.0
16	Stru. Steel	M.T.	10.0
17	Door/Window/Ventilators	Sq. Mt.	250.0
18	Terrace W.P. Treatment	Sq. Mt.	100.0
19	Kota stoine flooring	Sq. Mt.	100.0
20	Chequard Tiles flooring	Sq. Mt.	100.0
21	Rain water pipes	RMT	100.0
22	Industrial Roof	Sq.mt.	300.0
23	Paver Block with necessary base preparation and sand filling	Sq.mt.	100.0
24	Collapsible gate	Sq.mt.	25.0
25	Rolling Shutter	Sq.mt.	25.0

26	SS Chain link As per Specification or by the instruction of Engineer – in - charge with required Structural Steel.	Sq.mt.	100.00
27	Existing Building Demolition 3 No.s staff quarter 2 nos. old digestors	Sq.mt.	25.0

Signature Of the contractor

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

21. MECHANICAL SPECIFICATION

PART I - GENERAL

GENERAL MECHANICAL REQUIREMENTS

The following clauses specify general mechanical requirements and standards of workmanship for equipment and installation and must be read in conjunction with the particular requirements for Contract. These general specification clauses shall apply where appropriate except where redefined in the particular required sections of the Specification which shall be applicable.

List of Standards

Titles of various standards referred to in the specifications are indicated below. This list does not necessarily cover all the standards referred to:

BS 5135	Specification for are welding of carbon manganese steels
BS 5316 Part-2	Specification for acceptance test for centrifugal, mixed flow and axial pumps – Test for performance and efficiency
BS 6072	Method for magnetic particle flow detection
BS 6405	Specification for non-calibrated short link steel chain (Grade 30) for general engineering purposes : Class 1 & 2
BS 6443	Method for penetrate flow detection
ASTM A-36	Specification for Structural Steel
ASTM A-216	Specification for Steel Castings, Carbon suitable for fusion welding for high temperature service
ASTM A-276	Specification or stainless steel and heat resisting steel bars and shapes
ASTM A-351	Specification for castings, Austenitic – Ferric (Duplex), for Pressure containing parts
ASTM A-743	Specification for castings, Iron – Chromium, Iron – Chromium – Nickel and Nickel Base Corrosion Resistant for general Application
ASTM A-744	Specification for castings, Iron Chromium – Nickel, Corrosion – Resistant
IEC – 189 Part 1 & 2	Low frequency cables and wires with PVC insulation and PVC Sheath
AWWA C 501	Cast Iron Sluice Gates
IS 5	Colours for ready mixed paints and enamels
IS 210	Grey Iron Castings
IS 318	Leaded Tin Bronze Ingots and Castings
IS 325	Three Phase Induction Motors
IS 807	Code of Practice for Design, manufacture, erection and testing (Structural Portion) of cranes and hoists
IS 1239	Mild Steel tubes, tubular and other wrought steel fittings
IS 1536	Centrifugally Cast (Spun) iron pressure pipe for water gas and sewage
IS 1537	Vertically cast iron pressure pipes for water, gas and sewage
IS 1538	Specification for cast iron fittings for pressure pipes for water, gas and sewage
IS 1554	PVC insulated (Heavy duty) electric cables
IS 2062	Steel for general structural purposes
IS 2147	Degrees of protection provided by enclosures for low voltage switch gear and control gear

IS 3177	Code of practice of electric overhead traveling cranes and gantry cranes other than steel work cranes
IS 3624	Vacuum and Pressure gauges
IS 3815	Point hooks with shank for general engineering purposes
BS 2910	Methods for radiographic examination of fusion welded circumferential butt joints in steel pipes
BS 3017	Specification for mild steel forged ram shorn hooks
BS 3100	Specification for steel castings for general engineering purposes
BS 3923	Methods for ultrasonic examination of welds
BS 4360	Specification for weldable structural steels
BS 4772	Specification for ductile iron pipes and fittings
BS 4870	Specification for approval testing of welding procedures
BS 4871	Specification for approval the sting of welders working to approved welding procedures
BS 4942	Short chain link for lifting purposes
IS 5120	Technical requirements of roto dynamic special purpose pumps
IS 5600	Horizontal / vertical non clog type centrifugal pump for sludge handling
IS 7090	Guide lines for rapid mixing devices
IS 7208	Guide lines for flocculator devices
IS 10261	Requirements for clarifier equipment for waste water treatment
IS 8413	Requirements for biological treatment and equipment
Part-II	Activated sludge process and its modifications
IS 10037	Requirements for sludge dewatering equipment, sludge
Part-I	Drying beds, sand, gravel and under drains
IS 6280	Specification for Sewage Screens
IS 3938	Electric Wire rope hoists

Materials

All materials incorporated in the works shall be the most suitable for the duty concerned and shall be new and of first class commercial quality, free from imperfection and selected for long life and minimum maintenance.

Design and Construction

a. The plant design, workmanship and general finish shall be of sound quality in accordance with good engineering practice, Design shall be robust and rated for continuous service, at the specified duties, under the prevailing operational site conditions.

b. The general design of mechanical and electrical Plant, particularly which of wearing parts, shall be governed by the need for long periods of service without frequent attention but shall afford ready access for any necessary maintenance.

c. Similarly items of Plant and their component parts shall be completely interchangeable. Spare parts shall be manufactured from the same material specification as the originals.

d. No welding, filling or plugging of defective work will be permitted without the written permission of the Engineer. All welding spatter shall be removed.

e. It shall be the responsibility of the contractor to ensure that all the equipment selected is fully compatible, mechanically, electrically and also with respect to instrumentation, control and automation.

f. It shall be the responsibility of the contractor to ensure his equipment interfaces with any existing equipment correctly. Any interfaces must not affect the integrity of the equipment, or invalidate any warranties or guarantees.

g. Each component or assembly shall have been proven in service in a similar application and under conditions no less than those specified therein.

h. The equipment shall be compatible with the civil structure, when installed, with sufficient space for operator access and maintenance procedures.

i. All materials shall be of the best commercial quality and free from any flaws, defects or imperfections.

j. Materials shall be selected to eradicate or reduce corrosion to a minimum.

DESCRIPTION

A. The requirements of this Section are subject to the General Conditions of Contract. Other applicable sections of the Specifications shall be constructed to form a part of this Section where the context so requires. Specific characteristics, dimensions and other details applicable to any particular equipment shall be given in the Schedule to Technical data provided at the end of the relevant Section.

B. The Contractor shall provide all the required labour, permanent equipment and materials, tools, construction plant and equipment, safety equipment, transportation and test equipment for supplying, installing, adjusting and fully testing all the mechanical work shown General Assembly Drawings, in detail included in these Schedules.

QUALITY ASSURANCE

A. STANDARDS

All mechanical equipment and the materials used therewith shall comply with the relevant Indian Standards unless a more rigorous requirement is specifically stipulated. If no applicable Indian Standard is available for any item of equipment or materials, the corresponding British Standards laid down by the regulating Authority in the United States dealing with the subject in question shall be adopted. In every situation the latest specifications, standards etc. shall apply unless otherwise stated. In instances where there is a conflict between two codes (the Indian Standards excepted), the more restrictive of the two shall apply.

B. EXTRA WORK

Any item of equipment or materials not shown in the Drawings or specified elsewhere, but is clearly essential to make the system operable, shall be supplied and installed by the Contractor as if it had been shown or specified therein. Subject, however, to the above requirement, work that is not included in the Contract Documents shall not be performed except when approved in writing by the Engineer-in-charge/S.M.C.

C. QUALITY STANDARDS

Where the name of one or more manufacturers has been shown on the drawings or mentioned in these specifications, it has been so done to indicate type and quality required and acceptable. No restrictive choice is either implied or intended, and tenderers are free to offer other makes of equipment or materials provided they comply with these specifications and the requirements shown on the

Drawings.

D. DATA

All equipment furnished shall have a data plate fabricated out of 316 Stainless steel with a minimum thickness of 1.6 mm with embossed or preprinted lettering, and fastened to the frame with corrosion-resistant pins. Name plates shall have stamped on them the name of the manufacturer, serial number, model number, type operating and performance data and other pertinent information. Letters and numerals shall not be smaller than 4.75 mm. high.

E. TAGGINGS

Name tags shall be provided and attached to each item of equipment and device to identify it. The name tags shall be of rectangular shape and shall be approximately 37 mm x 76 mm in size. They shall be made from brass or stainless steel sheet etc. and have a minimum thickness of 0.75 mm. Letters and numerals shall be less than 4.75 mm high. The name and number of each item of equipment or device, as shown on the drawings, shall be shown on each name tag. A 4.75 mm diameter hole shall be provided in the upper left hand corner of each tag and shall be used to attach the name tag to the equipment and devices, with 3.2 mm stainless steel chain.

DRAWINGS

A. PROJECT DRAWINGS

The mechanical drawings are diagrammatic and indicate the general layout of the complete construction work.

1. Locations of equipment, inserts, anchors, motors, panels, conduits, stub-ups, fittings, fixtures, air, water and process inlets, unless specifically dimensioned on the drawings, shall be determined to suit site conditions encountered and the Contractor shall be responsible for ensuring clearances between pipes, equipment and similar appurtenances, without extra cost to the S.M.C..

2. The contractor shall review the Drawings and specifications of other trades and shall include the mechanical work shown thereon that shall be required for the installations.

3. Should there be a need to deviate from the Mechanical Drawings and Specifications, the Contractor shall submit written details and reasons for all changes to the Engineer-in-charge for approval before making such changes, Any extra cost to make such changes must be borne by the Contractor unless such changes are discussed, negotiated and finalized at the tender stage and included in the letter of Award of the Contract.

4. In the event of conflicting interpretations of the construction drawings, the Engineer- in-charge interpretation shall prevail.

B. SHOP DRAWINGS

1. Prior to fabrication of custom-made equipment or placing orders for available manufactured equipment, the Contractor shall obtain from the manufacturer and submit to the Consultation for his approval five copies of shop drawings for showing details of fabrication, assembly, foundation drawings, installations and data covering materials used, power drive assembly, parts, devices and other accessories forming a part of the equipment to be furnished. Unless otherwise specified, these shall constitute data covering materials used, power drive assembly, parts, devices and other accessories forming a part of the

equipment to be furnished. Unless otherwise specified, these shall constitute the initial submittals.

2. The Contractor will submit six (6) copies of certified performance or certified test curves as specified for all pumps, blowers or com-pressers furnished, unless otherwise specified with the tender. The Contractor shall notify the Engineer-in-charge three (3) weeks prior to any testing, should the Engineer-in-charge elect to witness the tests or have the tests witness by an authorized representative on his behalf.

C. RECORD DRAWINGS

1. The Contractor shall maintain a complete and accurate record set of drawings for the mechanical installation and construction work.

2. Record all work that in installed differently that shown on the project drawings.

3. Upon completion of the work, the contractor shall submit to the Engineer-in-charge in triplicate complete set of "Record Drawings". These shall be a clean, legible and unambiguous set of drawings with all changes from the approved project drawings distinctly shown in these two descriptions shall be used throughout the Contract.

4. All underground piping shall be located by the dimensions, baseline stationing, approximate elevation and other pertinent data required to facilitate the relocation of the pipes or fittings when later necessary.

ADAPTATION OF EQUIPMENT

Should the equipment selected require any revision to the structure, piping, electrical or other shown on the drawings, the Contractor shall include the cost of such revisions in his bid for the equipment and no extra payment shall be made for such revision. All such revisions shall be subject to the approval of the Engineer-in-charge. It should however be noted that no equipment will be accepted which require any major structural, piping electrical or other changes.

UTILITY SERVICE INTERRUPTION

All utility service interruptions initiated by the Contractor in the course of execution of his work shall be scheduled in advance and approved by the Utility Authority and the Engineer-in-charge.

MANUALS

A. QUANTITY AND PROCEDURE

The Contractor shall obtain from the manufacturer and hand over to the Engineer-in-charge three sets of Instruction and Maintenance Manual's for the equipment furnished under these Specifications, to provide adequate information for proper installation, operation and maintenance of the equipment. This requirement shall cover all equipment furnished. The Engineer-in-charge shall approve the manuals for the adequacy of the contents and the format and return one (1) set to the contractor for his use in the start-up of the equipment.

If any errors or inadequacies discovered are of minor nature, extra sheets or addenda shall be supplied by the contractor in consultation with the Engineer-in-charge. If gross inadequacies are detected, the Engineer-in-charge shall point these out, together with brief comments on the short comings, to the Contractor who shall then have the manuals recast and improved to a general level of acceptance.

The extra sheets, addenda or revised manuals shall all be resubmitted to the Engineer-in-charge for recruiting and approval within fourteen (14) days of date on which the Engineer-in-charge's comments are conveyed to him.

B. SCHEDULE

Manuals for approval shall be submitted to the Engineer-in-charge not later than the date of dispatch from factory.

C. CONTENTS

The Instruction Manuals shall contain, but not limited, to at least the following information, where applicable.

1. General introduction and over all equipment description, purpose, functions, simplified theory of operations etc.
2. Specifications.
3. Installation, instruction and precautions
4. Start-up procedures
5. Operation procedures
6. Shut down procedures
7. Short and long term inactivation procedures
8. Maintenance, calibration and repair instructions
9. Parts lists and spare parts recommendations
10. Name and address of critical spare parts and repair facility.
11. Prevative and predative maintanace sechdule of each items as per the manufacturer standard.

D. FORMAT

The Instruction and Maintenance information shall be assembled into binders of not more than 100 mm th. and shall be arranged and indexed in the order as in these specifications. The first sheet shall contain the booklet index and be of laminated plastics. Each volume shall have the project name and volume embossed into the cover in gold colour. The format and designs shall be shown to and the approval obtained from the Engineer-in-charge before the binders are finalised.

Each different section shall be headed with a laminated plastic page containing the following information.

1. Manufacturer's name
2. Local address and telephone number
3. The year of purchase

4. Equipment model and serial number of all such items as motors, pumps, variable speed drives etc.

A master table of contents should be given in Volume Drawings and pictorials shall illustrate the text sufficiently to ensure a clear brief presentation. In the event that a manual covers a family of similar equipment, the inapplicable information shall be struck of neatly or the relevant sections emphasized by use of thick arrows, circles or boxes, whichever is cleanest and neatest.

E. BINDERS

Binders shall be of type approved, after an inspection of samples, by the Engineer-in-charge. In general they have an expanding back and be of simulated blue leather. The information on the cover shall be as described in sub-division and approved by the Engineer-in-charge.

F. EQUIPMENT GUARANTEE

This requirement shall conform to the General Conditions of Contract. Unless specified otherwise elsewhere, the Contractor shall furnish and replace, at no cost to the S.M.C. any component of the equipment that is defective or shows undue wear within one (1) year from the date of acceptance of the work by the Engineer-in-charge. In addition to performance guarantees, processes or systems shall comply with the requirements stipulated in the relevant sections of the Specifications.

PART 2 - PRODUCTS

MATERIALS AND WORKMANSHIP

All equipments furnished under this or allied sections shall be new guaranteed free from defects in materials, design and workmanship. In inadequate information is provided in the specifications, it shall be the manufacturer's responsibility to ascertain the conditions shall be successful. All parts of the equipment shall be adequately proportioned to safely withstand all stresses that may occur or be induced in them during fabrication, erection and intermittent or continuous operation.

All equipment shall be designed, fabricated and assembled in accordance with the best current engineering and workshop practice. Individual parts shall be manufactured to standard sizes and gauges so that spares, furnished at any time, can be installed the field. Corresponding parts of duplicate units shall be fully interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required for tests. All materials used shall be appropriate for the service conditions. Iron casting shall be tough, close-grained gray iron free blow-holes, flaws or excessive shrinkage and shall comply with the requirements of I.S. 210.

Except where otherwise specified structural and miscellaneous fabricated steel used in items of equipment shall conform to the relevant Indian Standards. All structural members shall be considered as subject to shock or vibratory loads. Unless otherwise specified all steel which will be submerged, in part or fully, during normal operation of the equipment shall have a minimum nominal thickness of 6.0 mm. The location of the fabricator and his shop schedule shall be furnished to the Engineer-in-charge prior to commencement of fabrication to enable him to schedule shop inspections if he so decides.

SAFETY GUARDS

All belt or chain drives, fan blades, couplings, exposed shafts, and other moving or rotating parts shall

be covered on all sides by safety guards which shall be free of sharp edges and corners.

Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be hot-dipped galvanised. All safety guards n out-door locations shall be designed to prevent the entry of rain and dripping water.

The canopy of 14 SWG Galvanised sheet be provided over and around the motor & gear boxes with proper louvers ventilation in order to protect from direct rain fall and the cost of the same shall be included in the cost of the equipment. All the canopy shall be painted with epoxy paint.

Above all safety guards should be supplied and fitted free of cost.

EQUIPMENT BASES AND BEDPLATES

A heavy cast iron or welded steel base shall be provided for each item of equipment which is to be installed on a concrete foundation. Equipment assemblies, unless otherwise specified or shown on the drawings, shall be mounted on a single, heavy cast iron or welded steel bedplate. Bases or bedplates shall be provided with machined support pads, tapered dowels for alignment or making adjustments, adequate opening to facilitate grouting and openings for electrical conduits. All seams and contact edges between steel plate and shapes shall be continuously welded and ground smooth.

JACKING SCREWS AND ANCHOR BOLTS

Jacking screws shall be provided in the equipment bases and bedplates to aid in leveling prior to grouting.

Equipment suppliers shall provide anchor bolts, nuts, washers and sleeves of adequate design as required for proper anchorage of the bases and bedplates to the concrete bases. Sleeves shall be minimum of one and a half times the diameter of the anchor bolts. Unless otherwise shown or specified, anchor bolts for items of equipment mounted on base-plates shall be long enough to permit 38 mm of grout beneath the base plates and to provide adequate anchorage into structural concrete. Anchor bolts shall be 316 stainless steel and no bolts of other material shall be permitted except with the written permission of the Engineer-in-charge.

Anchor bolts, together with template or setting drawings, shall be delivered sufficiently early to permit setting the bolts accurately in place when the structural concrete is placed.

Signature of Contractor

Dy. General Manager and Ex. Engr. (Drainage)
Surat Smart City Development Ltd.

22. MECHANICAL SPECIFICATION OF EACH ITEM

DETAILS OF MECHNICAL WORK IN DIDNOLI SPS

SR NO	DESCRIPTION	UNIT	QTY.
1	**NON CLOG SEWAGE SUBMERSIBLE PUMP SETS** Supply, installation ,testing and commissioning of Non Clog ewage Submersible Pump Sets 3 Ph., 415 V AC, 50Hz., 1000 RPM (Synchronous) motor **Capacity : 340 LPS , Head : 17 Mtr.**	Set	6
2	Supply, installation, painting, testing and commissioning of Kinfe gate valves for the dischagre line of Pump Sets **Size : 350 mm Dia (Manually Operated)**	Set	6
3	Supply, installation, painting, testing and commissioning of Non Return Valve for the dischagre line. **Size : 350 mm Dia size**	Set	6
4	**REPARING OF EXISTING MECHANICAL SCREEN** (A) General Overhauling and Servicing of Existing Incli Rack Type Coarse bar screen :	Set	1
5	**C.I. FITTINGS & SPECIALS** Supply, installation, testing, painting and commissioning of C.I. double flanged suction, delivery & header pipe conforming to IS 7181or IS 1537, Class B technical specifications. The length and size of the pipes and specials are indicative and shall e designed and proposed as per the pump model.	Kgs.	12000
6	**C.I. DISMANTLING JOINT**		
a	Supply, installation, testing and commissioning of C.I. Dismantling Joint as per IS 1538 ,Design Temperature :50 C for Common Header **Size : 1000 mm Dia**	Nos.	1
b	Supply, installation, testing and commissioning of C.I. Dismantling Joint as per IS 1538 ,Design Temperature :50 C for Common Header **Size : 350 mm Dia**	Nos.	6
7	Supply, installation,testing and commissioning of Air valve for Common header line **Size :200 mm Dia**	Nos.	1
8	**SERVICING OF 3 TON E.O.T. CRANE** General Overhauling ,maintanance and painting of Existing 3 ton EOT with all required spareparts and accessories.	Nos.	1
9	Supply, installation, painting, testing and commissioning of Sluice valve of Rising Main Line. **Size : 1000 mm Dia** **Mode of Operation : Electrically**	Nos.	1
10	Supply, installation, painting, testing and commissioning of Non Return Valve for Rsing Main. **Size : 1000 mm Dia**	Nos.	1

11	M.S.Fabrication work		
a	For Modification Work and Grills, Jalias , etc.	Kgs.	1500
b	I Beams, Channels for EOT crain , Common Header etc	Kgs.	5000
12	S.S Fabrication Work for Manual Screen and Ladder Etc.	Kgs.	1500
13	General Overhauling ,servicing and Refitting of Exitiing Electrically Operated Wall Thimbled mounted sluice gate **Size : 1200 mm (w) x 1200 (h) mm** **Mode of Operation : Electrically**	Nos.	4
14	Supply, installation, testing & commissioning of Ultrasonic type level transmitter along with all mounting accessories & hardware, control cables and signal cables and complete connection with anel, interlocking with all pumps and other required accessories with Level switch as technical specification & Data Sheet. **Range : 0- 12 Mtr.**	Nos.	1
15	Supply, installation, testing & commissioning of FRP Chequred Plate	Sq. Ft.	150
16	Supply, installation, testing & commissioning of FRP coated MS Railing	Rmt.	25
17	Supply, installation, testing & commissioning of Electromagnetic Flow Meter for Commom Header. **Size : 1000 MM**	No.	1

Note:-

Above details is for guidance purpose only and tenderer must make site visit and obtain details of all units/machineries/plant equipments & accessories before giving his offer. Existing all units/machineries/plant equipments & accessories are covered under the scope of work. No dispute of any kind regarding quantity/capacity of equipment/unit at later date shall be entertained.

DETAILS OF MECHNICAL WORK FOR UPGRADATION OF EXISTING 66 MLD AND NEW 101 MLD SBR BASED STP AND 40 MLD NET OUTPUT CAPACITY TSTP

Note:-
Tenderer must make site visit and obtain details of all units/machineries/plant equipments & accessories before giving his offer. Existing all units/machineries/plant equipments & accessories are covered under the scope of work. No dispute of any kind regarding quantity/capacity of equipment/unit at later date shall be entertained.

The specifications of different items mentioned below are subjected to general specification mentioned before when and where required for different equipment.

ITEM NO.1: OPEN CHANNEL ALUMINUM, ELECTRICALLY OPERATED, PEN STOCK GATE AS PER DETAILS SPECIFICATION. THIS GATE SHOULD BE MANUFACTURED BY APPROVED MANUFACTURER AND NOT BE LOCALLY FABRICATED.

The construction of Aluminum open channel gate shall be in accordance with the specifications mentioned hereunder. The open channel gate shall be capable of performing the duties set out in this specification without undue wear or deterioration, They shall be constructed, so that maintenance is kept to a minimum. The open channel gate shall be rising spindle type.

DETAILS OF ALUMINIUM OPEN CHANNEL GATE.

1.	Shape of water way	: Square / Rectangular.
2.	Size (W x H) in mm	: As per Design Requriement
3.	Mounting	: Suitable for mounting in between two parallel walls of an open channel.
4.	Type	: Self contained type gate with headstock mounted on the yoke of the gate frame.
5.	Top water level	: 200 mm less than gate height.
6.	Type of head	: Seating as well as Unseating.
7.	Distance between channel bed/invert of gate opening to top of operating platform	: As per site requriments..
8.	Method of operation	: Electrically operated suitable for opening with maximum18 kgs effort by a single person with maximum diameter of Hand wheel/crank being 750mm.

9. Specific Construction Requirement for gate : Gate frame shall be manufactured of non-corrosion 6061-T6 high strength extruded aluminum section weighing minimum of 5 Kg/m.
Frame guides shall be made of UHMWPE to prevent metal to metal rubbing between frame and shutter.
The shutter shall be made of same composition as the frame and sufficiently reinforced to restrict deflection to less than 1/360 of span under the design head. All parts of shutter shall have minimum thickness of 6mm.
The complete gate assembly shall be given a coating of suitable epoxy lacquer.

10. Stem : Rising type unless otherwise specified.

11. Type of closure : Flush Bottom closure.

12. Sealing : Only at two vertical and bottom sides of gate aperture due to open channel installation.

13. Seal seat clearance : With the slide in the closed position shall not exceed 0.10mm.

14. Fluid flowing : Raw unscreened sewage.

15. Polycarbonat (UV resistant) transparent Pipe hood cover to cover the threaded portion of spindle and with additional mechanical stop nut on threaded stem.

16. Indicate number of hand wheel revolutions required to fully open the gate.

17. Approved Gate Makes : JASH / IVC / KIRLOSKAR ERHAD

18. **MATERIAL OF CONSTRUCTION :**

	PART	MATERIAL
a)	Gate frame, shutter/Door	: Aluminium Alloy 6061-T6
b)	Side Guides	: Ultra High Molecular weight polyethylene
c)	Rubber Seals	: EPDM Rubber
d)	Rubber seal retainer bar	: Stainless Steel AISI-304
e)	Drive Nut	: Leaded Tin Bronze to Is : 318 LTB-2
f)	Assembly bolts, nuts and fasteners	: Stainless Steel AISI-304
g)	Stem & connecting pin	: Stainless Steel AISI-304
h)	Yoke	: Mild Steel to IS : 2062
i)	Headstock	: Cast Iron
j)	Pipehood	: Transparent Polycarbonate

19. **PAINTING :**

a) Paint for gate assembly : Epoxy primer and finish paint.
b) Paint for yoke and : Epoxy primer and finish paint. Minimum coating

headstock thickness to be 150 microns.

20. **SHOP TESTING :** : Following shop tests at manufacturer site will be conducted as per procedure mentioned hereunder.

a) Movement Test : Movement test should be conducted in assembled condition using stems & headstock. The gate should be operated once from full close to full open and back to full close condition with a max. force of 135 Newton-meter on the crank or hand wheel.

b) Dimensional Check : Important Dimensions shall be checked with reference to approved GA drawing.

c) Seat clearance check : With the gate in closed condition 0.1 mm thick feeler gauge should not pass through the sealing faces.

d) Material Test Certificates : Material test certificates for important components such as Frame, Side guides, Shutter, Rubber seals & Fasteners to be furnished at the time of inspection.

ITEM NO.2: CAST IRON THIMBLE MOUNTED SLUICE GATES

GENERAL:

The construction of cast iron sluice gates shall be in accordance with the specifications mentioned hereunder and as per IS:13349-1992. The sluice gates shall be capable of performing the duties set out in this specification without undue wear or deterioration. They shall be so constructed, that maintenance is kept to a minimum.

DESIGN & CONRUCTIONAL DETAILS:

The constructional features and details of components of the required types of gates are to be as under:

1. GATE FRAME :

a) The gate frame will be made from cast iron and shall be sufficiently rigid to withstand the designated water head. The gate frame shall either be flat back type or flange back type to suit the designed head and site condition.

b) Back flange of the gate aperture frame to be precisely machined flat and drilled to engage with the Cast iron wall thimble mounted on the wall. A rubber gasket will be provided between the wall thimble and the gate for ease in future dismounting of the gate for repairs / replacement.

c) The gate frame of these sluice gates shall either be self contained type or non self contained type depending upon site requirement.

In case of non self contained gates the frames shall have short length extension guides and shall be without yoke at their top. The length of extension guides in such cases shall be sufficient to engage at least half the overall vertical height of door when the gate is full open and shall be in accordance with the relevant provisions of IS-13349.

In case of self contained gates the frames shall have full length extension guides and shall be provided with a yoke at their top. The length of extension guides in such cases shall be sufficient to engage the overall vertical height of door when the gate is full open position.

2. GATE SLIDE / SHUTTER / DOOR :

   a) The gate slide / shutter / door will be made from cast iron and shall be sufficiently ribbed to withstand the designated water head.

   b) The gate slide / shutter will be provided with integral pocket to house the thrust nut used to connect the stem with the slide.

3. SEATING/SEALING FACES :

   a) Materials: These should be of Stainless Steel or as specified.

   b) Fitment: The facings shall be attached to flat machined faces of gate frame and door and secured in place using taper screws. The taper screws adopted for facings shall be of same material as that of the seat facings.

   c) The front faces of integral extension guides which can come in contact with the sealing faces of door while opening, shall also be fitted with sealing faces of the same material as that of the sealing faces on door. This is required to offer non corroding smooth sliding surfaces to the sealing faces of door/shutter during its vertical travel for opening and enhance the effective life of gate.

   d) Finish: The mating seating/sealing faces on the gate frame and door shall be precisely finished for proper contact. They should be so finished that the clearance or gap, if any, between the mating sealing faces, in gate closed position, does not exceed 0.1mm.

4. WEDGING DEVICES :

   a) The Sluice gates shall be provided with adjustable wedging devices to ensure forced contact between frame and shutter seat facings, when the gate is in closed position.
   b) The gates meant for seating head shall be provided only with side wedging devices. Gates meant for unseating head of sizes larger than 600 mm, shall be provided with side, top and bottom wedging devices or with side and top wedging devices and flush bottom closing arrangement as required.
   c) The wedging devices comprise of wedge brackets shall be fitted on gate aperture frame and door. The wedge bracket on frame shall remain in fixed position and those on door shall be adjustable or vice versa. A sort of slot and tennon arrangement shall be provided on base of wedge brackets to prevent any tendency to shift. Provision shall be made to clamp the adjustable brackets firmly in adjusted position.
   d) The wedging devices shall be made of cast iron. If the wedges/wedge blocks of wedging devices are of Cast Iron, then these are to be lined with contacting faces of the same material as that of sealing faces attached to the gate frame and door.

5. CONVENTIONAL OR FLUSH BOTTOM CLOSING :

The sluice gates shall be provided with conventional or flush bottom closure arrangement as required.

The sluice gates provided with conventional bottom closing arrangement involve corrosion resistant metallic contacting sealing faces at the bottom sill of gate. In such cases, the invert of the gate is required to be kept above the floor of the channel / chamber by at least 100mm to 150mm depending upon the size and type of gate. The gate manufacturer should verify whether this clearance is available at the site of installation for fitting a conventional bottom closure gate.

In case of conventional closing gate, if the invert of the gate is kept at the same level as that of the channel/chamber floor, then there remains a slot or a groove at the invert of the gate. Debris, dirt etc. which may settle in this slot and may not allow the gate to close properly and this may give rise to heavy leakages while in operation.

With a view to avoid this, in situations where the invert of the gate is to remain at the same level as that of the channel/floor, a Flush Bottom closing gate instead of Conventional Bottom Closing gate should be provided.

Flush Bottom Closing shall involve a flexible rubber seal at the bottom of the gate, mounted either on the shutter or on the frame, ensuring that the sealing face remains flush with the floor. The cast iron bar fitted at the bottom of the frame is required to be embedded in the channel / chamber floor and for this a cut out / recess of ample dimensions is required to be provided beneath the waterway opening along the gate invert, while constructing the floor. The dimensions of this cut out shall be provided depending upon the feasibility to do so as per actual site conditions.

This cut out/recess is to be later on filled up with removable asphalt or loose concrete mixed with sand dust or vermiculate after putting the gate in position so that it is possible to break open this second stage grout for removal of the gate in future.

The rubber seal employed shall be made of EPDM or Neoprene rubber and the rubber seal retainer bars as well as the fasteners for fitting the rubber seal and the retainer bar are of stainless steel.

6. GATE OPERATING HEADSTOCK/LIFT MECHANISM :

a) The operating headstocks shall be designed in such a manner as to permit the gate operation by a single person under the specified maximum operating head with an effort of less than 18kgs on the crank / hand wheel.
b) The headstock shall be geared type and the geared headstock may be either of single speed or of double speed, as might be necessary to make it convenient for one person to open or close the gate as fast as practicable. Two speed headstocks shall be supplied with gates requiring higher hoisting capacities. In this type of headstock the low speed is meant for crack opening the gate when the effort required to open the gate is maximum and the high speed is meant for further faster opening after the gate is crack opened.
c) Geared headstock shall be supplied with easily removable crank handle or hand wheel with a radius not exceeding 375mm.

d) All the gears of geared headstock shall be kept completely encased in cast iron housing to protect them from damage, dirt, dust, water etc. and other atmospheric effects and thus ensure their smooth operation, especially in the intended application where most of the time the gearboxes will be subjected water sprays coming from top of the cooling tower. Grease nipples shall be provided at proper places for lubricating with grease.

e) Headstock meant for mounting on operating platform shall be supplied with a pedestal/floor stand to provide a convenient operating height of approximately 900 mm. The pedestal of the headstock shall be provided with a covered window opening to enable cleaning and greasing of stem threads.

7. LIFTING SPINDLE/STEM :

The sluice gates shall be supplied with rising type lifting spindles/stems. The stem shall be provided with acme / square threading, length of threaded portion being about 400mm more than the height of waterway opening. This much extra length is required to allow for a minor variation of approximately 100mm on either side of the specified height of operating platform.

The design of stem will be done as per the provision in IS-13349.

8. STEM BLOCK / CONNECTING BLOCK / THRUST NUT :

The rising type stem shall be connected to the door through a stem block/thrust nut housed in a ribbed pocket cast integral with the door. The bottom end of stem shall thread into the stem block and is locked in place by a set screw to prevent the stem from unscrewing. The Stem block shall be cast bronze or Gunmetal.

9. SAFETY STOP NUT :

The stem shall be provided with a safety stop nut to prevent the chances of over closing of gate which may otherwise damage either the stem or the lifting platform. The stop nut shall be furnished with a set screw for setting it in a fixed position after the gate is installed. Upon installation the safety stop nut should be set in such a way that its bottom remains about 1 to 2 mm away from the top of headstock, in gate closed position.

In case of stainless steel stem the stop nut shall also be of stainless steel material of the same grade.

10. STEM/SPINDLE COUPLINGS :

For ease in transportation and handling, maximum length of one piece stem shall be restricted within 4.5 to 5 meter length. Where the stem are required to be furnished in more than one piece, threaded stem couplings shall be furnished to interconnect different sections of the stem. The couplings shall have provision for pinning after inserting in the threaded end of the stem.

In case of stainless steel stem the couplings shall also be of stainless steel material of the same grade.

11. STEM GUIDE BRACKETS :

Longer stems shall be provided with sufficient number of stem guides to prevent buckling of stem. The stem guide bracket to be provided shall be Adjustable Centre Type - wherein a separate stem guide is bolted on to the wall bracket. The stem guide shall be adjustable in the slots on wall bracket in a direction perpendicular to the face of wall. Wall bracket should also offers minor adjustment in the direction parallel to the wall.

The stem guides shall have machine bored split journals to facilitate erection. The journal shall be lined with brass/gunmetal bush.

12. PIPE HOOD FOR STEM :

A Pipe hood shall be provided on the top of headstock in case of rising spindle/stem gates to cover the spindle threads for protection against damage, dirt, dust, water etc. It shall be made of transparent fracture resistant polycarbonate material. The pipe hood shall have vent holes to prevent condensation.

13. GATE OPENING INDICATING ARRANGEMENT :

Gate opening indicating arrangement shall be provided to indicate the position of the shutter. This shall comprise of scale mounted on the pipehood and an indicator nut mounted on the rising spindle to show the extent of the opening and closing. The minimum scale graduation shall be 25 mm.

14. MATERIAL OF CONSTRUCTION :

The material of construction for various components shall be as under.	
Gate frame, Shutter , Thimble,	: Cast iron IS 210 FG 260
Headstock, Wedges, Stem Guides	: Cast iron IS 210 FG 260
Seating faces	: Stainless Steel ASTM A 240 type 304
Rubber Seals	: EPDM Rubber
Rubber seal retainer bar	: Stainless Steel ASTM A 240 type 304
Assembly bolts, nuts and fastener	: Stainless Steel ASTM A 276 type 304
Stem & connecting pin	: Stainless Steel ASTM A 276 type 304
Yoke	: Mild Steel to IS : 2062 grade A
Thrust nut and Lift nut	: Gunmetal / Phosphor Bronze

15. PAINTING : Following painting procedure shall be adopted for the gates :

Priming	:	1 coat of red oxide primer before and after shop testing.
Finish Painting – gate	:	Black bituminous paint for gate assembly. Minimum DFT 200 microns.
Painting yoke & headstock	:	Epoxy red oxide primer and epoxy grey paint. Minimum DFT 150 microns.

ITEM NO.3 : MECHANICALLY CLEANED MULTI RAKE BAR SCREENS:

GENERAL INFORMATION AND REQUIREMENTS FOR MECHANICALLY CLEANED MULTI RAKE BAR SCREENS:

1.1 The construction and general design of mechanically cleaned multi rake bar screens shall be in accordance with the specifications mentioned hereunder.

1.2 The Mechanically cleaned multi rake bar screens shall be capable of performing the screening duties in storm water / waste water pumping stations/ water intake structure and in water and waste water treatment plants. The screens should be suitable for operation in a flow having a high content of fibrous screenings and which may be heavily grit laden.

1.3 They shall be so constructed that there is no undue wear or deterioration during its operative life and so designed that the maintenance is kept to a minimum.

1.4 The Screens assembled structure should be able to withstand a minimum of 3 times the water depth for static and hydraulic forces exerted by the flow. All structural and functional parts shall be adequately sized to prevent deflection and vibration which could impair the raking operation.

1.5 All the Mechanically cleaned multi rake bar screens shall be shop tested at plant for correctness of dimensional details, verification of material used and movement tested using the offered drive arrangement integrated with local as well as remote electrical panel.

1.6 All the Mechanically cleaned multi rake bar screens shall be supplied along with all accessories such as screens structure, bars, rakes, chains, sprockets, bushes, scraper assembly, geared motors, covers, local and remote control panel and miscellaneous items like fasteners and anchor bolts etc required to erect and install these items.

1.7 All the mechanically cleaned multi rake bar screens shall be installed under the supervision of manufacturer's representative and subsequently site tested to verify the performance as specified. This testing will be done in presence of client / client representative or approved third party inspection agency.

1.8 The mechanically cleaned multi rake bar screens manufacturer shall be ISO-9001:2008 certified and have an existing track record of supplying mechanically cleaned bar screens for more than 5 years in the Indian market and should have a total of 10 installations in various projects in India.

1.9 A job reference list showing location, name of client and design capacity of the type of screens required as per the specifications shall be submitted with the tender for assessment.

1.10 The manufacturer shall conduct welding using the welding process described in AWS D 1.6 and ASME Welding code - Section IX using qualified welding process and welders. The manufacturer

1.11 All construction and welding is to be undertaken according to ASTM. All welding is to be of the continuous type, both-sides welded with all weld seams properly treated. The welding is to be done is such a way that corrosion, especially fissure corrosion, is avoided. Intermediate seam-welding and open fissures are not permitted.

1.12 The manufacturer shall ensure that all the weld joints shall be Dye penetrative tested using qualified inspectors.

1.13 The corrosion resistant properties of stainless steel get reduced when exposed to heat while cutting by plasma. To avoid this, all the cutting of stainless steel material shall be done using heat less water jet cutting procedure.

1.14 All the stainless steel material used on the assembled product will be checked for correct chemical composition using Positive Material Identification equipment. This shall be re-verified at the time of inspection.

1.15 The manufacturing and assembly of stainless steel products shall be carried out in a clean area. This clean area is to be maintained in line with good manufacturing practices to be observed while working with stainless steel so as to avoid ferrous contamination which results into corrosion impregnation in stainless steel.

2. SPECIFICATIONS FOR SCREENS :

2.1 GENERAL REQUIREMENTS :

Each mechanically cleaned multi rake bar screens will be manufactured as detailed hereunder and shall be supplied duly tested as per requirement.

The assembly will be supplied as a factory assembled unit and shipped to site as a ready to install unit. This assembly will be uncrated at site and installed as complete assembled unit without stripping down into components. This is to ensure that the performance integrity of the screen remains as factory tested and supplied condition, thus minimizing the influence of the installation
process to achieve optimum performance at site after installation.

2.2 DESIGN & CONSTRUCTIONAL DETAILS :

The constructional features and details of components of the required mechanically cleaned bar screens are to be as under:

a. The mechanically cleaned multi rake bar screens shall be front-raked with a multiplicity of raking combs carried by two endless revolving chains on upper and lower sprockets. The rakes should remove the screenings trapped on the rack of submerged screen bars. The screens shall be fitted with as many raking combs as required to achieve the stated raking frequencies.

b. The screenings collected from the bar rack shall be positively discharged via chutes by means of a scraper assembly which requires no manual cleaning. No screenings shall be allowed to carry over and fall back into the flow on the downstream side.

c. The screens are to be installed at an angle of 75o to the horizontal, nominally adjusted to suit the configuration of the civil structure. The screens should be supplied complete with all necessary accessories and fixings. The screens shall be manufactured in whole or in segments to aid installation, with the provision of lifting lungs as appropriate.

d. The screens shall be of rugged design and construction with a minimum plate thickness of 4 mm for the self-carrying framework. The screens shall have adequate strength and be manufactured in stainless steels as stipulated in the specification.

e. The screens shall be able to operate in continuous mode at variable speeds and shall be suitable for both forward operation and reverse operation. The design should be such that screen field bars, rakes and tines, drive-chains, sprockets and bearings can be replaced without the need to remove the screen from the channel.

f. The screen field shall be of continuous and solid taper-section bars. The bars shall be sized to withstand the differential head requirement as stipulated in the specification but shall be of dimensions no less than 8 mm (front) x 4 mm (rear) x 40 mm (depth).

g. The bars shall be individually replaceable without dismantling the screen or the rest of the screen field structure. The screen field bars shall be of sufficient length to suit the flow. The screen field length shall be equivalent to the maximum water level plus an additional 500mm of freeboard.
h. The design of screen will be such so as to permit change in bar spacing at a later date to suit the changing waste requirement.
i. The debris plate shall extend from the top of the screen field to the discharge level. The debris plate shall be true and flat such that the clearance of only 3 mm between the raking tines and the plate is maintained during the operation.
j. The height and position of the discharge chute shall be aligned to the hopper of the discharge receptacle which is to be suitably positioned on deck level. The minimum incline of the plate of the discharge chute down which collected screenings are ejected for deposit into receiving receptacles shall be 60 degrees to the horizontal.
k. The minimum horizontal distance between the point of discharge from the screen and the most proximate point of the screen frame shall be 300mm, to allow the easy positioning of a discharge receptacle / belt conveyor / screw conveyor etc.
l. The raking combs shall be manufactured with removable tine-sections constructed from single elements of a minimum plate thickness of 10 mm and be strengthened with support profiles of a minimum plate-thickness of 6 mm.
m. Engagement of the rake tines into the screen field shall be effected by mechanical means. The rake tines shall protrude a minimum of 10 mm into the screen field spaces to ensure complete removal of the screenings trapped on the screen field. The screen design must achieve a combined rake load-carrying capacity for all upward-travelling rakes of 7500 N/m2 in horizontal projection.
n. The rakes shall be bolted to the side-plates of the drive-chain using special adaptor links. The screens are to be supplied with heavy-duty chains of the roller type made entirely from stainless steels and with a minimum breaking load of 112 kN.
o. Chain guides of stainless steel shall be securely fixed to sides of the screen within the recesses of the supporting framework, with both chains and guides in an arrangement that shall impose minimum hydraulic obstruction to the flow. Chain tension take-up devices shall be provided at the top of the screen.
p. The drive motor shall be continuously rated with enclosure protected to IP55 of BS EN 60529 and totally enclosed fan ventilated type, equipped with thermistors and anti-condensation heaters. The drive unit inclusive of the reduction gearbox shall be directly shaft-mounted and be adequately sized to provide the required minimum raking frequencies and load-carrying capacities. The drive unit shall deliver adequate torque to the drive-shaft of the screen at any chosen speed. The drive units for the screens shall be freely interchangeable.
q. The drive-shaft will be solid and shall be sized to withstand operating torque under full load but shall be of a diameter no less than 90mm.
r. Drive sprockets shall have conventional roller bearings. Submerged sprockets shall have bush bearings with Ceramic bushes or better, to prevent extensive wear by the abrasive ingredients of the flow.
s. In order to minimize odour emissions and for safety reasons, the head of the screens are to be fully enclosed for the full length of the screen above operator-level. The screens are to be equipped with removable front covers. The covers shall be made of clear impact-resistance polycarbonate material to allow for visual observation during operation. The screens are to be supplied with rear-access windows also of polycarbonate and designed to shroud the discharge chute.

t. The screen should be provided with facility to operate at twice the normal operating speed during high flow / flooding / higher head loss condition.

u. The screens shall incorporate an electro-mechanical overload protection device. Overload protection purely by current-sensing detection systems will not be permitted. The electro-mechanical overload protection device must be operable when the screen is running in either forward or reverse.

v. The screen shall be capable of automatic self-cleaning when an overload situation is detected. In the event of blockage, the screen must stop, following which the controls should initiate the exercise of self-cleaning cycles. The screen must reverse in an attempt to clear the obstruction, automatically resuming forward-mode when the blockage is cleared. If the first cycle in self-cleaning mode is unsuccessful, the screen should automatically repeat the forward-reverse-forward cycle, for an adjustable number of trials.

2.3 MATERIAL OF CONSTRUCTION :

The material of construction for various components shall be as under.

- Frame & support structure : Stainless Steel ASTM A 240 type 316*
- Bars & rakes : Stainless Steel ASTM A 240 type 316*
- Chain & sprockets : Stainless Steel ASTM A 240 type 316*
- Assembly bolts, nuts and fasteners : Stainless Steel ASTM A 276 type 316*

* Positive Material Identification (PMI) tests to be carried out for these components at manufacturer works during the inspection.

2.4 SHOP TESTING :

Following shop tests at manufacturers place shall be conducted.

a) Functional Test	Functional test should be conducted in vertical / horizontal assembled condition using operating mechanism. In this test the screen should be operated for 10 minutes using offered operating arrangement. During this test the self cleaning forward reverse forward cycle test should be carried out by using a wooden piece as blockage.
b) Dimensional Check	Important Dimensions shall be checked with reference to approved GA drawing.
c) Material Test Certificates	Material tests certificates for all important components of assembly to be furnished at the time of inspection.
d) Positive Material Identification Test	Positive Material Identification (PMI) test to be conducted for stainless steel components during the inspection to verify that the correct material as specified has been actually used.

3. SUBMISSION OF BROCHURES, DRAWINGS AND DATA SHEET:

The contractor shall submit color brochures of the offered screen and following data sheet duly filled, signed and stamped by manufacturer during detail engineering.

Sr. No.	Item description	Unit	Technical particulars required by SMC	Technical particulars offered by the contractor
(a)	**General**			
(i)	Make		As per approved vendor list	
(ii)	Design Flow capacity/screen	mld	As per design	
(iii)	Qty of screens	Nos.	As per design	
(iv)	Head loss at maximum flow	mm	As per design	
(v)	Channel Width	mm	As per design	
(vi)	Channel Depth	mm	As per design	
(vii)	Maximum water level	mm	As per design	
(viii)	Spacing between bars	mm	6	
(ix)	Discharge Height	mm	As per Site Requirement	
(x)	Minimum raking frequency	times per min	As per design	
(xi)	Chain breaking load	kN	As per design	
(c)	**MOC**			
(i)	Frame & support structure		Stainless Steel ASTM A 240 type 316	
(ii)	Bars & rake		Stainless Steel ASTM A 240 type 316	
(iii)	Chains and sprockets		Stainless Steel ASTM A 240 type 316	
(iv)	Bolts, nuts and fasteners		Stainless Steel ASTM A 276 type 316	
(d)	**Testing**			
(i)	Dimension verification		As per approved drawing	
(ii)	Review of material Test certificate		Materials required as per approved drawing	
(iii)	Functional Test		Required	
(iv)	PMI test of SS Component		Required	

ITEM NO.4: BELT CONVEYOR:

It shall be in corporate with followings.

A belt type conveyor system for transporting screenings, of loaded from fine bar screens will be provided. The length shall be suitable for full width of all screens.

The following information has to be furnished by the manufacturer:-

1 Belt capacity rating for the conveyor assembly.
2 Belt conveyor layout including locations of all supports, idler spacing, skirt dimensions, power transmission layouts and other accessories necessary to maintain proper operating conditions.
3 Material specifications for all component parts.
4 Anchor Bolt placement and concrete block-out locations.
5 Details of Take-ups to prevent slack in belt system.

i Belt

The belt material shall be two (2) Plylon or equivalent with 3mm Neoprene covering on carrying side and 0.75m Neoprene cover on pulley side. The speed of the belt shall not exceed 20 meters. /min.
The width of the belt shall be 0.6 Mts.

ii Idlers:

The belt shall operate over 127 mm dia. three (3) roll 20 throughing idlers. The idlers shall rotate on precision type, deep grove, single slow ball bearings with built in close fitting triple labyrinth grease seal. The ends of the outer shell shall be counter bored and a full length centre tube journalled concentrically. The outer shell, centre tube and precusuib die formed steel ends shall all be brazed into an integral unit to provide roll concentricity. The ends of the centre tube shall be bored concentrically with each other after roll assembly to provide correct bearing alignment and prevent pre stressing of borings. The centre tube shall be grease fit after assembly.

On the return run the belt shall operate over 100 mm diameter flat roll idlers having bearing shaft and lubrication arrangements as discussed above for carrying Idlers. The Idlers shall be constructed of steel tubes.

iii Pulleys:

The head and tail pulleys shall be of welded steel or cast iron and shall be furnished with rubber lagging. Lagging for drive-pulleys shall be grooved. Pulley shall be equipped with taper lock bushings. Shafting for pulleys shall consist of heat treated carbon steel. They shall be forged, ground and polished to obtain close diameter tolerance. The head shaft shall be of a diameter not less than 50 mm. The tail end shall be equipped with take-up assemblies permitting a minimum 75 mm travel, manually adjustable screw type.

iv Power Transmission:

The belt conveyor shall be a squirrel cage, TEFC, IP 55, 415 volts, 3 phase, 50 cycle motor as per general specification of capacity not less than one (1) H.P. A V-belt drive chain drive arrangement shall be provided between the motor and helical speed reducer; the latter shall be mounted on the end of the head shaft. The driving pulley shaft shall have back stops to prevent backward movement of the belt.

v Supports:

The conveyors shall be supported on 150 mm channel stringers with 14 gauge steel deck plate between the two runs of the belt and the necessary supports to the floor. The floor supports shall not be made out of steel not less than 6 mm thick. Frames shall be anchored to floor with galvanized steel anchor bolts.

vi Scraper:

An adjustable belt scraper shall be provided on the screening hopper end of the conveyor belt. The scraper and attachments normally in contact with the screenings shall be of 316 stainless steel.

vii Outlet chute provided in discharge and it shall be fabricated from 6 mm thick FRP and extended upto container/vehicle height.

viii All the bearing and chain shall be properly protected from dust, water and weather.

ix Bearing shall be pre lubricated seales bearing and make of bearing shall be SKF/FAG/RHP make.

ITEM NO 5: DEGRITING TANK MECHANISM, CLASSIFIER AND WASHING OF GRIT:

Removing different type of grit, clay, sand, metal etc. From tank Mechanism, Classifier and washing of grit etc.

It shall incorporate following.

a Removing different type of grit, clay, sand, metal etc. from tank mechanism:

The different type of grit, clay, sand, metal etc. settled in a tank shall be scrapped a collection point by a scrapper mechanism. It shall be designed for continuous operation. The mechanism will be coupled to a suitable motor-gear- box assembly. The collected grit shall be elevated to the
top of tank by the help of a classifier. While the grit is being elevated from the tank bottom, suitable arrangement for grit washing by plain tap water shall be made. All moving parts shall be abrasion resistant.

Grit Mechanism (Square type)

The Grit mechanism will be suitable for installation in a square tank and will comprise of the following:

i Grit Collection Mechanism.
ii Organic return pump.
iii Classifier and rake mechanism.

The Grit Collection Mechanism will consist of:

Drive assembly comprising of

i Motor of recommended make.
ii Worm reduction gear.
iii Chain & Sprocket drive/direct gear drive..

Vertical shaft.
Scrapper arms with blades. The blades shall be of stainless steel (AISI-304) material fitted with S.S. fasteners.

NOTE: -

The Bridge cum walkway and its railing spanning the square tank and at right angles at the centre shall be included in civil work items. Cost of the same is not included here.

b Grit classifier equipment generally comprising of:

Classifier R.C.C. Tank shall be included in Civil work cost of the same is not included here.
The length of classifier shall be suitable for easy removal of grit from the unit.
Classifier shaft with flights, welded to the pipe.
Outlet chute (F.R.P.) provided on the discharge end should be extended upto vehicle/container height.

NOTE: -
The require length of the classifier R.C.C. tank and flexible R.C.C. Baffle wall shall be included in civil work item. Cost of the same is not included here.
Drive unit consisting of:
Motor of recommended make.
Worm reduction gear.
Chain Sprocket with guard.

The design of motor and gear box should be such that it can with stand the torque due to uneven and unbalance load and in any circumstances, it should not give vibration and abnormal noise.
c Organic return pump/Turbine mixture pump/Grit wash pump.

Organic return pump/turbine mixer/grit wash pump positioned on the water table level generally consisting of:
Drive motor of recommended make.
SS Shaft with coupling on one end and SS impeller on the other end.
Box frame.

C.I. pipe (if required).

ITEM NO : 6 : GENERAL SPECIFICATION FOR DIFFERENT TYPES OF VALVES

General

Valves shall be as per internationally recognized standards. Flanges shall be machined on faces and edges to ISO 7005, IS 6392 or BS 4504. Flange drilling should confirm to IS 1538

Valves shall be double flanged type and the face shall be parallel to each other and flange face should be at right angles to the valve centerline. Back side of valve flanges shall be machined or spot faced for proper seating of the head and nut.

Valve buried or installed in underground chamber, where access to a hand wheel would be impractical, shall be operated by means of extension spindle and/or keys.

Valve shall be suitable for frequent operation as well as operation after long periods of idleness in either open or closed position.

The valve stem, thrust washers, screws, nuts and all other components exposed to the sewage shall be of a corrosion resistant grade of stainless steel.

Valves shall be free from sharp projections.

Butterfly, non return valves and non rising spindle sluice valves shall be provided with bypass arrangement as per relevant IS specification. This may be integral with valve or connected between pipes.

6.1 SLUICE / GATE VALVES

Design Requirements and construction Features

Valve shall be non rising spindle type PN 1.0 rating free from sharp projections which are likely to catch and hold stringy materials.

Body of the valve shall be designed for 1.5 times the rating of the valve.

Valve flange face shall be parallel to each other and flange face should beat right angle to the valve centerline.

Back side of valve flange shall be machined or spot faced for proper seating of bolt head and nut.
Wherever extension spindle is provided, the valve shall also be provided with suitable headstock.

Valve shall close with clockwise rotation of the hand wheel. The direction of closing shall be marked on the hand wheel.

Valve shall be non rising spindle type and rated for nominal pressure of PN 1.0

Materials of Construction

a Body and wedge	:	CI to IS 210 GR FG 260
b Spindle	:	SS to BS 970 Gr 316 S16
c Seat rings	:	SS to BS 970 Gr 304 S16
d Back seat bush	:	Bronze to IS 318 Gr LTB2
e Shoe & channel linings	:	SS to BS 970 Gr 304 S16

Note:

Material test certificates shall be furnished for all the above parts.

6.2 NON RETURN VALVES

Design Requirements and Construction Features

Valve shall be free from sharp projections which are likely to get clogged with stringy materials.

The valve shall be suitable for mounting on horizontal pipe line.

The internal parts shall be easily accessible for inspection through inspection hole.

Hydraulic passages and doors shall be designed to avoid cavitations.

Valve body shall be designed for 1.5 times the rated pressure.

Valve shall be of swing type or ball type. All the Valves of size equal to 350 mm dia. and below shall be Ball type only. Ball type valve must house a freely moving ball in such a way that return flow is effectively prevented.

Valve shall be quick closing type with non-slam characteristics in case of swing type. The non-slam characteristics shall be achieved by providing suitable combination of door and hydraulic passages without any external lever/damping arrangement.

Flow direction shall be clearly embossed on the valve body.

Valve flange face shall be parallel to each other and shall be at right angles to valve centerline. Flange back shall be machined or spot faced for proper seating of bolt head and nut.

Valve shall be rated to 10 bars

Materials of Construction

a Body and Doors	:	CI to IS 210 Gr FG 260
b Body Ring	:	SS to BS 970 Gr 304 S16
c Door Ring	:	SS to BS 970 Gr 304 S16
d Bearing bushes	:	bronze to IS 318 Gr LTB2
e Ball (if applicable)	:	to be with EPDM Rubber

6.3 PP BALL VALVE

Polypropylene (P.P.) Ball Valve shall be suitable for use in Chemical Dosing line as well as Gas Line. The specifications for P.P. Ball Valve shall be as under:

1. Material of Construction: Flange & Body made from lsotactic Polypropylene with back compounded for Ultra Violet Resistant.

2. Ball Material Construction: Ball made from XLPP Material for High Chemical Resistant

3. Packing Seal: Neoprene Rubber

4. Packing Seat & Spindle Bush: Teflon seat

5. Handle: P.P. Lined MS

6. Spindle & Fasteners : EN 8 ZINC COATED

7. Testing: Tested up to 10 Kg/Cm^2 from body & seat also

6.4 BUTTER FLY VALVES

General
This specification describes the design, construction, material, manufacture, performance and testing aspects of Butterfly Valves.
Codes and Standards

The butterfly valves shall generally comply with one or more of the following codes and standards.
AWWA C504: Standard for Rubber Seated Butterfly Valves.
BS 5155: Cast Iron and Carbon Steel Butterfly Valves for general purposes.
IS – 13095 – 1991 – Butterfly Valves for General Purpose

Other international standards, which may be equivalent or superior to those specified above, shall also be acceptable.

Performance Requirement

Butterfly valve and its operator shall be of heavy duty construction and shall be designed to withstand all working conditions i.e., shall be able to open, close or hold from/at any intermediate disc position, as required, without any difficulty under different combinations of flow and pressure.

Butterfly valves located within pumping stations shall be manually operated. Butterfly valves installed on transmission mains shall be manually operated and provided with gear reducer for bigger sizes (350 NB and above).

During manual operation of valves (of smaller sizes, not provided with actuator or gear reducer), the maximum manual pull to be applied at the hand wheel/lever shall be limited within twenty (20) kg.

Valves fitted with power pack unit shall automatically close/open or stay put in the event of disturbance in the system in which the valve is installed so that the "fail safe" criterion is satisfied.

Design and Construction
General
The valve design shall take care of the pressure drop across the valve disc in case of partial opening of the valve and shall take care of the erosion and cavitations effect on the body and disc during such operation.

Valve(s) subjected to back pressure shall have the valve seat, disc and the operator suitably designed to ensure trouble-free operation.
The design of the valve shall take into consideration the water hammer effect in case of accidental closure of the valve disc.

Valve Body
Valve body shall be of cast iron/fabricated steel with flanged ends or wafer type. Hubs for housing the shaft bearings shall be integrally cast / fabricated with body.
Body thickness of valves (rubber-seated) shall comply with Indian / BS Standard.

Valve Shaft
Valve shaft may be of single piece extending completely through the valve disc or in two pieces, stubbed into the disc hubs. The shaft diameter shall take into consideration the maximum torque required for the valve operation, the maximum differential pressure across the valve disc when the valve is closed and the shock load due to accidental closure of the valve disc.

Valve Disc
Valve Disc may be of cast or fabricated design, with no external ribs transverse to the direction of flow. The disc shall be designed for maximum differential pressure across the valve as well as the shock load due to accidental closure of the valve. Disc design shall offer minimum head loss. Disc shall also offer minimum resistance to flow. Disc shape shall be contoured. Disc head loss characteristic and flow discharge co-efficient shall be based on model test conducted.

Valve Seat
Rubber seats shall preferably be applied on the disc. Valve seat shall be designed to provide bubble tight shut-off at all operating conditions. Valve seats shall be of a design that permits removal and replacement at site and shall be securely clamped on the body or disc of the valve. Seal shall be single piece design and bolted to disc using bolts passing through seals. Seat has to be designed as per Music Note or “Bulb” design for the required pressure rating.

Seat material shall be suitable for the operating conditions and handling fluid and may be suitably reinforced, if required.

The rubber seal design shall permit easy removal for replacement purposes without the need for removing the valve from the line. No deposited or welded seat rings permitted.

Valve Bearings

The valve shall be fitted with two sleeve type shaft bearings, contained in the hubs of the valve body. Bearings shall be of 'self lubricated' type and shall not have any harmful effect due to handling fluid.

Adjustable thrust bearing(s) shall be provided to hold the valve disc securely in the centre of the valve seat, when asked for in the data sheets.
Shaft Seals

Shaft seals shall be provided both at drive and non-drive end of the shaft to prevent fluid flow to valve bearings. Shaft seals shall be of replaceable type and shall allow easy replacement with minimum dismantling of the valve components.

Valve Operators
Operator shall be used for opening, closing or holding the valve disc at the intermediate positions as and when required. Operator sizing shall be done on the basis of the maximum torque requirement of the valve for seating/unseating/ holding the disc at the intermediate positions and the time required for valve operation.

Gear Reducers

Bigger size valve(s) which are difficult to be hand operated shall be supplied with suitable gear reducing device for easy operation. Design of the gear reducers shall conform to AWWA standard.

Actuators

Where required, butterfly valves shall be supplied along with an electric motor actuator for power operation, specification of the actuators shall comply with the specification of actuators.

Manual Operator

Irrespective of whether the valve is operated by a power actuator or not, each butterfly valve shall be provided with a hand wheel for manual operation. The hand wheel and associated gearing arrangement shall be designed to limit the maximum manual effort to around twenty (20) kgs for valve operation.

Valves located at inaccessible position, shall be provided with extension spindle and floor stand or hand lever/round chain as specified in data sheets, to facilitate manual operation.

Valve to be operated through gearing arrangements and/or by power actuator, shall be provided with adjustable mechanical stop limiting device to prevent over travel of the valve disc in 'open' or 'closed' positions.

Position Indicator

The valve shall be provided with a mechanical position indicator and a scale to indicate 'open', 'close' or intermediate positions of the disc. An arrow mark on the hand wheel shall be provided to indicate 'open' or 'close' direction.

Material of Construction

Valve body	:	CI IS 210 FG 260
Valve disc	:	CI IS 210 FG 260
Body seat	:	S. S. AISI 316
Disc seat/lining	:	EPDM Rubber
Valve shaft	:	S. S. AISI 410
Shaft bearing	:	Self Lubricated
Seat Retaining rings	:	S. S. AISI 304

Inspection and Conducting Shop Tests

Manufacturer shall conduct all tests and stage inspections required to ensure that the equipment offered by him conform to the specification requirement.

Test certificates for all shop tests shall be furnished to Employer for approval.

The Client may witness the tests, if he so desires.

Various Tests

Material Test
Material to be used for the valve components shall be of tested quality. Chemical analysis and mechanical tests on materials to be used for forging and casting shall be done as per relevant standard.

Non-destructive Test

Valve body and disc shall be subjected to Non-Destructive Testing (NDT). Components subjected to NDT and approved shall be stamped for identification.

Hydrostatic Test

Each valve body shall be subjected to hydrostatic test as specified in BS-5155/AWWA-C-504 and seat leak test as per BS-5155. For valves subjected to back pressure condition, leakage test shall be carried out on both sides of the disc.

Disc Strength Test

One valve of each size and category shall be subjected to disc strength test at a hydrostatic pressure of twice the maximum working condition for a period of minimum five (5) minutes.

Test shall be carried out with valve at tight shut condition and the other side open to atmosphere. For valves subjected to back pressure condition, disc strength test shall be carried out on both sides of the disc. Rubber seat shall be replaced after the test.

Performance Test
Each valve complete with operator shall be shop operated at least three (3) times from fully closed to fully open conditions and reverse, hold at intermediate positions under no flow condition, to prove the workability of the assembly.

Test at Site
Performance of the valves shall be tested at site at actual working condition, if specified in data sheets.

Cleaning
Prior to factory inspection, all manufacturing waste such as metal chips debris and all other foreign matter shall be removed from interior of valve. All mill scale, rust, oil, grease, chalk and all other deleterious material shall be removed from the interior and exterior surfaces.

Painting
Valves shall first be given two coats of zinc base primer after completely cleaning the surface and then it shall be coated with three coats of coal tar epoxy paint. The resulting coating shall be uniform and smooth and shall adhere perfectly to the surface.
For valves used in pipes carrying water, the inside coating shall not contain any constituent soluble in water or any ingredient which could import any taste or odor to the water.

Fixing Of Valves
Loading at store and unloading at site of works shall be done carefully using suitable mechanical handling devices such as crane, chain pulley etc. The arrangement of housing the valves with chambers and stable and firm foundations. The chamber and top roof cover with removable lid shall be provided so that it shall be possible to remove or replace or recondition the valves seats and to remove the parts without removing the valves from the pipe work. For this suitable flange adapters may be provided. Butterfly valves shall have high nitrile rubber seats, preferably metal reinforced, unless otherwise specified and shall be installed in the pipe work in such a manner that they can be removed from the line for dismantling and replacement of rubber seats.

Where the valves are required to be operated electrically, actuators shall be sized to guarantee valves closures at maximum possible differential pressure across the valve. Each actuator shall be supplied with installation, instructions and wiring diagrams and sufficient spare parts.

Valves used on pipeline shall be straight through type and non chokable. Each valve or its operation equipment shall bear an approved name plate stating its function. All operation spindles, gears and head stocks shall be provided with adequate points for lubrications.
The tightening of nut and bolts shall be done smoothly in such a way that no excessive strain occurs on any one side. The nuts shall be tightened on diametrically opposite site at a time.

Tender Drawings

The following documents shall be submitted by Bidder along with the quotation.
Preliminary outline dimensional drawings.
Typical cross section drawings.

Supplier's data sheet showing valve size, pressure rating, test pressures, list of tests to be conducted etc.
List of spares for two years.

ELECTRICAL ACTUATOR WITH INTEGRAL STARTER:

SCOPE :

This specification covers the design requirements, features of construction, inspection, testing, painting, delivery, installation and commissioning of actuator with integral starter with required hardware etc.

CODES AND STANDARDS :

The design and manufacture of the actuator shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall relieve the vendor of this responsibility. It shall be manufactured with relevant national/international standard.

DESIGN REQUIREMENTS:

1. Electrical Actuator shall be selected based on the working of actuator at rated pressure of valves/ gates. Each actuator shall be adequately sized to suit the application and be continuously rated to suit the modulating control required. The operating gear of all pen stocks / Sluice Gates shall be capable of opening or closing the gate against and unbalanced head equal to the maximum working pressure. The valve actuator shall be capable of producing not less than 1.3 times the required valve torque and shall be suitable for at least 15 minutes continuous operation.
2. The actuators shall develop the required torque to operate the valves smoothly and there shall not be any jerks in the operation at any position.
3. The actuator shall be capable of functioning in an ambient temperature ranging from 0 • C to +50 • C
4. Motor shall be of suitable rating to work with design safety margin on maximum torque required for open & close valve at design working pressure of valve/gate.
5. In case of underground valves in chambers, necessary appropriate head stock, shaft extension, coupling, support, etc. shall be considered, actuator shall be mounted minimum 1.0 mtr height above the ground/chamber.
6. Contractor shall have consider all parameter such a temperature, site environment, site condition, Fixing provision etc. before designing and supply.
7. Following data shall be provided:
   Stem diameter
   No. of turns from full open to full close position.
   Selection of gearbox, if necessary and as per selection of model of actuator.
   Consider required coupling, stuffing box etc.
   Required Torque for opening as well for closing.

CONSTRUCTIONAL FEATURES:

1) Valves shall be operated by an electro mechanical actuator, comprising of motorized gear train and screw assembly which drives the valve stem. The actuator shall be supplied with the following accessories.
   - A.C. electric motor.
   - Reduction gear unit and stool
   - Coupling to couple with existing valves / gates
   - Torque switch mechanism complete with set of torque switches
   - Limit and Auxiliary switch for protection (such as over travel limit, intermediate position indication, etc ….),
   - Hand wheel for manual operation.
   - Auto manual clutch,Hand-auto change over lever with suitable locking arrangement.
   - Local/remote control switch/push buttons
   - 415/110 V AC control transformer
   - Local LCD Display with Digital Valve position indicator.
   - Integral forward reverse starter

A.C. ELECTRICAL MOTOR:

2) A.C. electrical motor provided shall be fully tropicolised and suitable for operation in the prevailing climate conditions. They shall be suitable for operating satisfactorily under variations of electric supply.
3) Motors shall be 3 phase. Squirrel cage induction motor as per IS 325 minimum efficiency class 2, with insulation class "B", winding to be impregnated to render them non-hygroscopic / oil resistant suitable to operate in any harsh & corrosive environment. Motor shall be rated for 15 / 30 min. It shall be protected by bi metallic relay or electronic relay. Reset should be manual.

ACTUATOR:

4) The actuators shall be heavy duty and shall capable of opening and closing of the valve/gate. Actuators shall be suitable for operation on 3 phase. 415+10% volts, 50 Hz+3% A.C. supply.

5) Enclosure shall be IP 67.

6) The actuator shall be local controls comprising switches for Open, Close and Stop and a Local/Remote selection lockable in any one of the following three positions:
   - Local control only,
   - Off (no electrical operation),
   - Remote control with local stop only.

The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity for stopping the actuator.

STARTERS:

7) Reverse forward starter shall comprise electrically and mechanically interlocked reversing contactors, suitably rated, HRC type fuses.

8) Local control shall comprise push button for operations of CLOSE, OPEN AND STOP. Local-remote selector switch shall be provided having three different positions viz, local remote only, remote control plus local stop only and stop locked off-no electrical operation.
9) Internal wiring shall be as follows: control wiring of 1.5 mm2 copper control cable and power circuit of 4 mm2 cable. Suitable cable entry shall be provided.
10) The terminals shall be provided to terminate a wire cross section up to 6 Sq.mm. copper cables for power & 2.5 Sq.mm for controls cables.

ACTUATOR STARTERS WITH INTEGRAL STARTERS:

When specifically asked, the actuators starters shall be integrally housed with the actuator in a robustly constructed totally enclosed weather proof housing. The motor started shall be capable of starting the motor under the most server conditions.
The starter housing shall be fitted with contract and terminal for power supply, remote control and remote positional indicating, and shall also be fitted with internal heaters so as to provide protection against damage to conditions. Heaters shall be suitable for single phase 110 volt operation. The hears shall be switched "ON" when the starters are "OFF" and shall be switched "OFF" when the starters are "ON" .

Each starter shall be equipped as follows.

a. 2 No. T.P. Magnetically operated line Contactor with no-volt release and electrical and mechanical interlock.
b. 1 No. T.P. Thermal cut-out device.
c. 1 No. 415 – 110V, Control, Circuit Transformer fully protected by fuses on primary and secondary circuits.
d. 1 Set of "Open","close" and "Stop" buttons.
e. 1 No. Local – Off –Remote switch with padlocking facilities.
f. 1 No. Set of Torque and limit switches for "Open" and "Close" positions with 2 NO + 2 NC contacts.
g. 2 Sets of Auxiliary limit switches with 1 NO + 1 NC contacts for intermediate position.
h. 4-20 ma signal unit provided for SCADA operations.

REDUCTION GEAR UNIT:

11) Reduction gear unit shall be of totally enclosed oil bath/grease lubricated type. Gear box shall be provide with the first charge of oil lubricants and appropriate filling and drain connection. This is not applicable if it is grease lubricated.
12) Gearing shall be adequate to open and close the vale under full maximum operating pressure differential at a speed sufficient to cover the extent of travel.
13) The gear box shall have suitable stops to have stops at definite location. i.e. to prevent movement of shaft beyond fully open/close position. The gear box shall also be designed for 15 5 torque than maximum valve torque,.
14) The valve operating equipment shall have hammer blow device to loosen stuck valve or retrieve jammed valve position as an inbuilt feature achieved through "Lost motion principle"

HAND WHEEL WITH MOTOR RIDING FEATURE:

15) The actuator shall be provided with a hand wheel for emergency manual operation. The selector fork lever when put on the hand position shall disconnect the motor drive. When the motor is switched on the hand wheel connection shall be disengaged automatically. Hand wheel shall be marked with open and close direction.
16) Hand wheel shall not rotate during electrical operation & Manual drive operation shall automatically disengage when the motor starts.

LOCAL INDICATOR/DISPLAY:

17) A actuator should have a local LCD display to show the local digital position indication to show the actual position of the valve. Along with the digital position indicator, actuators should also show the status as well as fault indications/information of actuator on LCD display.

SPACE HEATER:

18) An anti condensation heater shall be provided in switching compartment of the actuator.

LUBRICATION:

19) Actuators shall be grease-filled prior to dispatch from the factory. Apart from periodic inspection, no lubrication maintenance shall require. Actuator should be suitable for any positional mounting.

RISING SPINDLE GATE/VALVE:

20) All actuators with the exception of rising spindle penstock shall be equipped with indicators showing whether the penstock is fully open or closed. A transparent P.V.C. cover shall be fitted to protect the thread of the rising spindle.
21) All operating spindles, gears and head stock shall be provided with adequate points for lubrication.

PROTECTIONS:

AUTO PHASE CORRECTION:

The controls should monitor the rotation of the incoming 3 phase supply and automatically directs the actuator controls to ensure that the motor always runs in the correct direction throughout the life of the unit.

SINGLE PHASE PROTECTION:

If one or more phases are lost the control circuit will be prevented from energizing the contactors.

INSTANTANEOUS REVERSAL: