

Thirumudivakkam Industrial Enviro Company Pvt., Ltd.,  
PP 3, Communication Centre,  
TANSIDCO Industrial Estate,  
Thrumudivakkam, Chennai-600 132  
Ph: 7278112345, 9444089840 / E.Mail : tiecotmv2019@gmail.com

## CORRIGENDUM

S.NO	QUERY	CLARIFICATION
1	The Earnest money deposit of Rs. 1,50,000/- has to be paid as per item 6 of Volume 1, Page 10. For MSME, paying of EMD is exempted in TANSIDCO tenders. Request you to consider this.	IF YOU HAVE THE UDHAYAM CERTIFICATE AND YOU HAVE TO PRODUCE IT & THEN IT CAN BE EXEMPTED
2	In Page 14, Volume 1, item 3A, it is stated that bidder has to produce bankers solvency certificate obtained from any nationalized bank for a value of Rs. 50,00,000/- It is requested to consider that the solvency certificate shall be obtained from any nationalized / scheduled bank, instead of nationalized bank alone.	ANY SCHEDULED BANK WHICH COMES UNDER RBI CAN BE ACCEPTED
3	In Volume I, Page 3, item 8, it is mentioned that the contract will be an item rate contract and work done will be measured and paid for at the rate agreed as per schedule of quantities. Accordingly in Volume 2, from Page No. 76 to 78 the Bill of Quantities are given. But in Page 67, Unit wise bill of quantities are given for civil structures. Volume-II, page No.66-68, BOQ for Electromechanical items and page No.77 & 75 for BoQ civil quantity mentioned as approximate. It may vary according to the design furnished by tenderer.	1.Vol1 Page 3 is mentioned for No escalation is Price and you are responsible for One year free O&M. You have to give your quote for the Second and third year for O&M. 2. Vol 2 Page 76-78 and Page 67 BOQ given ..you have to fill up the cost against each line item and Add total and add GST for the Total Value and submit your Quote
4	In the tender, 2 stage RO system are provided to recover the permeate from the treated effluent. But in Electric power load calculation Page 65, Volume 2, RO 3 pumps are considered. Please clarify.	RO THREE STAGES REQUIRED
5	In Page 68, Volume 2 for bill of quantities of Electro mechanical units, item 13 and 14 both are mentioned as Pressure sand filter. Please clarify	IT IS TYPOGRAPHICAL ERROR 13. ACF 14.PSF
6	In Page 78, item 5, Volume 2, generalized finishing work category is provided with quantity of 1229.09 m2.	AS MENTIONED IN SUB HEAD 5 THE FINISHING WORKS SHOULD MEET THE SPECIFICATION



7	But the finishing works like outer plastering requirements, other site cleaning process, compound wall, drainage, disposal of surplus earth, dewatering, Rock excavation, if any not considered. Please clarify.	WHAT YOU HAVE MENTIONED IS PART OF THE CIVIL WORK WHICH COMES UNDER YOUR SCOPE ONLY
8	Tender title says O&M required for 1 year; while detailed specifications says that O&M is need for 3 years. Client to clarify the same.	O&M IS FREE FOR THE FIRST YEAR . YOU HAVE TO QUOTE FOR SECOND AND THIRD YEAR APART FROM THE PROJECT COST
9	Payment Terms- The breakup of payment terms does not account to 100% for both supply & erection. In addition, Civil & O&M payment terms have not mentioned in the tender document. Please advice.	IT IS CLEARLY MENTIONED IN VOL 1 PAGE 5 PAYMENT ON SUPPLY COVERS 95% AND FINAL PAYMENT OF 2.5% WILL BE RELEASED ON OBTAINED CERTIFICATE FROM CEIG AUTHORITY, EFFLUENT QUALITY CERTIFICATE FROM TNPCB AND ALSO PROVIDE PERFORMANCE GUARANTEE OF 10% OF THE VALUE OF THE WORK FOR COMPREHENSIVE OPERATION AND MAINTENANCE IN THE FORM OF IRREVOCABLE BANK GUARANTEE FOR A PERIOD OF 3 YRS.IN THE FINAL PAYMENT OF 2.5% VALUE OF WORK WILL BE RETAINED FOR ONE YEAR AS GUARANTEE FOR DEFECT LIABILITY PERIOD
10	Payment Terms- The breakup of payment terms does not account to 100% for both supply & erection. In addition, Civil & O&M payment terms have not mentioned in the tender document. Please advice.	CIVIL ITEMS ALSO COMES UNDER LINE ITEM AND IT IS COMING UNDER SUPPLY AND ERECTION ONLY.. O & M IS FREE FOR FIRST YEAR
11	Please clarify on the Insurance mentioned for natural calamities	NO. PLEASE SEE VOL1 PAGE 6 TITLE: RISK INSURANCE
12	Last date for tender purchase:	7TH OCTOBER 2021 / 3 PM

13	Date of tender submission and its place of submission	8TH OCTOBER 2021 / 3 PM : THIRUMUDIVAKKAM INDUSTRIAL ENVIRO P LTD OFFICE PP3 COMMUNICATION CENTRE TANSIDCO INDUSTRIAL ESTATE THIRUMUDIVAKKAM CHENNAI 600132
14	Date of tender opening	8TH OCTOBER 2021 / 4 PM (TECHNICAL BID ONLY) AT SPV OFFICE
15	PLC/HMI/SCADA – mentioned please confirm whether it is fully automatic system up to MEE/ATFD or below spec alone need to consider · UF system has been fully operated from PLC · RO monitoring and all instruments monitoring shall be done through PLC	YES
16	EMFM Online connectivity to TNPCB from the CETP – clarity required on the scope required.	YES
17	Mini Lab setup –BOD, COD, Jar Test, pH, Conductivity – clarity required on the scope of working table, exhaust, water sinks, etc.	MINI LAB IS REQUIRED AS PER THE DETAILS GIVEN IN PAGE 114 VOLUME 1 . THE ADEQUATE SIZE OF THE WORK TABLE , RECORD KEEPING STORE RACKS, NECESSARY SINKS, EXHAUST ETC IS YOUR SCOPE. YOU CAN SUBMIT YOUR PLAN AND GET APPROVAL FROM US AT STAGES.YOU NEED TO PROCURE ALL TYPES OF GLASS WARE ACCESSORIES CONSUMABLES FOR MINIMUM ONE YEAR REQUIREMENT
18	Raw Effluent TDS is 15000 ppm considering 80% recovery then MEE feed TDS is 75000 ppm in tender it mentioned as >30000 ppm please confirm inlet Feed TDS need to design for 15000 or less than that	TDS RAW EFFLUENT <15000mg/lit - After UF <2750
19	Is the raw effluent from plants to the tank is by gravity or thro pump	COLLECTED IN LORRIES AND DELIVERED TO THE SITE
20	Is there any chemical we should use that you suggest? Or the chemical can be decided by the Contractor?	YOU NEED TO GET OUR APPROVAL ABOUT THE CHEMICALS YOU ARE USING FOR THE PROCESS . IF YOU NEED INPUT WE WILL ALSO SUGGEST THE RIGHT CHEMICAL
21	Is Procurement of Chemicals during DLP Period and O&M Period is Contractor scope	YES
22	Is Mechanical Seal required for all the Pumps	YES



23	As per the process description, specification of electromechanical equipments table, RO SYSTEM provided is of two stages, where as the Electrical load detailed table, there is a third stage RO Please specify	RO THREE STAGES REQUIRED
24	Is pH adjustment is required	YES
25	Is Disposal of Sludge is Client's Scope	YES
26	As per the Process decription there are two stages of Calendria. But as per Bill of quantities and in Electromechanical elements triple effect calandria is mentioned. PI Clarify	There are only two stages of Calendria We are attaching the Operating Parameters and Specification of MEE & ATFD & LAB once again for your preview.
27	Given the number of Sludge recirculation pump is 4, in what locations should these four pumps be installed	2 NOS PRIMARY CLARIFIER AND 2 NOS SECONDARY CLARIFIER - ONE FOR WORK AND ONE FOR SPARE IN EACH STAGE.PLEASE SEE THE DRAWING -ZLD PLANT - EQUIPMENT LAYOUT AND STRUCTURAL DRAWING
28	it is given that 13 electromechanical flow meters are required, But as per Page 48, only 8 electromechanical flow meters given?	13 NOS REQUIRED
29	The Various drawings and Performance curves of pumps asked will be provided by the vendor only after placing the order, hence it is not possible to submit it along with Proposal	YOU CAN SUBMIT THE VARIOUS DRAWINGS AFTER YOU GOT THE ORDER PLACED ON YOU
30	In the treated water characteristics the amount of heavy metals present gets reduced to below detectable limit after pretreatment itself?	YES
31	The sludge holding tank is not mentioned in the drawings sheet where as in flow chart holding tank given . PI clarify	SEPARTE SLUDGE HOLDING IS NOT REQUIRED
32	PROJECT COST - SEEMS TO BE LESS .. HOW TO MEET?	GOVT APPROVAL IS FOR 2.6 CRORES ONLY. YOU HAVE TO GIVE YOUR BEST COMPETETIVE QUOTE TO MEET THE SPECIFICATIONS

For TIECO

  
Managing Director

Thirumudivakkam Industrial Enviro Pvt., Ltd.,  
PP 3, Communication Centre,  
TANSIDCO Industrial Estate,  
Thrumudivakkam, Chennai-600 132  
Ph: 7278112345, 9444089840 / E.Mail : tiecotmv2019@gmail.com

**TENDER NOTICE**

Sealed Tenders are invited by M/s.ThirumudivakkamIndustrial Enviro Pvt., Ltd., PP 3, Communication Centre, TANSIDCO Industrial Estate, Thirumudivakkam, Chennai – 600 132, Tamil Nadu, India, the Special Purpose Vehicle (SPV) for the construction of Effluent Treatment Plant to be set up at TANSIDCO Industrial Estate, Thirumudivakkam, Chennai – 600 132, Tamil Nadu, with financial assistance under the Common Prodsuction Infrastructure (CPI) scheme of Government of Tamil Nadu

ITEM	PARTICULAR	QTY in Nos	EMD in Rs.	Appx. Value Rs. In lakh	Period of Completion
1	Construction of Common Effluent Treatment Plant 200 KLD with ZLD	1	1,50,000	260.00	180 days

Technical Specifications for the above are available in the Tender Document.

Tender document **of Rs.15,000+ GST 18% - DD in favour of TIECO Pvt. Ltd., payable at Chennai towards the cost of tender can be downloaded from the websites [www.tansidco.tn.gov.in](http://www.tansidco.tn.gov.in) or [tiema.co.in](http://tiema.co.in)** and the same may be submitted along with the demand draft as mentioned above.

- Date of commencement of sale of tender 09.09.2021 @ 10.00 am
- Date of Pre-Bid Conference at SIDCO, C.O., Chennai 22.09.2021 @ 3.00 pm
- Last date for issue of Tender 07.10.2021 @ 05.00 pm
- Last date for receipt of Tenders / downloaded 08.10.2021 @ 03.00 pm
- Date of opening of sealed Tenders at SPV office (Technical bid only) 08.10.2021 @ 04.00 Pm

Managing Director,  
TIECO Pvt. Ltd.,

# **Thirumudivakkam Industrial Enviro PvtLtd**

PP3 Communication centre,  
SIDCO Industrial Estate,  
Thirumudivakkam,  
Chennai

## **VOLUME – I PRE-QUALIFICATION BID**

**NAME OF WORK : DESIGN, ENGINEERING, CONSTRUCTION, SUPPLY, INSTALLATION, COMMISSIONING AND O & M FOR ONE YEAR OF 200 KLD COMMON EFFLUENT TREATMENT PLANT WITH ZERO LIQUID DISCHARGE FOR TIECO, THIRUMUDIVAKKAM, KANCHIPURAM DISTRICT, TAMILNADU. (Two Cover System).**

**EMD AMOUNT : Rs.1,50,000 + GST.**

**DATE OF TENDER : 9<sup>th</sup> September 2021**

**ISSUED TO :**

**Managing Director, TIECO**  
PP3 Communication Centre,  
SIDCO Industrial Estate,  
Thirumudivakkam, Chennai.  
Contact No: +917278112345, +919444089840  
Email : [tiectmv2019@gmail.com](mailto:tiectmv2019@gmail.com)  
website <http://tiema.co.in>

## **FOR THE SPECIAL ATTENTION OF THE BIDDERS**

1. Issuance of documents under two cover system i.e. Qualification schedule and Price tender schedule (Commercial tender) to the bidders will be purely based on the basic documents and information furnished along with the requisition and cost of tender documents. Issuance of documents will not confer any right on the bidder for automatic qualification for price tender for the work.
2. Approval or otherwise of the Qualification bid will be strictly based on the detailed evaluation done on the basis of the Documents / Records / Evidences / Certificates produced by the bidders in the Qualification bid.
3. Qualification bid (Cover 1) will be opened as per notice inviting tender and after detailed evaluation, the date and time of opening of price bid will be intimated to the qualified bidders.
4. The bidders shall quote for operation and maintenance charges for a period of 3 years after the Defect Liability Period of one year in the format furnished in price bid. This will be taken into consideration for tender evaluation purpose.
5. The bidders shall be responsible for properly super scribing and sealing the covers in which the bid is submitted and the Tender Inviting Authority shall not be responsible for the accidental opening of the covers that are not properly super scribed and sealed as required in the tender documents before the time fixed for tender opening.
6. Canvassing or influencing the Tender Accepting Authority in any form will entail disqualification.
7. Rates shall be firm throughout the contract period and no escalation shall be permitted.
  - A. **Defects Liability Period (DLP):** (Which shall also be free maintenance period) shall be 12 months from the date of virtual completion certificate or from the date on which all the defects have been rectified and so certified by the Consultant/ Engineers, whichever is later.
  - B. **Operation during Defects Liability Period:** During the Defects Liability Period of 12 months, the contractor must quote for the operation of the complete CETP system and must post suitable qualified persons having adequate field experience and knowledge in the operation of the CETP system.
  - C. **Comprehensive Operation and Maintenance for 3 years:** After expiry of the Defects Liability Period the contractor must quote for the comprehensive Operation and Maintenance of the CETP system inclusive of cost of materials, spares, labour etc with

adequate field Engineers / Staff for a period of 3 (Three) years. The Operation and Maintenance shall include the daily, weekly, monthly, quarterly, half yearly and annual checks and remedies if necessary to be performed for effective operation of the plant, elaborate detail, all operating and maintenance procedures and policies which are required, advisable and / or necessary for the Facility to achieve full compliance with the operational guarantees and to achieve maintenance and repair standard for the Facility which will ensure compliance with the maintenance specifications.

- D. **Guarantee:** The CETP should be guaranteed against faulty design, materials manufacture and workmanship for a period of 12 months from the date of handing over of the plant to the Department in perfect working condition. The guarantee should cover free replacement of defective parts / accessories of the mechanical and electrical parts in CETP system. The To and Fro Bata charges for Mechanic/ Electrician and transport charges for taking defective materials to the company and bringing them back to the site should be borne by the tenderer only. If at any time during the guarantee period the plant is out of order for more than a 10 days at a time, then the GUARANTEE period will be extended by the period RECKONED from the date the PLANT went out of order to the date when it was re-commissioned.
- E. **Free Servicing:** The mechanical and electrical installations in CETP should be serviced regularly on daily, weekly, monthly, quarterly, half yearly and annual checks during the GUARANTEE PERIOD AT FREE OF CHARGE. Break down calls should be attended immediately free of charge. The capability of tenderer in ensuring required after installation services must be stated.

#### **8. Item rate contract:**

The contract will be an item rate contract and work done will be measured and paid for at rates agreed as per schedule of quantities and as certified by the Consultant/ Engineers. No extra on any account whatsoever will be payable other than measured work as aforesaid.

#### **9. All taxes:**

The contractor shall be solely responsible for the payment of all taxes under the provision of the Tamil Nadu Government and Government of India General tax Act as in force of the time being and the rates for the various items for the works shall remain unaffected by any changes that may be made from time to time in the rate on which any Tax is payable. **GST: The tender invited excluding GST. At the time of acceptance of the tender and signing of agreement, the applicable GST of 18% has been included for this work.**

#### **10. Payment Details:**

The payment will be made as follows.



The final payment will be released on production of Safety Certificate availed from CEIG authority, Effluent Quality Certificate obtained from TNPCB and also provide performance guarantee of 10% of the value of work for comprehensive operation and maintenance in the form of irrevocable Bank Guarantee for a period of 3 years. In the final payment 2.5% value of work will be retained for one year as guarantee for Defect Liability Period.

The bidder shall quote rates for supply and erection of Mechanical and Electrical equipments as per the tender price bid.

**Payment on supply:**

70% of accepted supply rate of item :	Against delivery of materials at site.
10% of accepted supply rate of item :	On erection.
10% of accepted supply rate of item :	On testing and successful commissioning and handing over to SIDCO.
5% of accepted supply rate of item:	On completion of all necessary documentation, license, test certificate etc.

**Payment on erection:**

85% of accepted erection rate of item :	On completion of erection in position at site.
5% of accepted erection rate of item:	On testing and successful commissioning and after erection and handing over to TIECO.
5% of accepted erection rate of item:	On completion of all necessary documentation, submission of As-built drawings, maintenance manuals, licenses, test certificates etc.

**12. Exclusion:**

TIECO will assist for getting Electricity & Water connection during execution of work and cost will be beared by the Contractor.

**13. General Conditions:**

Unless otherwise specified, the conditions put forth in the General specifications and Special conditions of contract will hold good.

- I. The work should be carried out in Cooperation with the Department and other contractor working at site.
- II. For slow progress of Work/ Bad work–man ship/ leaving the work incomplete shape, the department will take action to impose fine / penalty as per Department penalty clause enclosed separately.

- III. The Contractor engaging the Labourers for the work is wholly responsible for any accident or death occurring to the Labourers while carrying out the work and the Department shall not be held responsible for such occurrence and for payment of compensation to the labourers.
  - IV. The work in TIECO executed by the contractor under the Contract shall be maintained by the Contractor until the work to be taken over by the Engineer in charge. "The Contractor shall arrange his own insurance against fire, flood, volcanic eruption, earthquake, other conditions of nature and all other natural calamities, risk arising out of acts of God during such period and that the Government shall be liable for any loss or damages occasioned by arising out of any such acts of God.
  - V. Provided however that the contractor shall not be liable for all or any loss or damage occasioned by arising out of acts of foreign enemies, invasion, hostilities or war like operations, (Before or after declaration of war) rebellion, Military or USUR ped power.
14. **Risk Insurance:**  
The work executed by the Contractor under this Contract shall be maintained at the Contractor's risk until the work is taken over by the Engineer TIECO. The Government shall not be liable to pay for any loss or damages occasioned by (or) arising due to flood volcanic eruption, earthquake other conditions of nature and all other natural calamities risks arising out of acts of God during such period and that the option whether to insurance coverage (or) not to cover such risks is left to the contractor.
15. **Labour:**
- I. The contractor shall not employ the labour below the age of 12 and shall also note that he must offer employment to ex-service man, ex-toddy tappers and unemployed agricultural labourers as far as possible.
  - II. The Contractor shall abide the contractors labour regulation of TIECO framed by the Tamil Nadu Government.
16. **Extension of Time:**
- I. The extension of time required to complete the work should be obtained by indicating the reasons for the delays and any period not covered by extension of time will be treated as unauthenticated calling for penal action.
  - II. Proper evidence should be produced by the firm to the satisfaction of the General Manager (Technical) – TIECO whenever Force Major Conditions arise.
17. **Security Deposit:**  
The successful Tenderer should furnish a Security Deposit 2% value of the contract in the form of N.S.C./Small Savings scripts / Deposits / Accounts duly pledged to favour of the Managing Director, TIECO, Chennai. Bank Guarantee will also be accepted. On evaluation of tender if it is found that if the overall quoted amount of the, tender is less than 5 to 15% of the

value put to tender, the Contractor shall pay additional security at 2% of the Estimated value. If the tender discount exceeds 15% to 20% the contractor shall pay an additional security deposit of 50% of the difference between the quoted amount and estimate amount. Failure to furnish the additional security Deposits within 15 days from the date of receipt of acceptance Order and execute the agreement shall detail cancellation of award of contract and forfeiture of E.M.D furnished. In such a situation the next lowest tender will be considered.

**Managing Director, TIECO**

PP3 Communication Centre,  
SIDCO Industrial Estate,  
Thriumudivakkam, Chennai.  
Contact No: +917278112345, +919444089840  
Email : [tiectmv2019@gmail.com](mailto:tiectmv2019@gmail.com)  
website <http://tiema.co.in>



**TWO COVER SYSTEM**  
**QUALIFICATION BID & PRICE BID APPLICATION**

**REF. NO.** \_\_\_\_\_

From

To

**Managing Director, TIECO**

PP3 Communication Centre,

SIDCO Industrial Estate,

Thirumudivakkam, Chennai.

Contact No: +917278112345, +919444089840

Email : tiecotmv2019@gmail.com

website **<http://tiema.co.in>**

Sir,

**Sub: Design, Engineering, Construction, Supply, Installation, Commissioning and O&M of 200 KLD Common Effluent Treatment Plant With Zero Liquid Discharge For TIECO, Thirumudivakkam, Kanchipuram District, Tamilnadu. (Two Cover System).**

Ref: : TENDER NOTICE NO:

Dated:

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Having examined the two cover system documents in respect of Qualification schedule & price tender schedule including scope of work, Time Frame for construction and the criteria stipulated for Qualification. I / We hereby submit all necessary information and relevant documents for qualifying me/us, to offer my/our tender for the above mentioned work.

The Application is made by me / us on behalf of (Partnership firm / Private limited company / Public Limited Company) in the capacity of \_ \_ \_ \_ \_ duly authorized to submit the tender.

Necessary evidence admissible in law in respect of authority assigned to me / us on behalf of the Partnership Firm / Private Limited Company / Public Limited Company, for applying for qualification is attached herewith.

We present my / our documents herewith taking into consideration all the instructions in the Qualification schedule supplied to me / us including special instructions to Applicants / Criteria for Qualification schedule / Information and Instructions in the detailed two cover tender notice etc.

The EMD amount is enclosed in the shape as notified in the Qualification bid

I / We understand that **TheManaging Director, TIECO**, PP3 Communication Centre, SIDCO Industrial Estate,Thriumudivakkam, Chennai, reserves the right to reject any or all the tenders or drop the proposals of receiving tenders without assigning any reason therefore.

**Date:**

**Signature of the Bidder including  
Title Capacity in which Application is made**

**Name:**

**(IN BLOCK LETTERS)**

Encl:

1. Qualification schedule.
2. Price tender schedule.

## **QUALIFICATION & PRICE TENDER NOTICE**

### **FORM OF CONTRACT :**

### **LUMPSUM AGREEMENT :**

### **TWO COVER SYSTEM**

**1. INVITATION:** Tender under sealed two cover tender system i.e. Qualification schedule & Price tender schedule (item rate tenders) are invited by **Managing Director, TIECO, PP3** Communication Centre, SIDCO Industrial Estate, Thirumudivakkam, Chennai. One Cover contains EMD and Qualification conditions and other details and the Second Cover containing price tender schedule.

**2. FOR SPECIAL ATTENTION:**

- I. The bidder should be a well-established and reputed contractor who have been registered Firm with the Government of Tamilnadu or other State Government/ Government of India/ State or Central Government undertaking.
- II. The bidder should have executed a work in single agreement of Construction, Erection and Commissioning, Start up and performance trial run for 1 year followed by 3 years of O&M of One work of 200 KLD capacity CETP with ZLD including civil works (OR) Two works of 100 KLD capacities CETP with ZLD including civil works with selected modern technology basis of value not less than One work of 80% value (OR) Two works of each 60% value (OR) Three works each of 40% value during any one of the last three years with specifications as mentioned above. The bidder shall produce letter of satisfactory completion report either from the client or from the consultant. The purchase / work order or agreement copy in this regard shall not be accepted.
- III. The bidder should have an annual turnover of Rs. 125.00 lakhs (Rupees One Hundred and twenty five lakhs) during any one year of the past three financial years. The bidder shall produce necessary audited certificate in this regard.
- IV. The bidder shall be solvent to a tune of at least **Rs. 50.00 lakhs** (Rupees Fifty Lakhs only) on immovable properties in his name. The applicant should produce current Revenue Solvency certificate on immovable properties for a value of not less than **Rs. 50.00 lakhs**, issued by the Tahsildar concerned. Necessary continuous Encumbrance certificate for the period from the date of Revenue Solvency certificate on the properties listed out in the solvency certificate shall be produced (or) The bidder should produce Banker's solvency certificate obtained from any Nationalized Bank for a value of Rs.50.00 Lakhs obtained not earlier than July 2020 or one month from the last date for submission of tender.
- V. The Bidder should have an office in Chennai.

**3. PURCHASE OF DOCUMENTS:**



- I. The documents under two cover system Qualification Schedule & Price tender schedule will be available for sale at a cost of Rs.15,000 +GST in the office of the Managing Director, TIECO, PP33 Communication Centre, SIDCO Industrial Estate, Thirumudivakkam, Chennai during office hours from **06/09/2021 to 05/10/2021**.
- II. Tender documents can be downloaded from the website <http://tiema.co.in> free of cost.

#### **4. DESCRIPTION OF PROJECT:**

Design, Engineering, Construction, Supply, Installation, Commissioning and O&M of 200 KLD Common Effluent Treatment Plant With Zero Liquid Discharge For TIECO, Thirumudivakkam, Kanchipuram District, Tamilnadu.

#### **5. PERIOD OF COMPLETION:**

The period of completion shall be **6 months–Calendar months**, which is inclusive of monsoon period from the date of handing over of the site to the successful tenderer.

#### **6. EARNEST MONEY DEPOSIT**

- A. Earnest money deposit of **Rs.1,50,000/- (Rupees One Lakh fifty thousand only)** must accompany the qualification Tender for this work.
- B. The Earnest money deposit may be produced in any one of the following forms.
  - I. Demand Draft issued by Nationalised or Scheduled Banks drawn in favour of the Tamilnadu Small Industries Development Corporation Limited.
  - II. Small savings scripts / Deposits / Accounts and Kisan Vikas Patras duly pledged in favour of the Tamilnadu Small Industries Development Corporation Limited.
  - III. Irrevocable Bank Guarantee in the prescribed proforma issued by Nationalised / Scheduled Bank in favour of the Tamilnadu Small Industries Development Corporation Limited.
- C. Qualification schedule not accompanied with Earnest money deposit will be rejected as 'Non-responsive' tender.
- D. If the tenderer withdraws his tender after the acceptance of tender or fails to pay the requisite security deposit amount within the specified period of time, the Earnest money deposit paid with the tender will be forfeited. Communication to the unsuccessful tenderers will be sent in **7** (seven) days time from the date of communication sent to the successful tenderer. Refund of Earnest money deposit will be made within **15** (fifteen) days from the date of receipt of refund vouchers duly stamped and signed from the unsuccessful tenderer.

## **7. SECURITY DEPOSIT:**

- A. The successful tenderer shall furnish a Security Deposit for an amount equivalent to 2% of the total contract value, which includes the earnest money deposit already paid within 15 days (Fifteen days) from the date of receipt of work order. If the successful tenderer fails to execute the contract (i.e. signing the agreement) within the aforesaid 15 days time, the Earnest Money Deposit amount remitted with the Qualification Tender will be forfeited.
- B. The Security Deposit in the shape of irrevocable Bank guarantee will also be accepted.
- C. In addition to the aforesaid security deposit, the Executive Engineer shall deduct from the running account bills, a sum equivalent to 5% (Five Percent) of the total value of each bill as retention money.
- D. 2½ % (Two and a Half Percent) of the total value of the work will be retained in the final bill of the work for a period of one year reckoned from the date of completion of the work . During this period of one year as all defects be made good according to the true intent and meaning hereof.
- E. The Retention money of 2½ % (Two and a Half Percent) of the total value of contract after deducting any amount due to the Department, shall be refunded to the contractor after the defects liabilities attached to the contract is over and certified by the Executive Engineer concerned that no liability is due from the contractor.
- F. The successful bidder shall also provide performance guarantee at 10% of the value of work for operation and maintenance in the form of irrevocable Bank Guarantee for a period of 3 years. The final bill for the main work will be released only on receipt of this performance guarantee.

## **8. LANGUAGE OF TWO COVER TENDER SYSTEM:**

Tenders shall be offered only in the prescribed forms in “**ENGLISH**” only.

## **9. VALIDITY OF PRICE BID:**

The price bid shall be valid for a period of 90 days (Ninety Days) from the date, notified for opening of price bid.

## **10. SUBMISSION OF PRICE BID BY TWO COVER SYSTEM**

Bidders should quote their rates both in figures and in words for each item per unit and amount for each item of work for full quantity. Grand total of the whole contract should be furnished without fail in the last page of schedule of Price bid.

- A. The two covers (i.e. Qualification bid and Price bid) must be submitted separately in a wax sealed envelope. The Cover No.1 containing the Qualification bid, EMD & Documents and Cover No.2 containing the Price bid (Called as inner envelopes) must be super scribed as mentioned below and addressed to the Tender Inviting Authority.

(a)	Cost of tender documents	<b>Rs.15,000.00 + GST</b>
(b)	Period of issue	<b>06/09/2021 to 05/10/2021</b>
(c)	Earnest Money Deposit (EMD)	<b>Rs.1,50,000/-</b>
(d)	Last date for submission of bids	<b>05/10/2021 till 3.00 pm.</b>
(e)	Opening of Pre-Qualification Bid	<b>05/10/2021 @ 3.30pm.</b>
(f)	Pre – Bid meeting	<b>14/09/2021 @ 3.00pm.</b>

*SHOULD BE SUPERSCRIBED AS FOLLOWS*

<b>COVER NO.1 QUALIFICATION BID</b>	<b>COVER NO.2 PRICE BID</b>
a. NAME OF WORK b. TENDER NOTICE NO. c. DUE DATE FOR OPENING OF TENDER d. E.M.D. <b>Rs.1,50,000/- (Rupees One Lakh fifty thousand only)</b> To be furnished only with the qualification Tender e. NAME OF CONTRACTOR AND ADDRESS	a. NAME OF WORK b. TENDER NOTICE NO. c. NAME OF CONTRACTOR AND ADDRESS

- B. Tenders received in late on any account or any reasons whatsoever will not be opened or considered and will be returned to the tenderer unopened.
- C. Bids made by telegram, fax, e-mail or telex, Post, Courier will not be considered.
- D. Department will not take any responsibility for the delay / loss in transit of the tenders sent by Post.

## **12. OPENING OF TENDERS :**

The Qualification bid will be opened by the Managing Director, TIECO, PP3 Communication Centre, SIDCO Industrial Estate, Thirumudivakkam, Chennai at **15.30 Hours, on 05/10/2021** in the presence of the tenderers or their authorised representatives who choose to be present. If the last day for receipt of tenders is declared as a Government holiday subsequent to the issue of this notice, the tenders will be received upto 15.00 hours. of the next working day and opened at 15.30 hours on the same day. After detailed evaluation of Qualification bid, Price bid (Cover – II) of the qualified contractors those who are satisfying the eligible criteria only will be opened. The date and time of opening of price bid will be informed to the qualified bidders by the



Managing Director later. The Price bid Cover of the unqualified bidders will be returned to them unopened.

**13. NEGOTIATION :**

Negotiation of rates will be made only with the lowest tenderer for reducing the quoted rates.

The E.M.D. is liable to be forfeited if the tenderer withdraws his / their tender after acceptance of the tender.

**14. WHOM TO CONTACT:**

Managing Director, TIECO, PP3 Communication Centre, SIDCO Industrial Estate, Thriumudivakkam, Chennai may be contacted for further information in the matter.

**Dated signature of the Bidder with  
seal**

**Managing Director, TIECO**  
PP3 Communication Centre,  
SIDCO Industrial Estate,  
Thriumudivakkam, Chennai.  
Contact No: +917278112345, +919444089840  
Email : [tiema2019@gmail.com](mailto:tiema2019@gmail.com)  
website <http://tiema.co.in>

## **INFORMATION AND INSTRUCTION FOR TENDERERS UNDER TWO COVER SYSTEM**

- 1. FOR SPECIAL ATTENTION :** Qualification Tender hereunder is invited in accordance with the PWD Procedure for Qualification of Tenderers.
- 2. SCOPE OF WORK:** Design, Engineering, Construction, Supply, Installation, Commissioning And O & M For One Year Of 200 Kld Common Effluent Treatment Plant With Zero Liquid Discharge. Apart from the prescribed scope of work, the tenderer shall quote for 'Operation & Maintenance' of the Plant for two consecutive years after one year mandatory 'Operation & Maintenance'.
- 3. MINIMUM CRITERIA FOR QUALIFICATION:**

- A.** The bidder shall remain in the same "NAME" and "STYLE" should have been in the field as a well-established and of long standing experience of at least for the past "FIVE" years.

**Evidence to be produced:**

- a. Audited Balance sheet with Chartered Accountant's Certificate for the past **"THREE"** years in the case of individual Contractors, Partnership Firms, Private / Public Limited Companies.
- b. Registered Partnership deed in the case of Partnership Firms.
- c. Articles of Association and memorandum of Association registered with Registrar of Companies as per company act in the case of Private Limited Companies and Public Limited Companies.
- d. The bidder should produce Revenue Solvency Certificate on immovable properties for value of not less than Rs.50.00 Lakhs (Rupees fifty Lakhs only).

**Evidence to be produced:**

- a. Current Revenue Solvency Certificate issued by Tahsildar concerned.
- b. Necessary Encumbrance Certificate issued by the Registration Department on the properties listed out in the Solvency Certificate for the period from the date of issue of solvency upto August, 2021 without break.
- c. If the date of Solvency Certificate is on or after July, 2020, Encumbrance Certificate need not be produced.

**(OR)**

- a. The bidder should produce Banker's solvency certificate obtained from any Nationalised Bank for a value of Rs.50.00 Lakhs obtained not earlier than three months the last date for submission of tender.

- B.** The bidder should produce Income Tax returns valid for the current period & 'TIN' Number, 'GST' Verification Certificate valid for the current period.

**Evidence to be produced:**

- a. The Income Tax (PAN No.) claimed and paid during the past "THREE" years and the total contract amount received in the past "THREE" years should have been reflected therein.
  - b. Attested Copy of Registration Certificate showing the 'TIN' Number assigned by the Commercial Tax Department issued by the Competent State / Central Commercial Tax Department officials.
  - c. Attested Photocopy of the 'GST' certificate issued by competent State / Central Commercial Tax Department officials.
- C. The bidder should furnish the details of Common Effluent Treatment Plant works completed during the past "FIVE" years.

**Evidence to be produced:**

List of CETP works completed in the past five years with full complete details such as

- a. Name of Work
- b. Value of work
- c. Name of Employer
- d. Agreement Number
- e. Period of Completion as stipulated in the agreement
- f. Time taken for completing the work
- g. Reasons for delay if any
- h. Type & Nature of work
- i. Certificate issued by the competent authority not below the rank of Executive Engineer.

**Details furnished without supporting certificates will not be considered.**

- D. The bidder should have executed One work of 200 KLD or more capacities CETP with ZLD including civil works Two works of 100 KLD or more capacities CETP with ZLD including civil works of Construction, Erection and Commissioning, Start up and performance trial run for 1 year followed by 3 years of O&M of 200 KLD Common Effluent Treatment Plant With Zero Liquid Discharge with selected modern technology basis of One work of 80% value or Two works of each 60% value or Three works each of 40% value during any one of the last three years with specifications as mentioned above.

**Evidence to be produced:**

The bidders shall produce letter of satisfactory completion report either from the client or from the consultant clearly showing the following details.

- a. Name of work
- b. Location of the work – (Town / Taluk / State)

- c. Name / Designation of the Employer / Owner
- d. Value of work – (As per Agreement)
- e. Agreement Number
- f. Stipulated period of contract as per agreement
- g. Date of commencement of work
- h. Date of actual completion of work
- i. Reasons for delay in completing the work, if any
- j. Actual value of work as per final payment made
- k. Quality of work executed.

**The purchase / work order or agreement copy in this regard shall not be accepted**

- E. Annual turnover of the bidder should not be less than **Rs. 125.00 lakhs** (Rupees One Hundred and Twenty Five lakhs only) per year during any one of the year of the preceding “three” years.

**Evidence to be produced:**

- a. Audited Balance sheet, Profit and loss Account etc., duly certified by the Chartered Accountant for the preceding “THREE” years.
- b. The total contract amount received as shown in the Balance Sheets should have been reflected in the Income Tax Clearance Certificate also. In case if there is difference in the contract amount received as depicted in the Balance sheets and as furnished in the Sales Tax Clearance Certificate, lesser among the two figures alone will be taken for consideration.

- F. The bidder should have a minimum issued and called up Share capital plus capital reserves equal to at least 20% of the value of work for which qualification bid & price bid have been called for – (In this case 20% value of the work is Rs.40.00 lakhs (Rupees Forty lakhs only)

**Evidence to be produced:**

- a. Audited Balance Sheet for the preceding three years duly certified by the Chartered Accountant.
- b. The amount indicated in the Audited Balance Sheets as
  - I) Paid up Share Capital In the Case of Private / Public Limited Company.
  - II) Called up and subscribed share capital In the Case of Private / Public Limited Company.
  - III) Partner’s Capital Account in the case of Partnership firm.
  - IV) Individual Capital Account in the case of individual Contractors.

V) Reserves and Surplus fund Available in Capital account and FD alone will be taken as amount available as paid up share capital / called up share capital.

H. The bidder shall have working capital available at least sufficient to finance one – month current activity on the assumption that this work is awarded to the applicant, on being qualified.

**Definition:**

- a. Working capital means the amount available in the Bank Accounts of the applicant on the date of submission of application plus the unutilised amount of overdraft / credit facility extended to the applicant by the Nationalised / Scheduled Banks.
- b. One month current activity means, sum total of the value of the unfinished portion of works already committed by the applicant and being executed by the applicant–(out standing value)-divided by the balance period available for completion of each of the committed works under execution plus the value of the work for which the qualification Tender & price tender is called for divided by the number of months stipulated for its completion.
- c. Outstanding value of committed works means the total value of each project under execution minus the value of work completed as on the date of submission of qualification schedule.

**Evidences to be produced:**

- a. List of works already committed by the applicant and are in progress.
- b. Certificate–(for each of the committed works)- issued by the Engineer-in-charge– (Not below the rank of Executive Engineer / Project Engineer)- of the work, being executed by the applicant with the following details.
  1. Name of work
  2. Name / designation of the Owner / Employer
  3. Agreement Number
  4. Total value of the work
  5. Period of completion stipulated in the agreement
  6. Date of commencement of the work
  7. Balance period available for completing the work
  8. Value of work so far completed.
  9. Value of Balance items of work to be completed.
  10. Physical Progress or stage of work
  11. Remarks

- c. Certificate issued by Bank / Banks / showing the amount available (on the date of submission of application) in the current Account / Savings Bank Account of the applicant.
- d. Certificate issued by the Bank / Banks showing the limit up to which overdraft / credit facilities is extended to applicant and the overdraft / Credit facility availed by the applicant up to date and the unutilized overdraft / credit facility available.

**Note:**

Fixed Deposit in the name of the “Bidder” will also be considered for the purpose of working capital, on production of “Certificate” issued by the Respective Banks, clearly stating that the Fixed Deposits are available in the Name of the “Applicant” and the same are “Encumbrance Free” and can be readily “Cashable”.

- I. The bidder should not have any of his contracts terminated / rescinded due to breach of contract on the part of the applicant during the past "FIVE" years by any agency.

**Evidence to be produced:**

Sworn in affidavit duly certified by Notary Public, is to be produced (Specimen appended) – in twenty rupee Non-Judicial Stamp Paper.

- J. The bidder shall have Site Engineers with B.E., Degree in Civil/Environmental Engineering and Diploma in Electrical Engineering with minimum field experience, noted against each, available as given below, exclusively for this work.

<b>Site Engineers:</b>	<b>: 1 No</b>	- (One number) – B.E., Degree in Civil/Environmental Engineering with at least three years experience
	<b>: 2 Nos</b>	- (Two Numbers) One Diploma in Electrical Engineering with at least three years experience and One Diploma in Civil Engineering with at least three years experience.

**Evidence to be produced:**

- a. List of Technically Qualified personnel under permanent / regular employment available with the Applicant with details such as (a).Name (b). Qualification (c). Total Experience (d). Under regular Employment with the applicant since ----- (e). Emoluments paid etc.,



- b. List of Technical Personnel to be deployed for this work along with their willingness & attested Xerox copy of the testimonials in support of the qualification of the personnel to be deployed.
- c. If required numbers of Technical Personnel are not under Regular Employment of the applicant, Names, Qualification, Experience etc., of the Technical Personnel to be employed for this work along with their willingness and attested Xerox copy of the testimonials in support of the qualification of the Technical Personnel proposed to be employed exclusively for this work should be furnished.

K. The bidder shall have the EPF code of their own.

**Evidence to be produced:**

Xerox copy of the allotment order/Registration Number of the EPF Code issued by the Regional Provident Fund Commissioner.

**Note:**

- a. If any of the information furnished by the applicant is found to be concealed or false at a later date, the contract will be terminated forthwith without prejudice to the rights thereon, consequent on termination and the contractor will be banned from business dealings.
- b. All the documentary evidences should be stitched neatly and the pages should be serially numbered. Index of the Documents produced should be prepared and reference to page number of the documents produced should be furnished in the index.
- c. The Qualification Tender evaluation shall be done on a **PASS or FAIL** basis against each of the above Criteria.
- d. The evaluation will be done only based on the information, evidence, documents, Records, particulars furnished by the applicant and hence the applicants are advised to furnish adequate and relevant information along with requisite documentary evidences without any omission.
- e. As far as possible, details shall be furnished in the schedules appended to this Application. If the space left is found insufficient, additional sheets may be attached to the schedules.
- f. Photograph of the works completed by the applicants may be pasted in thick white paper and produced along with the documents.
- g. Brochures, Pamphlets etc, shall also be stitched along with the documents volume.
- h. All bidders are cautioned that the Qualification Tender application containing any deviation from the contractual terms and conditions, specifications or other requirements will be rejected as Non-Responsive and low performance reliability.

### **3. METHODS OF TENDERING:**

- a. If the Qualification bid is made by an individual, it should be signed by the individual, with his full name and his current address.
- b. If the Qualification bid is made by a sole Proprietary firm, it shall be signed by the proprietor along with his full name and full name of the firm with it's current address. Documents with regard to registration as firm by the Registrar of Firms should be produced.
- c. If the Qualification bid is made by a FIRM in partnership, it shall be signed by all the partners of the firm with their full names and current address or by a partner authorised by the firm (either as per Articles of the Deed of Partnership / by power of attorney)- for signing in Tenders, Agreements etc. In which case, certified copy of the registered deed of Partnership along with the current address of all the partners and a certified photocopy of the Registered Power of Attorney issued in favour of the signatory, should be produced. If the Qualification bid is made by a "Limited Company" or a "Limited Corporation ", it shall be signed by a duly authorised person holding the Power of attorney for signing the bid, in which case, the certified copy of the power of attorney shall accompany the qualification bid. Such limited company or corporation shall also furnish satisfactory evidence of its' existence along with the Qualification schedule.
- d. QUALIFICATION BID FROM JOINT VENTURES ARE NOT ACCEPTABLE.**
- e. All the signatures in the Qualification Bid and all the signatures in the Documents produced **Shall be dated.**
- f. All the originals of the documentary evidences shall be produced, if asked for, for verification at the time of opening of Qualification Bid or subsequently.

#### 4. CAPABILITY OF BIDDER:

The Applicant shall include with the Qualification bid, details in the prescribed performance schedule "A" to "G".

- |     |                        |   |
|-----|------------------------|---|
| i   | Schedule 'A'           | : Structure and Organization.   |
| ii  | Schedule 'B'           | : Financial Capability statement.   |
| iii | Schedule 'C'           | : Details of Technical Personnel under Regular Employment with the Applicant. |
| iv  | Schedule 'D1, D2 & D3' | : Work experience (Works completed & Works in progress )                      |
| v   | Schedule 'E'           | : Abandonment of work   |

vi Schedule 'F' : Affidavit

vii Schedule 'G' : Undertaking

## 5. OPENING OF QUALIFICATION BID & PRICE BID SCHEDULE

- a. The Qualification Bid & Price Bid schedule will be received in sealed cover (Separately) upto **15.00** Hours on **05/10/2021**. Qualification Tender will be opened on the same day at **15.30** hours by the Managing Director, TIECO, PP33 Communication Centre, SIDCO Industrial Estate, Thriumudivakkam, Chennai in the presence of the bidders or their Authorised representatives (who should produce the authorization issued by the Firm / Company) who choose to be present.
- b. The qualification Bid cover received will only be opened and evaluated on a PASS or FAIL basis against each of the Criteria.
- c. The Qualification Bid and Price Bid Schedule received belatedly on account of any reasons whatsoever will not be opened or considered and will be returned unopened to the bidder.
- d. E mail, Postal, Courier bids will not be entertained.
- e. The date of opening of Price tender will be notified to the qualified bidders after evaluation of qualification bid well in advance.
- f. **Website address :** <http://tiema.co.in>

**Dated signature of the Bidder With  
seal**

**Managing Director, TIECO**  
PP3 Communication Centre,  
SIDCO Industrial Estate,  
Thriumudivakkam, Chennai.  
Contact No: +917278112345, +919444089840  
Email : [tiectmv2019@gmail.com](mailto:tiectmv2019@gmail.com)  
website <http://tiema.co.in>

## Schedule "A"

### STRUCTURE AND ORGANISATION

- 1 Name of the Bidder :
- 2 Status :
  - Individual contractor
  - Sole :
    - proprietary Firm :
    - Firm in Partnership :
    - Private Limited company :
    - Public Limited Company :
- 3 Head office/Registered office address with phone / Telex / Fax :  
Number.
- 4 Regional office address with phone / Telex / Fax Number. / :  
Mobile Number.
- 5 Local office (if any ) address with phone / Telex / Fax Number :  
/ Mobile Number.
- 6 Field of activity of the Bidder as per deed of Partnership / :  
Memorandum of Association/ Articles of association (Civil)  
Engineering Contractor / General Engineering contractor /  
Electrical Engineering contractor etc., should be specified).
- 7 Country and year of incorporation. :
- 8 Main line of Business :
- 9 Name, position, status. capacity etc., of the Key personnel / :  
Directors of the company. (Attach organization chart showing  
the structure of the company/firm)
- 10 Name, capacity and address of the signatory who has signed the :  
Qualification bid. Attested copy of authorization issued (either  
by power of attorney or as per articles of Partnership Deed /  
Memorandum of Association) in favour of the signatory to sign  
the Qualification bid Price Tender/ Agreement, should be  
appended.

Dated Signature of Bidder with Seal

## SCHEDULE "B"

### FINANCIAL CAPABILITY

- |           |  |   |   |
|-----------|--|---|---|
| <b>1</b>  | Name and address of the Bidder   | : |   |
| <b>2</b>  | Income Tax Permanent account No.   | : |   |
| <b>3</b>  | 'TIN' Number   | : |   |
| <b>4</b>  | Annual turn over as per Income Tax returns filed for the past three years  | : | <b>TAX year</b><br>2017-2018<br>2018-2019<br><b>2019-2020</b> |
| <b>5</b>  | Annual turn over as per audited statement of account duly certified by the Chartered Accountant during the Preceding Three years (Attach attested copy of balance sheets.) | : | <b>TAX year</b><br>2017-2018<br>2018-2019<br><b>2019-2020</b> |
| <b>6</b>  | Financial Position   |   |   |
|           | i. Cash in hand.   | : |   |
|           | ii Cash in Bank / Banks.   | : |   |
|           | iii Current Assets.  | : |   |
|           | iv Current Liabilities.  | : |   |
|           | v Working capital.   | : |   |
|           | vi Net worth.  | : |   |
| <b>7</b>  | Outstanding value of works already committed and in progress and time left for completion. (Details for each work to be furnished separately).                             |   |   |
| <b>8</b>  | Amount available in capital Account:   |   |   |
|           | (i) Paid up share capital of (Partners or share holders)   |   |   |
|           | (ii) Called up and subscribed share capital  |   |   |
|           | (iii) Reserves under capital account.  |   |   |
|           | (iv) Surplus under capital account.  |   |   |
| <b>9</b>  | Net profit before tax during the preceding three years.  |   | <b>TAX year</b><br>2017-2018<br>2018-2019<br><b>2019-2020</b> |
| <b>10</b> | Bidders' Financial arrangements.   |   |   |
|           | (a) Own resources.   |   |   |
|           | (b) Bank credits / Over Draft.   |   |   |
|           | (c) Other source (Specify the source)  |   |   |

Dated Signature of Bidder with Seal

### **SCHEDULE "C"**

#### **Details of Technical Personnel under regular employment of the bidder who can be made available exclusively for this work**

**Name of Bidder:**

Sl. No.	Designation	Name	Educational Qualification	Under regular employment with Bidder since	Total span of experience	Salary being paid	Remarks
1.	<b>Site Engineer-1 No.</b> (One number) – B.E., Degree in Civil/Environmental Engineering with at least three years experience						
2.	<b>Site Engineer- 2 Nos.</b> (Two Numbers) One Diploma in Electrical Engineering with at least three years experience and One Diploma in Civil Engineering with at least three years experience.						
3.	Number of skilled Workers available						
4.	Number of unskilled workers available						

Dated Signature of bidder with Seal



**SCHEDULE "D-1"**

**WORK EXPERIENCE**

**List of similar type of CETP works completed in the preceding 5 years**

**Name of bidder:**

**Note:-** a) Details of original works alone should be furnished.  
Repairs / Improvements to existing structures should not be included.

Dated Signature of bidder with Seal

**SCHEDULE "D-2"**

**Details of similar CETP works - One work of 200 KLD capacities with ZLD including civil works Two works of 100 KLD capacities with ZLD including civil works completed in the preceding 5 years.**

**Name of bidder:**

<b>S. No</b>	<b>Decription</b>	
<b>1</b>	<b>Name of work</b>	
<b>2</b>	<b>Location Village / Town / Taluk / District / State.</b>	
<b>3</b>	<b>Name and designation of the employer / owner</b>	
<b>4</b>	<b>Value of work as per AgreementRs.</b>	
<b>5</b>	<b>AgreementNumber</b>	
<b>6</b>	<b>Stipulated period of contract as per agreement</b>	
<b>7</b>	<b>Date of commencement of the work</b>	
<b>8</b>	<b>Date of actual completion of work</b>	
<b>9</b>	<b>Reasons for delay in completion(If any)</b>	
<b>10</b>	<b>Actual value of work executed as per final payment</b>	
<b>11</b>	<b>Quality of work done</b>	

**Note:-**a) Certificate issued by the Engineer - in - charge (not below the rank of Executive Engineer / Project Engineer) of each of the work is to be appended.

Dated Signature of bidder with Seal

### **SCHEDULE "D-3"**

#### **Details of similar type of CETP works already committed by the bidder and are in progress**

**Name of bidder:**

<b>Sl.No.</b>	<b>Description</b>	
<b>1</b>	<b>Name of work with location</b>	
<b>2</b>	<b>Name / Designation of the employer or owner</b>	
<b>3</b>	<b>Agreement number</b>	
<b>4</b>	<b>Total value of the work as per agreementRs</b>	
<b>5</b>	<b>Period of completion stipulated in the agreement</b>	
<b>6</b>	<b>Date of commencement of the work</b>	
<b>7</b>	<b>Balance period available for completing the remaining portion of the work</b>	
<b>8</b>	<b>Value of workso far completedRs.</b>	
<b>9</b>	<b>Value of Balance items of work to be completedRs.</b>	
<b>10</b>	<b>Physical progress or stage of work</b>	
<b>11</b>	<b>Remarks</b>	

**Note:** Certificate for each of the committed works in Progress issued by the Engineer-in-charge (Not below the Rank of Executive Engineer / Project Engineer.) With all the above details should be appended.

Dated Signature of bidder with Seal

## **SCHEDULE “E”**

### **INFORMATION REGARDING CURRENT LITIGATION / DEBARRING/ EXPELLING OF APPLICANT OR ABANDONMENT OF WORK BY THE BIDDER**

- |   |  |        |
|---|--|--------|
| 1 | a) Is the Bidder currently involved in any Arbitration/ litigation relating to the contract works.                       | Yes/No |
|   | b) If Yes, Details thereon   |        |
| 2 | a) Has the Bidder or any of it's constituent partners been Debarred/ Expelled by any agency during the last “Five” Years | Yes/No |
|   | b) If Yes, Details thereon   |        |
| 3 | a) Has the Bidder or any of it's constituent Partners failed to complete, any contract work during the past “Five” years | Yes/No |
|   | b) If yes, give details thereon.   |        |

Dated Signature of bidder with Seal

**Note:** If any information in this schedule is found to be incorrect or concealed, the Qualification Bid will be summarily rejected & price bid will not be opened.

## **SCHEDULE “F”**

### **AFFIDAVIT**

**(To be furnished in a Twenty Rupees Non-Judicial stamp paper duly certified by Notary Public)**

1. I /We the undersigned solemnly declare that all the statements made in the documents, records etc., attached with this bid are true and correct to the best of my knowledge.
2. I /We the undersigned do hereby certify that neither my/our firm/company nor any of it's constituent partners have abandoned any work/works of similar nature and magnitude in India, during the Last “Five” years.
3. I /We the undersigned do hereby certify that any of the contract awarded to me/us has not been terminated rescinded, due to breach of contract on my/our part, during the last “Five” years.
4. I / we the undersigned authorize (s) and request (s) any bank/person/firm / corporation / Government Departments to furnish pertinent information deemed necessary and requested by the Managing Director, TIECO, PP33 Communication Centre, SIDCO Industrial Estate, Thriumudivakkam, Chennai to verify the statement made by me/ us or to assess my/ our competence and general reputation.
5. I / we the undersigned, understand(s) that further qualifying information/ clarifications on the statement made by me/us may be requested by the Managing Director, TIECO, P 33 Communication Centre, SIDCO Industrial Estate, Thriumudivakkam, Chennai and agree(s) to furnish such information/ clarification within “SEVEN” Days from the date of receipt of such request from the Managing Director, TIECO, PP33 Communication Centre, SIDCO Industrial Estate, Thriumudivakkam, Chennai

Dated Signature of bidder with seal:

(To be signed by the officer authorized by the Firm / company to sign on behalf of the Firm/ company with company's seal)

**Note:-** In case of sole proprietary concern, affidavit should be signed only by the sole proprietor.

(Title of the Officer)

(Title of the firm/company)

(Date)

The above named deponent has understood the contents well and solemnly and sincerely declared and affirmed by the deponent in my presence at.....and signed before me on this day of.....

(Signature of the Notary Public with Seal)

**SCHEDULE “G”**

**UNDER TAKING**

(Under taking should be furnished in a Twenty Rupees Non-Judicial stamp paper with the Qualification Bid and certified by the Notary public)

I/We

the bidder do hereby undertake that I/ we

will abide by the terms and conditions if any modified by the Government in the contract conditions subsequent to submission of Qualification Bid / Price Bid or subsequent to execution of the agreement.

Place:

Date:

Signature of the bidder with Seal

The above named deponent has understood the contents well and solemnly and sincerely declared and affirmed by the deponent in my presence at.....and signed before me.....on this day of .....

Place:

Date:

Signature of the Notary Public with Seal.



### SUMMARY SCHEDULE

(To be furnished by the Tenderers)

1	Is the offer is in Conformity with the Departmental Technical Specification?	:	Yes / No
2	Brand name and capacity / size of Components proposed to be used. (a) (b) (c)		
3	Completion Period		
	a. Time required for the supply of materials .....		
	b. Time required for the execution of work.....		
	c. Total completion period.....		
4	Is the tenderer agreeable for the departmental terms of payment?	:	Yes / No
5	Is the tenderer agreeable to furnish 2% of the contract value as Security Deposit in the shape of NSC, Small Savings Scripts / Deposits/ Accounts?	:	Yes / No
6	Is the tender valid for 3 months?	:	Yes / No
7	Is the latest Income tax clearance enclosed?	:	Yes / No
8	Is the quoted price inclusive of Excise Duty? (Specify the amount of Excise Duty)	:	Yes / No
9	Is the quoted price inclusive of required minor builder work?	:	Yes / No

10	Is the quoted price inclusive of scaffolding required for the work?	:	Yes / No
11	Is the quoted price firm until the completion of work?	:	Yes / No
12	Is the tenderer agreeable for the departmental penalty clause?	:	Yes / No
13	Is the work guaranteed for 12 months with free monthly servicing?	:	Yes / No

**PARTICULARS TO BE FURNISHED BY THE TENDERER**

1	Name of Tenderer with Address	:	
2	Name of Work	:	
3	Date of Tender	:	
4	Total value of Tender	:	
5	Details of EMD enclosed & its validity	:	
6	Recent work executed (Name of work, place of work, value of work should be mentioned)	:	
7	Works under execution (Name of work, place of work, value of work should be mentioned)	:	
8	Command of labour in brief	:	
9	Method of Procurement of Materials	:	
10	Turn over in previous Year	:	
11	Whether Income Tax Clearance Certificate enclosed? If not when It will be produced.	:	
12	Sales Tax Registration Number	:	
13	Whether sales Tax Clearance Certificate is enclosed. If not, when it will be produced	:	

Signature of the bidder with Seal

## PRICE BID

S. No.	DESCRIPTION	AMOUNT in Rs
<b>A</b>	<b>DESIGN, ENGINEERING, CONSTRUCTION, SUPPLY, INSTALLATION, COMMISSIONING AND O&amp;M FOR ONE YEAR OF 200 KLD COMMON EFFLUENT TREATMENT PLANT WITH ZERO LIQUID DISCHARGE.</b>	
	<b>Price Break-Up of (#A) for payment purpose only</b>	
	Supply of Electromechanical Equipments as per BOQ in Tender Vol-2. (The Cost should include the Transportation, Packing & Forwarding, Insurance and any other charges applicable)	
	Construction and testing of all Civil Structures and Installation & Commissioning of all Electromechanical Equipments as in the Civil and Electromechanical Equipments BOQ in Tender Vol-2.	
	TOTAL VALUE	
	GST % ON TOTAL VALUE	
	TOTAL VALUE INCLUDING TAX	
	<b>TOTAL O&amp;M COST FOR 2ND &amp; 3RD YEAR (#1 + #2)</b>	
	2nd Year Operation & Maintenance Cost of the CETP with ZLD including all Consumables and Spares.	
	3rd Year Operation & Maintenance Cost of the CETP with ZLD including all Consumables and Spares.	

# **Thirumudivakkam Industrial Enviro Pvt Ltd**

PP3 Communication centre,  
SIDCO Industrial Estate,  
Thirumudivakkam,  
Chennai

**COVER – 2**

**PRICE BID**

**NAME OF WORK : DESIGN, ENGINEERING, CONSTRUCTION, SUPPLY, INSTALLATION, COMMISSIONING AND O & M FOR ONE YEAR OF 200 KLD COMMON EFFLUENT TREATMENT PLANT WITH ZERO LIQUID DISCHARGE FOR TIECO, THIRUMUDIVAKKAM, KANCHIPURAM DISTRICT, TAMILNADU. (Two Cover System).**

**EMD AMOUNT : Rs.1,50,000 + GST**

**DATE OF TENDER : 9<sup>th</sup> September 2021**

**ISSUED TO :**

---

**Managing Director, TIECO**

PP3 Communication Centre,

SIDCO Industrial Estate,

Thriumudivakkam, Chennai.

Contact No: +917278112345, +919444089840

Email :tiecotmv2019@gmail.com

website <http://tiema.co.in>



## **TECHNICAL SPECIFICATIONS INDEX**

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## **INTRODUCTION**

Effluent treatment plants need land for construction, capital cost, power and specialized manpower for their operation and maintenance. Because of these constraints, small scale industries cannot afford to have their own effluent treatment facilities and therefore, combined effluent from all industries is to be brought to a centralized place for treatment. This facility is called a **Common Effluent Treatment Plant (CETP)**. For operation and maintenance of CETP, small scale industries formed a co-operative society. The expenses for operation and maintenance of CETP are being shared by participating industries. Wastewater management for the cluster of small scale industries was studied in details and various measures were incorporated to improve performance of the CETP and also to improve treated effluent quality to confirm standard prescribed by Government norms.

### **BENEFITS OF CETP**

- Saving in Capital and Operating cost of treatment plant. The Common treatment is always cheaper than small scattered treatment units.
- Availability of land which is difficult to be ensured by all individual units in the event they go for individual treatment plants.
- Contribution of nutrient and diluting potential, making the complex industrial waste more amenable to degradation.
- The neutralization and equalization of heterogeneous waste makes its treatment techno-economically viable.
- Professional and trained staff can be made available for operation of CETP which is not possible in case of individual plants.

- Disposal of treated wastewater & sludge becomes more organized. Reduced burden of various regulatory authorities in ensuring pollution control requirement.

## **SCOPE OF WORK**

The scope is intended to cover the design, engineering, procurement, manufacture, shop fabrication, assembly, pre-assembly, tests and inspection at manufacturer's works, packing, shipment, supply, unloading, leading to storage area, reloading, leading to erection site, erection & commissioning, trial run and performance testing of Common Effluent Treatment Plant followed by O&M for a period of one year at M/s. TIECO, PP33 Communication Centre, Thirumudivakkam, Chennai.

The zero liquid discharge plant is designed to treat 200.0 m<sup>3</sup>/day of Effluent at an average flow rate of 10.0 m<sup>3</sup>/hr, considered 20 hrs of operation. Waste water generated from the individual units will be sent to the CETP for Zero liquid discharge methodology to meet out the TNPCB norms.

The scheme of water treatment plant shall be:

**Collection tank – Mixing tank – Flocculation tank – Clarifier-1 – Aeration tank – Clarifier -2 - Filter feed tank – PSF – ACF – UF – ROI-RO II – Reject to MEE – ATFD (Salt for Disposal)**

## **PROCESS DESCRIPTION**

ETP : The raw effluent (Nickel+Zinc) will be received at the inlet of collection tank for the neutralization of pH level in the raw effluent.

- The raw effluent (Chrome) will be received at the inlet of collection tank for the reduction of chrome in the raw effluent.
- Both the effluents from pre collection tanks will be then passed to common collection tank.
- From the collection tank the effluent will be pumped to mixing tank & followed by flocculation tank for further chemical treatment, where coagulant, flocculent and polymer will be dosed for coagulation and flocculation.
- Polymer will be dosed to increase the floc size and settling rate of the suspended solids. The overflow from the mixing tank is passed to primary settling tank. Here the settled

chemical sludge will be pumped to the sludge drying bed at regular intervals. The overflow from the primary clarifier will be passed to the Aeration tank. The aeration tank will be provided with adequate detention time. A Blower will be provided to supply oxygen in the form of fine air droplets into the Aeration Tank for reducing BOD and Total Suspended Solids.

- The overflow from the aeration tank will be passed to a Secondary clarifier for removal of bio sludge. Here the settled bio sludge will be pumped to the sludge drying bed at regular intervals.
  - The clear overflow from the Secondary clarifier will be collected by collection tank.
  - From this collection tank, the effluent will be pumped to Pressure Sand Filter, followed by Activated Carbon Filter for removal of very fine suspended solids, odour and turbidity.
  - The dewatered sludge will be periodically disposed by clients. Dried sludge from filter press/sludge drying bed will be packed, weighed and stored inside the premises.
  - This will be pumped into the ultra-filtration system to make the water suitable for RO inlet and ensure the long life of the RO membranes.
  - Ultrafiltration (UF) is used for pre-filtration in reverse-osmosis plants to protect the reverse osmosis process.
  - Ultrafiltration is an effective means of reducing the silt density index of water and removing particulates that can foul reverse osmosis membranes
  - Ultrafiltration (UF) is a type of membrane filtration in which hydrostatic pressure forces a liquid against a semipermeable membrane. A semipermeable membrane is a thin layer of material capable of separating substances when a driving force is applied across the membrane.
- a. The UF permeate will be collected in a storage tank and pumped in to the reverse osmosis system through micron cartridge filter.
  - b. Pre filtration will be provided as a pre-treatment for RO system. Prior to the cartridge filter Antiscalant, antioxidants and acid will be dosed to prevent the scaling on membranes, to oxidize the free chlorines if present in the raw effluent and to neutralize the pH before entering into the RO Plants.

- c. RO will separate the feed water into two streams. Permeate with low dissolved solids and reject with high solid concentration. Permeate will be stored in a common permeate storage tank. The reject from RO stage I will be stored in a reject storage tank and pumped RO stage II through micron cartridge filter.
- d. Pre filtration will be provided as a pre-treatment for RO system. Prior to the cartridge filter Antiscalant, antioxidants and acid will be dosed to prevent the scaling on membranes, to oxidize the free chlorines if present in the raw effluent and to neutralize the pH before entering into the RO Plants.
- e. RO stage II will separate the feed water into two streams. Permeate with low dissolved solids and reject with high solid concentration. Permeate will be stored in a common permeate storage tank.
- f. The reject from RO stage II will be pumped to MEE for further treatment of RO reject. Slurry from the evaporator will be passed to ATFD for dying purpose.

#### **MULTIPLE EFFECT EVAPORATOR(MEE)**

- g. RO reject from the RO final stage will be stored in the Evaporator Feed tank.
- h. From the Evaporator feed tank the Feed will be pumped to Balance tank.
- i. Purpose of Balance tank is to feed uniform flow to the evaporator. Pumping is controlled by level sensors and its rate varies according to the depth of liquid in the balancing tank.
- j. Feed from the Balance tank will be sent to the Pre heater to pre heat the Effluent before feed to the Calandria. Because of this preheating the incoming feed solution is heated nearer to the boiling point.
- k. Steam input to the Calandria will be also sent to the Calandria for heating the effluent flows through the Calandria. The Calandria will be the shell and tube model. Liquid to be evaporated will be circulated through the tubes and the steam will be used as heating medium for the effluent in the outer side of the tubes in the shell.
- l. The vapour generated during the evaporation process will be sent to the vapour separator.
- m. In the vapour separator the vapour will be separated & the condensate from the bottom is sent to the surface condenser. The Vapor generated due to evaporation of the feed inside evaporator goes to the surface condenser which is equipped with circulating cooling water connection from a cooling tower for condensing the evolved vapours.

- n. The concentrate from the Calandria will be recirculated through Calandria 1. After reaching the saturation limit the concentrate will be pumped to Calandria 2.
- o. Similar process will be taken in the second stage also.

**ATFD (AGITATED THIN FILM DRIER):**

- Concentrate feed from Evaporator enters the ATFD and passes through the rotating feed distributor within the system.
- The distributor evenly spreads the feed on the heated inside surface of the steam heated jacketed vessel of ATFD.
- The distributed feed within in the ATFD is flowing downwards inside the wall of jacketed vessel because of gravity which spreads as a thin film by the action of scrapper blades provided for this purpose.
- The heat energy released by the condensing steam in the outer jacket of the ATFD is absorbed by the evenly distributed thin film of feed at the inside surface of the ATFD.
- Due to very thin film layer nature of the feed, it evaporates instantaneously and as it moves downwards it leaves behind all the dissolved salts coated on the heated surface.
- The deposited salt coating loses all its moisture and dries up at once due to high rate of prevailing heat flux within the ATFD.
- The deposited salts are scrapped off from the heating surface by the rotating scrapper blades which are forced against it due to the centrifugal force of rotation.
- The vapor generated due to evaporation of the feed inside ATFD goes to the surface condenser which is equipped with circulating cooling water connection from a cooling tower for condensing the evolved vapours.

## **RAW EFFLUENT & TREATED WATER CHARACTERISTICS**

S.No	Parameters	Unit	Raw Effluent	After PT	After UF	After RO
1.	pH Value @ 25 ° C	ppm	<5.0	7.0-7.5	7.0-7.5	6.5-7.5
2.	Bio chemical Oxygen Demand	ppm	<200	<30	<10	BDL
3.	Chemical Oxygen Demand (COD)	ppm	<700	<200	<50	BDL
4.	Oil & Grease	ppm	<1	BDL	BDL	BDL
5.	Total Dissolved Solids(TDS) @ 105 ° C	ppm	<15000	<15000	<15000	<500
6.	Total Suspended Solids(TSS) @ 105 ° C	ppm	<100	<20	<1	BDL
7.	Nickel (N)	ppm	0.42	BDL	BDL	BDL
8.	Zinc (Zn)	ppm	2.01	BDL	BDL	BDL
9.	Chromium (Cr 3+)	ppm	0.42	BDL	BDL	BDL
10.	Chromium (Cr6+)	ppm	0.1	BDL	BDL	BDL
11.	Chlorides(Cl)	ppm	<450	<500	<500	<500

**Note:**

Bidder to confirm stage wise guarantee as per above table



## **GENERAL SPECIFICATIONS - CIVIL**

The Contractor shall submit complete detailed design calculations for each of the components of the foundation, substructure and superstructure together with general arrangement drawings, construction drawings and explanatory sketches as required by the Employer's Representative.

Separate calculations for substructures or superstructures submitted independent of each other shall be deemed to be incomplete and will not be accepted by the Employer's Representative. Calculations for the foundations may be submitted independently and prior to those of the superstructure as long as the load transfer points are identified. These calculations shall be resubmitted with the substructure and superstructure calculations for verification.

Design calculations shall not be submitted until the preliminary layout drawings have been approved by the Employer's Representative as to the general overall dimensions, functionality of the structure and the general layout of facilities. The design calculations later submitted shall be based upon the approved layout concepts.

### **Design Standards**

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

The design of water treatment facilities shall be in conformance with the requirements of the Central Public Health and Environmental Engineering Organisation's (CPHEEO) Manual on Water Supply and Treatment (May 1999). Particular design criteria modified within these technical specifications shall override the stipulations of the CPHEEO Manual. The design considerations described herein establish the minimum basic design requirements of plain and reinforced concrete structures, architectural details, masonry structures and structural steel works. However, any particular structure shall be designed for the satisfactory performance fulfilling the functions for which the same is being constructed.

All the designs of structures and associated facilities shall generally confirm to the recommendations made in the publications (latest versions) of the Bureau of Indian Standards, some of which are listed below:

- a. IS 456: Code of Practice for plain and reinforced concrete
- b. IS 800: Code of Practice for general construction in steel
- c. IS 806: Code of Practice for use of steel tubes in general building construction
- d. IS 875: Code of Practice for design loads for buildings and structures other than earthquake loads (Parts 1 to 5).
- e. IS 1893: Criteria for earthquake resistant design of structures

- f. IS 2974: Code of Practice for design and construction of machine foundations (Part 1 to 4)
- g. IS 3370: Code of Practice for concrete structures for the storage of liquids (Part I to IV)
- h. IS 11388: Recommendations for design of trash racks for intakes
- i. IS 15310: Hydraulic design of pump sumps and intakes - Guidelines.
- j. Indian Roads Congress (IRC) 6 Part II: Standard Specification and Code of Practice for road bridges loads and stresses
- k. Standard Practice (SP) 34: Handbook on concrete reinforcement and detailing
- l. IS 1498 Classification and identification of soils for general engineering
- m. IS 2720 Method of test of soils (All parts)
- n. IS 2809 Glossary of terms and symbols relating to Soil Engineering
- o. IS 3764 Safety code for excavation work
- p. IS 4081 Safety code for blasting and related drilling operations

### **Design Life**

The minimum design life of all structures and buildings shall be 50 years.

### **Design Loads**

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

### **Dead Load**

This shall comprise loads arising due to all permanent construction including rafts, footings, columns, walls, floors, roofs, partitions, stairways, fixed service equipment foundations and machinery foundations.

The minimum Dead Loads shall be as per IS 875 (Part 1).

Equipment and Machine load: In estimating the loads of process equipment all fixtures and attached piping shall be included. For stored material load shall be as per IS 875 (Part 1).

Overburden load: Overburden load due to earth filling, landscaping, road construction shall be considered.

### **Live Load**

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

Live loads shall be in accordance with IS 875 (Part 2).

### **Earth Pressure**

This shall comprise horizontal component of the load arising due to earth fill and earth retain. The loads shall be as per IS 875 (Part V).

### **Wind Load**

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

### **Earthquake Load**

The seismic loading shall be calculated as per IS 1893 and the structures designed in accordance with this standard. The project area falls within India Seismic Zone V (five). This is the highest (most damage potential) of any of the zone ratings in the country. The considerations for seismic design shall be reviewed with the upmost concern by the Employer's Representative.

### **Dynamic Load**

Dynamic loads (vibration forces) due to the operation of equipment items such as pumps, blowers, compressors, generators, switchgear, traveling cranes, etc. shall be considered in the design of structures.

### **Wave Load**

Wave loads (forces) acting upon the intake structures shall be estimated or calculated in accordance with standard engineering practice for the design of marine structures.

### **Joints**

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

Expansion joints for non-liquid retaining structures shall be provided as per IS 3414. A suitable gap at the location of expansion joints, which shall be spaced at a suitable intervals of not more than 30 m shall be provided in walls, floors and the roof slabs of all structures.

Construction joints shall be provided at right angles to the general direction of a member. The locations of construction joints shall be decided as per the convenience of the construction. To avoid segregation of concrete in walls, horizontal construction joints are normally to be provided at every 2.0 m of height.

Approved double bulb type PVC water-stops shall be used. The size of water-stop shall as specified in the table below:

Thickness of Member	Width	Web Thickness	No. of Rib	Center Bulb	Dump Bell
200 mm or less	230 mm	6 mm	2	20 mm	18 mm
More than 200 mm	300 mm	7 mm	2	24 mm	23 mm

### Partially or Fully Underground Liquid Retaining Structures

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

- Liquid depth up to full height of wall and free board: No relief due to lateral soil pressure from the outside shall be considered
- Tank empty (i.e., no liquid or any material inside the tank volume): Full lateral earth pressure at rest due to surrounding saturated soil and surcharge pressure as applicable, shall be considered
- Partition walls between a dry compartment and a water bearing compartments shall be designed for full liquid depth up to the full height of the wall
- Partition walls between two water bearing compartments shall be designed as one compartment being empty and the other full
- Structures shall be designed for uplift in the empty condition considering the depth of the highest historical water table recorded in the area.
- Walls shall be designed under operating conditions to resist earthquake forces developed due to the mobilization of earth and dynamic water loads

Underground or partially underground structures shall also be designed to accommodate stresses developed due to any combination of full and empty compartments with appropriate ground uplift pressures on the base slab. A minimum safety factor of 1.2 shall be applied to ensure against uplift or floatation.

### General Requirements for Concrete Work

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

- i) All leveling concrete shall be a minimum 100 mm thick with minimum concrete grade of Class M15 (15 N/mm<sup>2</sup> minimum compressive strength at 28 days).
- ii) All structural reinforced concrete other than for water retaining structures shall at least be of Class M25 having a minimum cement content of 320 kg/m<sup>3</sup> with 20 mm size downgraded coarse aggregates, for all structural members.
- iii) The minimum grade of concrete for water retaining structures shall be Class M30 having a minimum cement content of 360 kg/m<sup>3</sup> with 20 mm size downgraded coarse aggregates.
- iv) All design for water retaining structures including roofing shall be based upon limiting the crack width to 0.2 mm as per BS 8007.
- v) The minimum clear cover over all reinforcement including stirrups and links shall be 40 mm for all water retaining structures including the bottom of the roof. For other non-water bearing structures the minimum clear cover shall be as specified in IS 456.
- vi) Any structure or pipeline crossing below road grade shall be designed for a minimum of Class A of IRC loading criteria.
- vii) The bridges and supporting structures (for clarifiers etc.) shall be designed to safely withstand the loadings of the loads and torque transmitted through the scrapper blades, motors, gear reducers, etc. depending upon the arrangement.

- viii) All pipes and conduits laid below the structural plinth and road works shall be embedded in reinforced concrete of Class M15 having a minimum 150 mm thick concrete cover all around.
- ix) An approved water proofing compound (chloride free) shall be added during the concreting of all liquid containing structures, in the proportions specified by the manufacturer.
- x) For the walls of liquid retaining structures, the following shall be applied:
  - The minimum reinforcement shall be in accordance with BS 8007.
  - The maximum length of a panel to be concreted considering any partial construction joints shall be 7.5 m. The adjacent panels shall be poured with a minimum time lapse of 4 days. The Height of each pour shall not exceed 2.0m.

Note: The classes of concrete referred to in this Subsection are based upon a minimum compressive strength at 28 days expressed in N/mm<sup>2</sup>. The classes of concrete referred to in the Standard Specifications (Civil Works) are based upon a minimum compressive strength at 28 days expressed in kg/cm<sup>2</sup>. Therefore a Class M20 referred to this Volume of the Bid Documents will be equivalent to a Class M200 referred to in the Standard Specifications (Civil Works). The Contractor shall make this distinction when working with these Contract Documents.

The following minimum thicknesses shall be used for the different reinforced concrete members, irrespective of the required design thickness:

a. Walls for liquid retaining structures	200 mm
b. Roof slabs for liquid retaining structures	150 mm
c. Bottom slabs for liquid retaining structures	250 mm
d. Floor slabs including roof slabs, walkways, canopy slabs	150 mm
e. Walls of cables / pipe trenches, underground pits etc.	150 mm
f. Column	300 mm
g. Parapets, chajja	100 mm
h. Precast trench covers	75 mm

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## Reinforcement :

All major structures, buildings, pump houses, treatment process tanks, reservoirs and electrical substations to be constructed in this Contract shall use TMT (thermo-mechanical treatment) Fe 415 as defined in IS 1786 and as procured from TISCO/ SAIL /RINL or equivalent as approved by the Employer's Representative for concrete reinforcement. The minimum yield stress of the bars shall be 415 N/mm<sup>2</sup>.

Other concrete work including thrust blocks, pipe supports, sidewalks etc. may use HYSD (high yield strength deformed) Fe 415 steel bars as procured from TISCO/ SAIL /RINL or equivalent as approved by Employer's Representative. The minimum yield stress of the bars shall be 415 N/mm<sup>2</sup>.

## General Requirements for Buildings

Unless otherwise specified, all the building works shall comply with the following requirements:

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### External Walls and Framing

- i. All buildings shall have reinforced concrete framework unless otherwise specified.
- ii. A 75 mm thick RCC damp proofing course of Class M15 shall be applied onto all exterior building walls.
- iii. Anti-termite treatment as per IS 6313 Part-III (1971) with injection of chloropyrious emulsifiable concrete (1%) timber care ground treatment chemical emulsion (1:3) to create a chemical barrier under and around the column pits, wall trenches, basement excavations, top surfaces of plinth filling, junctions of walls and floors along the external perimeter of buildings, expansion joints, surrounding of pipes and conduits etc.
- iv. All external non RCC walls shall be made of 230 mm thick brick masonry laid with cement mortar at 1:4 (cement to sand). Transoms and mullions shall be of nominal 115 mm x 230 mm dimensions made of Class M20 cement concrete with four number 6 mm bars and 6 mm links at 150 mm c/c to form panels not exceeding 3500 mm x 3500 mm in size.
- v. All external masonry surfaces shall be plastered in two coats with sand faced cement plaster in cement mortar (1:4) and shall have a total thickness of 20 mm. Waterproofing compound of an approved make and quality shall be added to the cement mortar in proportions as specified by the manufacturer.

### Internal Walls

- i. All internal partition walls except for toilets shall be made of 230 mm thick brick masonry built with cement mortar 1:4 with transoms and mullions as stated above. Toilet partition walls shall be made of 115 mm thick brick masonry built with cement mortar 1:4 and shall have transoms and mullions as stated above to form panels not exceeding 1200 mm x 1200 mm in size.
- ii. All internal masonry surfaces shall be finished with 12 mm thick smooth faced cement plaster in cement mortar (1:4).

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### Plinth Layer

- i. Building plinth shall be a minimum of 300 mm above the average finished ground level around the building and shall be not be less than the plinth level of any existing buildings.

- ii. All buildings shall have a minimum 1.0 m wide, 100 mm thick plinth protection paving of Class M15 concrete finished with stone slabs or tiles. All plinth protection shall be supported on well-compacted stratum.
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## **Stairways**

- i. Wherever specified, staircases shall be finished with 25 mm thick Kota stone treads and 20 mm thick Kota Stone skirting or equivalent as approved by the Employer's Representative. The stair riser shall not exceed 170 mm in height and the minimum width of the tread shall not be less than 275 mm. All steps shall have a 20mm nosing. R.C.C. stairways shall be provided to permit access between different levels within buildings. All roof tops and tops of overhead tanks shall be made accessible with ladders provided. Vertical ladders fitted with landing point extensions will be permitted where considered appropriate by the Employer's Representative to access areas not frequently visited.
  - ii. All staircases shall be provided with steel railing with PVC covers or wooden handrail. The reinforced concrete roofs shall be made waterproof by the application of an approved cement/ lime based waterproofing treatment, to be guaranteed for 5 years. The finished roof surface shall have an adequate slope to drain quickly the rainwater to down comer drain points.
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## **Roofs**

- i. For roof drainage, cast iron rainwater down-takes with khurra and door bends with CI grating at top shall be provided. For roof areas up to 40 m<sup>2</sup> a minimum of two 100 mm diameter down-take pipes shall be provided. For every additional area of 40 m<sup>2</sup> or part thereof, at least one 100 mm dia. down take pipe shall be provided. The rainwater pipes shall be concealed.
- ii. Top surfaces of chajjas and canopies shall be made waterproof by providing a screed layer of adequate slope or application of an approved roof membrane and sloped to drain the rainwater.

## **GENERAL SPECIFICATIONS - PIPING & VALVES**

### **PIPING DESIGN CRITERIA**

The pipework shall be designed and erected in accordance with ANSI / ASME B31.1 'Power piping', and the relevant codes and standards of ASTM & AWWA or an expressively approved equivalent standard and Indian Boiler Regulations wherever applicable.

The present specification shall prevail against that of the code whenever the former is more restrictive.

The supply must be in accordance with the latest editions of the approved Standards as agreed by the Owner / Owner's Representative, incorporating any other features as required by this Specification and in accordance with the Piping Materials Specification.

All pipe components manufactured by the Vendor and parts on which he has worked, are to be marked clearly with an item number, specification number and material. This marking shall be permanent.

Sizes of pipelines shall be selected such that the velocity of fluid in pipes does not exceed the following limits under conditions of maximum possible volumetric flow:

Pump suction	Not more than 1.5 m/sec
Pump discharge for water	Not more than 2.5 m/sec
Pump suction for chemical solution	0.8 – 1.0 m/sec
Pump discharge for chemical solution	1.2 – 1.4 m/sec
Compressed Air Lines	15 m/sec.
Gravity lines	1m/sec (max.)

For over ground exposed steel pipe and underground pipe, the supply and application of painting shall be as per specification.

For rubber lined pipe, lining should be applied giving rise to a total thickness not less than 3.0 mm. The lining shall conform to IS:4682 Part-I.

All rules of the art considering technical and economic parameters shall be carefully followed, namely:

- Lower values of velocities than those stated above shall be used to determine line size if dictated by considerations of pressure drop, NPSH, surges, water hammer, etc.
- The design flows considered in line sizing shall not be less than the rated capacities of equipment to which the piping is connected such as pumps, blowers, compressors, valves, flow limiting orifices, etc., or, the system heat and/or mass balance diagrams.
- For lines conveying liquids, the design pressure must be equal to maximum operating pressure including the pressure reached during transients (water hammer.)
- The calculation of the pipework shall consider also the highest possible temperature that can occur during any mode of operation together with the highest corresponding pressure.



- The calculation of wall thickness required for pipelines subject to internal and / or external pressure shall be based on the formulae and recommendations as given in the applicable codes. Adequate allowances shall be made towards thinning due to bending, weakening at branch
- Connections, threading, commercial tolerances on pipe wall thickness, corrosion and erosion, etc. and the same shall be subject to approval by Owner / Owner's representative.
- In case of carbon steel materials, the nominal wall thickness of pipeline shall be not less than the minimum acceptable values given below :

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NB mm	15	20	25	32	40	50	65	80	100	125
(Inch)	(1/2)	(3/4)	(1)	(1 1/4)	(1.5)	(2)	(2.5)	(3)	(4)	(5)
Min.	3.2	3.2	4.0	4.0	4.0	4.5	4.5	4.8	5.4	5.4
Thick, mm										
-----										
----										
NB mm	150	200	250	300	350	400	450	500	600	
(Inch)	(6)	(8)	(10)	(12)	(14)	(16)	(18)	(20)	(24)	
Min.	5.4	6.3	6.3	6.3	7.1	7.1	7.1	8.0	8.0	
Thick mm										

> 600NB to 950NB: 10 mm

> 950NB to 1200NB: 12 mm

Sizes of NB 32 (1 1/4"), NB 65 (2 1/2"), and NB 125(5") shall not be used in the piping system.

Minimum thickness for stainless steel pipes shall be Sch 40S for 50 NB & below, and Sch 10S for 65 NB & above of ANSI B36.19.

In addition to the required wall thickness in accordance with calculations, a corrosion allowance of 1.6 mm must be added for unprotected water lines where corrosion is to be expected (not applicable for SS Pipes). For vessels of carbon steel construction a corrosion allowance of 3 mm shall be considered.

## DESIGN AND CONSTRUCTION OF PIPEWORK AND ACCESSORIES

The pipework and its accessories shall be designed and arranged so that all parts can be mounted and replaced without difficulty. All important parts, such as valves must be accessible from the floors / platforms.

The platform must be able to withstand the weight of the valve removed as well as the weight of the appropriate number of persons handling the valve, and must be sized adequately providing both working space for the men and space for the valve.

For piping systems with a nominal pressure of more than 20 bar (g), drainage and venting facilities must be fitted with double valves.

The pipes with nominal diameter up to and including 50 mm can be arranged at site according to lengths and specification. The pipes with nominal diameter more than 50 mm can be installed according to the erection drawing designed. Pipe can be pre-fabricated or manufactured according to pipe length and specifications.

No tubes with nominal diameters less than 25 mm shall be used, except for impulse measuring lines, dosing pipelines and instrument piping.

All sampling pipes shall be of SS and shall be fabricated with welded joints.

The nominal size of the takeoff connections for instruments shall not be less than 15 mm for service conditions not exceeding either 62 bar (g) or 425°C and 25 mm for service conditions which exceed either of these limits.

For all system parts subject to acceptance retests relevant provision shall be made so that they can be separated to allow for those retests.

None of the forces and moments transmitted by the pipes to adjacent machines, apparatus and platforms must exceed the maximum permissible values, given by the manufacturers of these items.

Trench piping shall not be used unless found unavoidable.

Piping systems shall be protected against excess pressure caused by thermal expansion of Locked - in fluids.

Valve sizes for vents and drains shall be 25 NB minimum. Vent lines, which are normally operated, shall be terminated at a minimum height of 3.0 M above the highest service platform.

For vents, pipes and any upward facing atmospheric exhaust, weather hoods and silencers as necessary shall be provided.

For tanks and pressure vessels, piping material for drains and vents shall be the same as that of the vessel. Suitable drains shall be provided upstream and downstream of valves to facilitate maintenance in the circuit safely.

In addition, plugged drain and air release bosses shall be welded at appropriate places in the piping to facilitate hydrostatic testing.

The Vendor shall furnish and install suitable thimbles at all points where pipelines pass through building floors and walls.

The Vendor shall provide effective flashing rings with rain-tight hoods for all pipes passing through the roofs or exterior walls.

All piping shall be cleaned and kept clean and free from all foreign matter before and during erection. The Vendor shall furnish, install and dismantle all temporary pipes, hangers, anchors, etc. required for cleaning of all piping systems.

As many welds as possible shall be carried out in the workshop. So far as practicable, hangers and supports shall be standardized and the number of types and component assemblies shall be reduced to the minimum. Each pipe hanger and support component shall be of a steel suitable for the maximum temperature that it shall attain during plant operation. Rigid supports, clamps and restraints shall be used as far as possible.

Sliding surfaces shall be constructed of non-corrodible materials that do not rely on coatings such as paint, galvanizing, etc. for corrosion protection. Excessive friction shall be prevented.

After plant start-up, all supports shall be checked to confirm that supports are in the correct position. In case of seawater service piping, following materials shall be provided. The same will be finalized during detail design.

a) Diameter Upto 50 NB: SS316L, 50NB < Diameter ≤ 600NB: GRP/ CS (Rubberlined or Pu coated), Diameter > 600NB: IS2062 Gr B with PU coating.

## **Piping Layout Considerations**

A minimum 2.3meter headroom shall be maintained to the lowest point of all piping components or insulation in walking areas and 7.5meter above roadways unless otherwise approved by the Owner / Owner's Representative. A minimum passageway of 1.5 m shall be considered for access between and around all equipments and a 150 mm minimum clearance shall be provided between piping, including insulation if applied, and any point of adjacent equipment or piping including flanges and/or pipe supports.

All valves, instruments, strainers, orifices, valve motor drives and other piping accessories shall be provided with adequate space for access and removal of parts for maintenance.

All buried pipe in general shall be laid with the top of the pipe minimum 1.0m below the finished ground level.

Bracket supports and other protruding attachments which constitute a hazard to operating personnel shall be elevated to a minimum of 2.3m from the operator's access elevation.

The instruments shall be positioned to allow easy observation. A 250 mm minimum clear space shall be provided from the bottom surface of pipe to trench bottom or finished grade.

All lines shall be provided with vent and drain connections at all high and low points, respectively, as per layout constraints with suitability for operation .All piping shall be arranged to permit complete drainage when a particular unit or system is shutdown. Condensate & water lines shall also be provided with vent & drain lines for hydro test conditions. Drain points shall have a suitable isolating valve. All such drain connections shall be piped to a suitable collection point

### **Piping Flexibility Analysis**

Piping systems shall be designed and analysed using CAESAR II or equivalent software (latest version) in such a way that no excessive stresses, forces, moments or deflections can take place. This static analysis shall be done for plant operating, shut down, hydro test and occasional loading. As a general guidance a line shall be subjected to comprehensive stress analysis if it is fall under any of the following categories.

1. All lines 100 NB and larger connected to sensitive rotating equipment.
2. All piping subjected to vibration
3. All relief lines connected to pressure relief valves and rupture discs
4. Other lines which in the option of Owner or Owner's Representative requires a formal analysis.

Pipe sagging shall be restricted to 2.5mm and piping rotation to less than 1degree.The calculations shall be based on design pressures, temperatures and weights of valves. In addition, the water weight for hydrostatic testing and the insulation weight shall also be taken into account.

The calculations shall determine the maximum combined pipe stresses and the forces, moments, and deflections at all points of support, anchors and restraints. In all calculations, the manufacturing tolerance (12.5% for OD pipes) shall be taken into account.

The design shall take into account possible maximum values, e.g. the maximum head of the pumps in the system as well as exceptional operating conditions, such as over pressures, vibrations and water hammer.

There shall be sufficient allowance for thermal expansion and displacement without excessive stresses. The thermal expansion of the pipe work shall be carefully analyzed and appropriate pipe

routing and location of the supporting equipment to be decided to prevent the piping from causing excessive forces & moments at the anchoring points.

### **Pipe Supports and Hangers**

Pipe supports shall be designed according to the layout requirements.

All supports for piping, cables and fitting supplied under this Contract are to be clamped to building steelwork in preference to bolting, screwing or welding. Under no circumstances shall any part of the building steel work be drilled, cut welded without prior permission of the Owner / Owner's Representative in writing. No point of passage of pipes through or walls is to be used as a point of support except with the approval of the Engineer.

All outdoor installation supports and hangers shall be suitably coated to withstand the local environmental conditions.

All Supports for horizontal piping shall be spaced to prevent excessive sag, bending and shear stress in the piping, with special consideration given where components, such as flanges and valves, impose concentrated loads.

For standard and heavier wall thickness piping, the maximum spacing between supports on straight run of the piping shall be in accordance with ANSI B 31.1.

Vertical supports shall be spaced to prevent the pipe from being over stressed from the combination of all loading effects.

### **Fabrication & Erection of Piping Systems**

The plant piping systems shall be fabricated, erected and tested in accordance with the requirements of ASME, ANSI, and API Standards.

All piping to be adequately supported during construction so that excessive moments or loads are not placed on equipment or other piping. The piping is to be installed to permit free expansion and contraction without damage to joints or supports.

The joint spacing between bevelled ends of pipe shall be maintained between 1.5 and 2.5 mm. Butt welding & end preparation for pipe connections with pipe and flanges shall be as per ANSI B 16.25.

All joints in high pressure and low pressure piping shall be of the fully butt welded type except at points where flanged connections are essential to permit dismantling of pipework for maintenance purposes or for matching flanged item of plants.

Interconnecting joints in all pipes shall be made by butt-welding. Such joints shall be made without the use of backing rings. The welds shall be performed entirely in Gas Tungsten Arc Welding (GTAW) Process but where this is not practicable, a combination of GTAW for the root run, and Shielded Metal Arc Welding (SMAW) for the subsequent runs, is acceptable. Consumable insert rings may be used where considered necessary.

All flanged joints shall meet the requirements of ANSI B 16.5 or the equivalent Approved Standard. All flanges shall be machined on the edge and spot faced at the back to receive bolts, washers and nuts. For high pressure services flange faces must be of serrated finish. Blank flanges are to be solid steel and machined all over. Flanges having pressure ratings less than 10 bar shall not be used. All flange jointing material unless specified, shall be subjected to the approval of the Owner / owner's Representative.

Screwed connections shall only be used on air services and only when the pipe is less than and equal to 50 mm nominal size. In case of threaded joints in piping, all screw threads shall be of the ISO metric form and the diameter and pitch of thread for all bolts, studs and nuts shall conform to the ISO standards. Threaded joints are used in galvanized steel pipes only. Threaded joints, which are to be seal- welded shall be made up without the use of any joint compound or sealing tape. Threaded joints, which are not to be seal- welded shall be made leak-tight by use of suitable joint compound. Backing off of the make-up threaded joints to facilitate fit-up to alignment is not permitted.

At all points where pipes pass through concrete floors or brick or other walls, suitable floor collars or wall boxes are to be provided and fixed. The floor collars shall have raised curbs of suitable height, which shall not be less than 75 mm. The wall boxes shall be flush fitting and be of neat design and approved finish.

The Contract shall include fixing of all necessary components for the protection against weather of such holes in an approved manner. Where pipes pass through roofs, the pipe collar shall up stand less than 200 mm above the top of the roof and hood shall shroud it to within 25 mm of the finished roof level. After the collars, boxes or other fittings been fixed in position, the floors, walls and structures shall be made good by the Vendor.

If service pipes run adjacent to each other, they are, wherever possible, to pass through a box. Where pipes of varying bore pass through a common box, a neat plate cover shall be provided between the pipes and the box. In the case of flanged pipework, boxes shall be large enough to permit the passage of the flange.

Where pipes are laid in covered trenches this Contract shall include for the supply and fixing of all the necessary pipe supports, clamps, packing and fixings, etc.

During erection the Vendor shall be responsible for providing temporary trench covers for the protection of the pipes in the trench and for the safety and convenience of his employees and those of other vendors working or having normal access in the vicinity of trench areas.

The Vendor shall be responsible for maintaining the trenches clean and dry, and shall hand over same to the Purchaser in clean and dry condition at the time of taking over of plant.

### **Cleaning, Packing and Handling of Piping Systems**

The Vendor shall take all necessary precautions to ensure that the interior of all piping is kept clean during erection and free from any injurious matter.

a) All the piping shall be wire brushed and purged with air to remove all rust and mill scale and soaking of wetness from inner surface. The method of cleaning shall be such that no material is left on the inner surfaces, which shall affect the serviceability of the piping.

b) All the internal and external surfaces of pipes shall be provided with suitable protective coating in accordance with the requirements of relevant codes for rust protection of the pipe surfaces during transportation and storage.

c) All components shall be checked for surface conditions inside and outside (Cleanliness & dryness).

d) Following application of corrosion protection systems, all components shall be covered, boxed, capped, plugged or otherwise shielded from further contamination of corrosion.

After cleaning (by any of the above methods), the pipes shall be protected by means of an outdoor preservative. All pipes shall be capped using plugs or plastic caps. All bevels, threads,

flange faces and other sealing surfaces shall be suitably protected with wood or plastic to prevent damage to these surfaces.

Suitable connections shall be made, where necessary, on all pipe runs to facilitate the removal of dirt and debris and the cleaning of each pipe run in accordance with the requirements specified elsewhere.

## **Testing of Piping Systems**

The following tests shall be conducted in the piping systems to check for cracks and the welding joint quality.

### **Hydro Test**

All pipework shall be tested hydraulically to at least 1.5 times the design pressure for at least 2 hours.

The hydro test of the pipe work shall be carried out with skids isolated from the pipe work. Skids shall be tested separately before installation and connection to pipe work.

The hydro test pressure shall not be applied until the piping system and the testing medium have reached thermal equilibrium.

Tested systems shall be vented and drained immediately upon successful completion of the test.

All stainless steel lines are emptied and dried immediately after hydrostatic tests are completed.

To avoid the possibility of pitting due to chlorine contents in water, demineralised or otherwise suitably treated water shall be used as the testing medium.

### **Pneumatic Test**

Pneumatic testing of a piping system is done

- i) When the piping system is so designed that it cannot be filled with water or other liquid testing medium.
- ii) When the piping system is to be used in services where traces of the testing medium cannot be tolerated.
- iii) When the piping system cannot be completely drained and dried out.
- iv) When hydrostatic testing would contaminate, or adversely affect chemical handled during the process.
- v) When the testing fluid would affect or damage internal lining.

Pneumatic tests shall meet the following requirements:

Air test shall be performed with clean, dry air. The source shall be equipped with appropriate pressure relief valves and gauges. The pneumatic test pressure shall not be less than 1.2 or more than 1.5 times the design pressure of the piping system.

No repair welding shall be performed on a pressurised system.

### **Radiographic Test**

Radiographic inspection shall be carried out in accordance with the requirements of ANSI B31.1 and ASME V for checking piping weld quality.

Random radiography shall be carried out in accordance with ASME V Article 2 for all full penetration butt welds. Weld repairs made as a result of radiographic examination shall be radiographed after welding. Repairing a particular area more than two times is not permitted and the component shall be rejected. Prior approval shall be obtained from the Owner / Owner's Representative before taking up major weld repairs (When depth of repair exceeds 20% of thickness or 25 mm whichever is smaller). Mapping of major weld repairs is also required.

Radiography shall be carried out as follows:

- i) For piping 65 NB or smaller, a single elliptical exposure which encompasses the entire weld circumference.
- ii) For piping 80 NB or larger, the double-wall-single-image technique shall be used with at least three exposures at 120 deg. to each other.

The radiographic film recording shall be performed in accordance with the ASTM E94-77. The Radiographic Procedures and Standards of Acceptability shall be in accordance with ASME V and as specified in the appropriate design requirements:

- Gamma isotope double wall IR-192.
- Film used shall be fine-grained, a high contrast, direct type.
- Intensifying screen shall be 'lead'.
- Image quality indicators shall be of the wire type (DIN 54109) selected to give the required level of sensitivity.

**All CPVC/UPVC piping shall conform to ASTM D 1785 Sch 40 minimum and fittings in Sch 80 only.**

## **VALVES**

All regularly operated isolation valves and control valves shall be accessible from a permanent floor or access platform. For operator convenience, valves shall have 1.0 m clear approach space. The stems of all valves for outdoor service shall have weatherproof protection covers of approved construction.

Sufficient overhead access and clearance shall be provided to enable the valve internals to be withdrawn and also for the complete valve to be removed by means of lifting tackle if necessary. Pipe work systems shall be designed and supported so that valves can be isolated for maintenance purposes without shut down of the system whenever feasible and practical.

Unless otherwise specified, manually operated gate, globe, or butterfly valves shall be hand wheel operated and plug valves or ball valves shall be wrench-operated. Manual gear operators shall be provided, as required, depending on the size and pressure rating of the valve. All gear operators shall be of the totally enclosed type, self-locking, with position indicators. All valves shall be equipped with a locking facility, which permits locking in the open or closed position.

All valves shall be fitted with indicators such that it may be readily seen whether the valves are open or shut, and the extent of opening. In case, the valves fitted with extended stems, indicators shall be provided both on the valve and at the extended stem hand wheel. Where remote indication is required, the valves shall be equipped with limit switches mounted on the valves for electrical signal of valve positions "open" and "shut" or position 0 to 100% as required.

Valves and related accessories shall be subjected to hydrostatic testing and seat leak testing as per the requirement of the applicable codes and valve pressure classes as per B16.34 / API 598 / BS 5146. All motor actuators shall be supplied with type and routine test reports.

For gas service, all isolating valves shall be ball type with double block and bleed function. These valves shall be "fire safe" in accordance with API - 607 or BS-5146 and of anti-static design in accordance with BS-5351.

The shut off valves in the vent line from the safety valves shall be locked open by a approved master key system.

All isolation valves shall be designed to withstand the differential pressure across them when closed.

The drains from each filter separator and other liquid drainage points shall be fitted with a non return valve and manual isolating valve. The drains shall be grouped and connected to a common drain header leading to the condensate tank.

Vents and thermal reliefs shall discharge to the vent system. The capacity and the design of the vent system shall be as per the recommendations of API standards.

Whenever there is a risk of pressure above design point safety valves shall be provided.

### **General Purpose Valves**

#### **a) Gate and Globe Valves**

All gate and globe valves, except bronze body valves, shall be screwed outside and yoke designed with rising stems. Bronze body valves shall have union type bonnets and rising stems. Bonnets joints shall be of the bolted, flanged type for class rating upto 600#. Pressure seal bonnets shall be provided for class rating above 600#. The bypass shall be integral with the main valve and shall be of welded connection.

Valves shall be provided with back-seating construction and shall be suitable for repacking at full pressure with the valve in the open position. Gate valves for pressure above 40 bar shall have double wedge type discs. Globe valves shall have plug type discs. All valves shall have replaceable seat rings.

#### **b) Check valve**

Check valves shall be designed for mounting in horizontal or vertical piping runs. Check valve shall be of a non slam type with a swing disc and, in special cases, of the tilting disc type or guided piston lift type used upto 50 NB. Check valves are placed in line with a gate valve or a globe valve where guaranteed tightness is required. All check valves shall be horizontally mounted.



**c) Butterfly valves**

Butterfly Valves shall be used in place of gate or globe valves for low-pressure liquid or gas service. Valves are to be designed for minimum pressure loss when open and capable to withstand the full pressure of the line when closed and cause minimum vibration when used for throttling of flow. All manually operated valves of 150 mm and larger shall be of the gear type with totally enclosed gearing, and smaller shall have multiposition lever operators.

For water system with pipe sizes NB 150 & above, butterfly valves shall be used and shall conform to AWWA C-504

**d) Ball Valves**

Ball valves may be used for low pressure liquid / air service. Each ball valve shall be provided with an operating lever.

**e) Instrument Root Valves**

Instrument shut-off valves shall be Globe type construction, no bonnet, outside screw, rising stem, with vent plugs and flanged or socket weld ends.

**Special Purpose Valves**

Special purpose valves include valves operated with motor, pneumatic & solenoid actuators. These valves are mainly meant for remote operation in critical controls of fluid pressure, flow and temperature. The special valves shall have provision for hand operating gear.

**a) Motor operated valves:**

Electrically operated valves are preferred for non-safeguarding service. Local operation shall be provided on all valves. Every selector switch shall be lockable in "local" or "remote" or "hand" positions and each shall be provided with a padlock and two keys. Supply voltage for Valve motors shall be as indicated in Vol-II, Sec B.

Electric actuators shall have torque-limiting devices effective throughout full travel, the torque at which these operate being readily adjusted, and travel limit switches for controls and also for the operation of remote indicating lights.

The speed of operation of all power-operated valves is to be selected to suit the operating conditions of the system and to minimise pressure surges. Actuators shall have adequate power and control systems to operate the valves accurately under all system operating conditions.

All motorized valves shall be equipped with four limit switches, for automatic control and position indication purposes. Two torque switches are equipped, one for acting in the opening direction and the other in the closing direction. Limit switches shall not be used as mechanical stops. The materials of the limit switches shall be corrosion resistant to gases and chemicals present in the plant environment by hermetically sealed snap acting single pole double throw type, able to switch faultlessly 125 V DC/24V DC/ 230V AC.

**b) Pneumatic actuated valves:**

Pneumatic actuators may be of the following types:

- Spring opposed diaphragm motor type
- Spring less opposed diaphragm motor type

- Piston operated type

Air actuators shall be designed to produce the required stem forces with supply air pressures of 5.5 - 7 bar (g). Piston actuators shall be used where stem forces dictate their use.

Diaphragms shall be of moulded rubber, neoprene or other suitable materials and diaphragm housings shall be of pressed steel construction.

Piston actuators use cast pistons and cylinders with O-ring seals. Air cylinders are manufactured in accordance with BS 4862 or approved equivalent.

The cylinders, unless otherwise specified, shall be required to be supplied with protective gaiters - bellows type to protect the piston rod seals. Cylinder seal materials are to be selected by considering higher ambient temperatures.

**c) Solenoid actuated valves:**

Solenoid coils are rated at 125 V DC for continuous energizing and designed to operate satisfactorily within 0.80 to 1.1 of rated DC voltage and in 55°C ambient temperature.

Solenoid valves shall operate on the "ON-OFF" principle. The use of economy resistors is not allowed. Solenoids shall be installed in a vertical orientation.

**d) Safety and relief valves:**

Safety & safety relief valves are provided to relieve the pressure in excess of the design pressure building up in the system.

All relief valves are direct spring loaded, angle body types of a design suitable for their respective operating conditions. Relief valves for compressed air "safety" type. Relief valves for water or oil shall be of the liquid relief type having a slow opening and closing action. All relief valves shall be arranged for field adjustment of the set pressure and provided with lifting levers.

**e) Control valves:**

Control valves are meant for regulating pressure, temperature & flow parameters in the system. Control valve stations are generally designed with a gate valve at its upstream and downstream with a globe vent valve and a globe type bypass valve. Manual bypass valve is provided where manipulation can provide satisfactory control or where it is required for the safe plant shutdown following failure of the control valve. Bypass valves are not provided in cases where manual control cannot sensibly be achieved.

Trim of control valves shall be designed to avoid erosion, excessive noise and vibration while handling flashing condensate.

Control valves shall have stainless steel stems, guide bushing, inner valves, seat rings, stem lock pins and stuffing box parts hardened with stellite or other equivalent seating surfaces.

Flow control valves shall be especially designed to meet high pressure drop applications with stainless steel stems, stellite, or other equivalent hardening, seats and discs.

Control valves shall be fitted with approved indicators, showing accurately the amount of valve opening, and shall have electric position transmitters with 4-20 mA output equivalents to 0-100% opening. All valve seats and faces shall be renewable and be made from materials that are corrosion and wear resistant. Noise levels for control valves shall be restricted to 85 dBA at 1 m.

**f) Pressure reducing valves:**

Pressure reducing valves shall be designed for perfectly stable, quiet and non-vibratory operation over its full range and shall be suitable for continuous duty at the operating temperature.

In case of electrical or hydraulic valve operator is provided, on failure of the operating mechanism, the valve shall not close automatically and the valve opening shall be readily adjustable by hand. A pressure relief valve shall be provided at the discharge of each reducing valve, capable of discharging the maximum flow of the reducing valve without build-up of pressure.

Pressure & Temperature gauges shall be provided upstream and downstream of each reducing valve and this valve is operated by sensing the downstream pressure with the set pressure.

## **Valve Selection Criteria**

The valve selection criterion is generally as below:

For reasons of plant standardization the Vendor shall standardize the valves, to reduce number of types and manufacturers to a minimum. Installation and testing of the valves shall be in accordance with the applicable standards. The requirement of this clause shall apply if they are more stringent than the approved standards.

All valves shall be suitable for the media and for the service conditions and those performing similar duties shall be interchangeable. All valves must meet maximum design demands for pressure and temperature of the piping system.

If the media handled are polluted, the shut off devices used in discharge lines (e.g. drains on vessels) and possibly also in vent lines should consist of gate valves.

The maximum permissible forces for actuation hand wheels are 300 N for wheels with diameter up to 400 mm and 600 N for larger diameters. Differential pressures requiring higher forces for actuation of hand wheels shall entail fitting the valve with gears. For calculation of the gears or all other actuators the design pressures shall be taken as differential pressures. Large valves that are frequently operated or hard to operate manually shall be motorized.

Valves that are required to be motor operated shall be provided with hand operated equipment for closing and opening of the valves during power failure and shall have a suitable arrangement for de-coupling when the valves are being motor operated.

Gear operator shall be of totally enclosed. Bevel gear in grease case with grease nipples for gate and globe valves and totally enclosed helical worm gear in grease case with grease nipples for ball, plug and butterfly valves.

Where required, valve spindles shall be lengthened so that the hand-wheel is at a minimum height of one metre above the level of the floor. Where necessary they shall be provided with headstocks and pedestals of rigid construction. The actuation of valves by means of chain drives is not permissible.

On all valves where the hand wheels are liable to be dangerously hot to touch thermal insulation shall be provided on the ring and spokes.

All valves shall be closed by rotating the hand wheel in clock wise direction when looking at the face of the hand wheel. The face of each hand wheel shall be clearly marked 'open and 'shut', with arrows indicating the direction of rotation to which each term refers.

Plastic or bakelite valve hand wheels shall not be accepted. Valves with solid hand wheels are not acceptable since all valves must be capable of being locked by means of a chain and padlock in the open and closed position.

All valves must be suitable for outdoor installation with due consideration of the special climate and environmental conditions at the site.

Unless otherwise agreed, all valves shall be fitted with the spindle in the vertical position. Eye bolts shall be provided where necessary to facilitate handling heavy valves or parts of valves.

Valves of sizes NB 50 and above shall be provided with position indications.

Fire safe valves shall be supplied with antistatic devices.

Materials used must confirm to the applicable standards. Materials for screws, bolts and nuts must have the operating temperature limits closely observed.

All valves of the relevant pipework systems must be suitable for pickling.

For cold water lines ductile iron shall be allowed. In no case shall grey cast iron be allowed.

Unless otherwise required by virtue of the valve's function, bodies shall have an internal cross section corresponding to the nominal diameter of the connection.

Integral bypass arrangement for gate valves shall be provided wherever necessary. In that case, bypass valve shall be a globe valve and bypass attachment to main valve body shall not be screwed. The integral bypass valve shall also be motorised if the connected main valve is provided with motor actuator.

Gate valves and swing check valves of the H.P. piping systems shall be equipped with self sealing lid covers. Gate valves with self-sealing lid covers shall be equipped with a safety device at the body. If discs are used they must be capable of being dismantled and changed under operating conditions.

Connecting flanges shall be in accordance with the applicable standards with regard to both the connection dimensions and the minimum thickness of the material.

The transition from the flat rear surface of the flange (nut contact faces) to where the welding begins must have no sharp-edged machined grooves.

The spindle must be made in one piece: the length of thread must be such that the threaded bush is fully engaged in any position of the moving part. The connection between the spindle and the cone must be sufficiently flexible. For H.P. globe valves and globe valves for throttling purposes of NB 50 or less the spindle and cone must be made in one piece.

In case of metallic sealing elements there must be difference in hardness between the body seat and the sealing element, the sealing element having the higher hardness values.

All globe valves shall be equipped with throttling cones with parabolic characteristics.

Each valves shall be marked on the body with the material diameter, the nominal pressure, type of valve and an arrow showing the flow direction whenever only one is possible.

No traps which incorporates internal screens or check valves shall be used unless specifically required by the specifications or approved by the Owner.

Condensate drainers shall be of the ball-float type.

For safety valves, pressure relief valves, bursting discs and other safety devices against excess pressure the directives of appendix II of the code ANSI B31. 1: 'New Mandatory Rules for the design of Safety Valve Installations' shall apply as well as requirements of Indian Boiler Regulations (IBR) wherever applicable.

Note: All valves in chemical application shall be in SS 316 wetted parts or equivalent corrosion resistant coating with pressure rating suitable for line.

## MATERIAL REQUIREMENTS FOR PIPING COMPONENTS AND VALVES

The main materials and special requirements specified under this title shall be seen as the minimum requirement. The following guideline represents minimum requirements. In case of intended deviations 'Deviation from Enquiry Documents' applies.

### PIPING MATERIAL SPECIFICATIONS

Service	Size	Pipe Material	Valve Material
1. High TDS water Service (Low Pressure)	SS 316 / GRP/ HDPE/CS Rubber lined or PU coated/ Equivalent (GRP underground is not acceptable) /CPVC/UPVC		
2. High TDS water Service (High Pressure)	SS 316		
3. Sludge line	≤ NB50	HDPE/ GRP	Copper Alloy
	> NB50 and < NB600	HDPE/ GRP	Butterfly valves Fabricated from IS:2062 (hard ebonite rubber-lined)
4. Chemical Dosing line	≤ NB50	CPVC	ASTM A182 F304L
	> NB50	CPVC	ASTM A351 CF8
5. Treated water line	≤ NB50	HDPE/ GRP/UPVC	Copper Alloy
	> NB50 and < NB600	HDPE/ GRP/UPVC	Fabricated from IS:2062 (hard ebonite rubber-lined)
6. Service water / Service air line	≤ NB150	CS as per IS1239	Service Water: ASTM B62/ IS318 Gr 2 upto 50NB CI IS210 FG 260 for >50NB Service Air: ASTM A105 upto 50NB ASTM A 216 GR WCB for >50NB
	>= NB200 and <=NB400	CS as per IS3589	
	>=NB450 and above	Fabricated from IS2062 Gr B plate	

7.Potable waste/ Instrument air	$\leq$ NB150	IS 1239 Galvanized	
	$\geq$ NB200 and $<$ =NB400	IS 3589 Galvanized	

## **General Requirements for Pipe work**

The Contractor shall supply, deliver and erect all pipe work and fittings within the structures and externally to the limits indicated on the approved drawings and in accordance with each section of specification. Pipework and fittings shall be suitable for a safe working pressure equivalent to the maximum working pressure of the system. The safe working pressure of the pumping mains shall be the closed valve head of the pump plus the maximum suction static head. The maximum surge pressure shall be limited to 125% of the maximum working pressure. All pipework and fittings shall be of adequate strength to accommodate the maximum surge pressure of the system.

## **Welder Qualification**

When requested by the Engineer In charge the contractor is to arrange for the welder to produce test welds in accordance with the provisions of BS 2971.

## **Pipe work Installation**

All pipework, pipe fittings, jointing materials etc. shall be of the best quality free from defects and obtained from a supplier approved by the Engineer. The installation of the pipe work shall be carried out using skilled personnel and pipework shall be installed according to the drawing approved by the Engineer. Where valves are incorporated in pipe work, the valves shall be provided with their own supports, such that no excess loading is exerted on pipework. All pipe work materials shall have no excess loading is exerted on pipe work. All pipe work materials shall be off-loaded, stored on site and handled thereafter in such a manner that they are adequately protected for damage or deterioration.

## **Underground Pipes**

Unless otherwise stated all underground pipes shall be buried in trenches which have been excavated in accordance with the relevant section of the specification

## **Examining Pipes**

Before being used, each pipe casting or fitting shall be properly examined and should appear defective in any way, it shall be set apart and not used until it has been examined and passed by the Engineer. All metal pipes which shall be buried in the ground shall, prior to their installation, be slung and sounded in an approved manner. Any pipe found to be faulty by this method, shall be set aside for examination by the Engineer.

## **Cutting Pipe work**

All pipework shall be cut with proper pipe cutting tools. The use of hammer and chisel for this purpose shall not be permitted. Great care shall be exercised when cutting concrete / bitumen lined spun iron and ductile iron pipes, to ensure that there is no damage to the lining. Should any damage to the lining take place which is to an extent which the Engineer deems to be undesirable, then the pipe shall be rejected. The Contractor shall then prepare another pipe for incorporation into the works. All pipes which have been cut shall have the edges dressed and deburred.



## **GENERAL SPECIFICATIONS - MECH. EQUIPMENTS**

This specification covers the design requirements, materials, and features of construction, inspection and testing and commissioning of Horizontal Centrifugal Pumps for lifting the water from underground sump to overhead tank.

Also the scope of work included with supply and installation of interconnecting piping works including all the related valves, specialties and all other accessories.

The pump set offered shall be generally horizontal centrifugal pump, single stage or multistage or mono-bloc pump to satisfy the duty conditions stipulated in the bill of quantities.

The pumps shall be selected having their maximum efficiency at average operating conditions. The maximum speed at which a pump shall run is determined by the net positive head available at the pump, the quantity of liquid being pumped and the total head.

Following standards and codes are made part of this specification.

IS 8418 - 1977	Specifications for horizontal centrifugal pumps.
IS 8034 - 1976	Specifications for submersible pump set for clear, cold, fresh water (First revision).
IS 5120	for handling water.
IS 5600 - 1970	for pumping storm water and sewage.
IS 325 - 1961	Specification for three phase induction motors.

### **SCOPE OF SUPPLY AND ERECTION**

The CONTRACTOR shall supply, install, test and commission all pumps and accessories, interconnecting material like pressure gauges & accessories, specialties and other items as required.

Contractor to provide flanged metal/rubber bellows at the suction and delivery side of pumps that are assumed to be a part of the equipment.

Scope of erection to be performed by the CONTRACTOR is outlined below:

The CONTRACTOR shall unload from carriers at plant site, handle, and check, receive, transport, store, erect and test all materials furnished by him and others in accordance with this specification and General Conditions of Contract. The CLIENT shall be informed of any loss of damage within seven days of receipt of material.

The CONTRACTOR shall also install small accessory piping and any specialties furnished for equipment such as built-in bypass and other equipment of this type.

The CONTRACTOR's scope under this includes the following:

Jointing material as required for all screwed joints. Fasteners (bolts, nuts, studs washers etc.) and gaskets is required for all flanged joints.

Erection tools, tackles drilling machines, chasing machines as required.

### **TESTS AND INSPECTION**

A standard hydrostatic test shall be conducted on the pump casing with water at 1.5 times the maximum discharge head or twice the rated discharge head, whichever is higher. While arriving at the above pressure, the maximum suction head shall be taken into account. (Maximum

discharge head = Shut off head + maximum suction head). The hydrostatic tests on the casing shall be conducted for a minimum duration of 30 minutes.

### **PERFORMANCE TEST**

#### **Standard Running Test**

The pumps shall be tested as per IS 5120, at rated speed at SUB-Contractor's works to measure capacity, total head, efficiency and power. The negative tolerance on efficiency shall be limited to 2.5% (not 5 % as indicated in IS 5120. These tests shall form the basis for acceptance of pumps except for vibration and noise. The pumps shall be tested over the range covering from shut-off head to the maximum flow. The duration of the test shall be minimum one hour. Minimum five readings approximately equidistant shall be taken for plotting the performance curves.

NPSH tests shall be conducted with water as the medium.

### **MECHANICAL BALANCING**

In addition to static balancing, impeller and balancing drum shall be balanced dynamically at or near the operating speed.

### **FIELD TESTING**

After installation, the pumps shall be subjected to testing at site also. If the field performance is found not to meet the requirements regarding vibration and noise as specified, the equipment shall be rectified or replaced by the CONTRACTOR, at no extra cost to the CLIENT.

### **CONTRACT DRAWINGS**

The contractor to submit preliminary outline dimensional drawing of pump and motor including suction and discharge connections and the foundation details required for the pump to be installed along with the Bids

Performance curves (capacity vs. total head, efficiency, NPSH and KW requirement) ranging from zero to maximum capacity.

### **PAINTING**

All metal surfaces shall be painted with two coats of enamel paint over a coat of approved oxide primer. However the components of the pumps shall not be painted before inspection.

### **GASKETS, SEALS AND PACKINGS**

The gaskets, seals and packing are used in special purpose pumps shall be suitably chosen so as to withstand the effect of liquid being pumped.

Clear cold fresh water Mechanical seal or cotton yard (lubricated) seal.

### **ACCESSORIES**

- Essential for pump set used for pumping water.
- Oil lubricator with oil level indicator if the pump is lubricated.
- Grease cup for grease lubricated bearings.
- Flanged ball valve/Gate valve on suction side if there is positive suction.
- Flanged ball valve/Gate valve on delivery side.

- Flanged horizontal/vertical check valve on delivery side.
- Pressure relief valve.
- Pressure gauge (for delivery pipe) and vacuum gauge (for suction pipe) with copper tubing and winch cock.
- Priming funnel with separate or integral air cock.
- Float switches or automatic level operated control switch.
- Base plate.
- Foundation bolts and nuts.

## **PUMP TEST**

Pump tests are made to determine the following:

The discharge against the specified head when running at the rated speed under specified suction lift or head.

The power absorbed by the pump at the pump shaft (BP) under the above specified conditions and Efficiency of the pump under the above specified conditions.

The pump has to be tested at manufacturers works and a test certificate furnished before supply and tested at site after installation as per procedure as per clause 13 of 5120 – 1968.

## **SPECIFICATIONS FOR PUMP INSTALLATION**

### **INSTALLATION**

Certain precautions must be observed in both planning a pump installation and erection

Piping: Both the suction and discharge lines should be independently supported so as no strains will be thrown on the casing such strains may cause distortions and rubbing.

The suction line should be as short and straight as possible. Any elbows should have large radii. For pumps operation with suction lifts no valves other than a foot –valve should be placed in it. Generally, the diameter is made one or two sizes larger than the pump flange size. All these precautions insure the maximum available suction head on the pump. When an oversize line is used an eccentric reducer, which is horizontal at top, is placed between it and the pump flange size.

It is very important to have the suction line airtight and to avoid high spots at which dissolved gases or air might separate out and destroy the vacuum. After piping is installed and the pump is running all joints should be inspected with a flame, as air leakage will draw the flame to the opening. The same method can be used to determine leakage through the packing box; the eccentric reducer is used at the suction flange to avoid high spot at which the air might collect. The inlet end of the suction line i.e., submergence should be 1 to 2 mtrs. Below the minimum water level of the sump (not less than 1 mtr.) to prevent air from being drawn into the pipe with the water.

It is desirable to have a long length of straight piping between the elbow and suction flange as possible to even out the flow of the water as it enters the pump. The pump should be placed to secure the greatest possible suction head and yet to be available for inspection and repair work.

A non-return valve and isolation valve are usually placed in the discharge line. The isolation valve is used to regulate the flow and the non-return valve prevents backflow into the pump, which might cause it to operate like a turbine and perhaps be damaged on account of over speed. The non-return valve is placed between the isolation valve and the pump so that it may be inspected or removed without emptying the discharge line.

### **FOUNDATION**

The foundation should be heavy to reduce vibrations and should be rigid to avoid any twisting or misalignment. A space of 2 to 4 cm is allowed between the base plate and top of the foundation, which is filled with grouting to secure a uniform load distribution. Alternatively, rubber cork anti-vibration pad shall also be placed.

When the grouting had dried the base plate should be drawn down evenly to avoid springing it. After this has been done the shaft is finally aligned both radially and axially with the driver by

means of shims or wedges so that it turns freely. If the shaft is not properly aligned there will be vibration and excessive wear on the bearings, packing and wearing rings.

## **PUMP OPERATION: TRAIL OPERATION**

The operation of centrifugal pump is quite simple and safe. There are relatively few valves and the pump will not be damaged even if the discharge valve is closed for short periods of time.

### **STARTING**

The pump must be primed before it will deliver any fluid. Failure to prime the pump may cause the wearing, rings, and rub and seize or the shaft may be scored at the packing boxes. During starting it is wise to have the vent cock in the casing open slightly to remove any dissolved air in the water.

It is best to have the discharge valve set so that the least load is thrown on the driver when the pump is started. The valve should be opened gradually to avoid throwing a large sudden load on the driver and to prevent a sudden surge in the discharge line. The discharge valve should be fully open when starting mixed flow or propeller pumps because the brake horsepower will then be a minimum.

### **RUNNING**

When the unit is running it requires very little attention beyond occasionally checking to see that the journal and thrust bearings are running cool and have a sufficient supply of oil. The packing is adjusted to permit a slight leakage to cool and lubricate it, and the water is flowing to the water seal of the suction gland to prevent air from leaking in.

### **SHUTTING DOWN**

When shutting down, the discharge valve should be in the same position as when starting up by closing the discharge valve gradually so that less power is dropped from the line and any sudden pressure surges in the pipe system are avoided.

### **INSPECTION AND MAINTENANCE**

Manufacturer supply instruction manuals, which give directions for the operation and maintenance of each pump.

The wearing ring clearance should be checked as they will increase with time and thus cause a decrease in efficiency. The frequency of the inspection will depend upon the liquid handled. If the liquid contains gritty materials or is corrosive, inspection may be made monthly, but if clear water is pumped it may be sufficient to check them annually. A general rule is to replace the rings when the clearance has increased 100 percent above the original.

The packing should be replaced after it becomes hard and tends to score the shaft. When the packing is being replaced the finish of the shaft sleeves should be examined for smoothness. It is essential that the lantern ring shall be placed directly under the water inlet when putting in the new packing to insure a circulation of the water and a satisfactory seal. The packing should be gradually compressed with the pump running. It should not be compressed too much as local heating of the shaft and consequent misalignment will result. A slight leakage will insure proper lubrication and cooling.

If the base is not too rigid the shaft alignment should be checked occasionally when the pump is at a temperature corresponding to running conditions. This must be done with the packing removed. At the same time the clearance of the journal bearings should be checked for wear. The oil should be changed as required and at that time inspected for the presence of water. If water appears in the oil the pump casing should be examined to find the leak.

#### **GUARANTEE OF PERFORMANCE OF PUMPS:**

The pumps shall be guaranteed by the manufacturer/supplier against defects in material and workmanship under normal use and service for a period of one year from the date of commissioning.

#### **TOLERANCE**

A tolerance of  $\pm 2.5$  percent shall be permissible on discharge. However, for small discharge up to 9000 litres per minute, a tolerance of  $\pm 2.5$  percent or +24 litres per minute whichever is higher is allowed. While the negative tolerance 2.5 percent is maintained.

The pump efficiency shall be not less than the specified value by more than 2.5 percent. This tolerance may be raised to 5 percent in case the prime mover does not get overloaded.

#### **GENERAL REQUIREMENTS**

The specified range shall lie on the stable portion of the head characteristic curve. This is applicable in case of parallel operations of pumps only.

#### **SUCTION AND DELIVERY ENDS**

The size of the suction end of a double suction pump should preferably be one size larger than that of the delivery. This is to offset the increased loss in the suction. Typical practices of piping used are:

80/65m, 100/80m, 125/100m, 150/125m, 200/150m and 250/200m etc.,

For a high-pressure pump, a reflux valve shall be connected on the delivery side and a pressure relief valve installed in pumping main outside pump house. Need for surge control devices verified.

#### **FLUID PASSAGES**

All the liquid passages in the casing and the impeller which are inaccessible to machining shall be finished to smooth surface as far as possible.

#### **DRAINAGE PLUGS**

Tapped drain holes with plugs shall be provided for draining the fluid that may drip from the sealing arrangement. The sealing arrangement shall be sufficiently deep to provide for sufficient quantity of packing to prevent leakage of air.

#### **LANTERN RING**

In case, where a lantern ring is used in a stuffing box, it shall be sandwiched between rows of packings and shall be easily removable.

#### **CASING**

Casing shall be of robust construction and tested to withstand 1.5 times the shut-off pressure or twice the rated pressure whichever is higher.

### **IMPELLER**

The impeller shall be properly balanced along with any other un-machined rotating parts on proper balancing equipment so as not to cause any vibrations.

### **SHAFT**

The shaft shall be finished to close tolerance at the impeller coupling, pulley and bearing diameters. The impeller, pulley and shaft sleeves shall be firmly secured to the shaft by keys or nuts on both.

### **SHAFT COUPLINGS**

Shaft couplings, where provided, shall be properly aligned and firmly secured to the shaft by keys or nuts on both.

The size of the shaft shall be calculated on the basis of the maximum combined shear stress. This shall not exceed 30 % of the elastic limit in tension or 18% of the ultimate tensile strength. The next higher standard size of shaft in accordance with the relevant standard shall be chosen. The design of the shaft shall also be taken into consideration the critical speed of the shaft, which shall differ from the actual working speed by at least ten percent on either side.

### **BEARINGS**

The bearings should be designed for a minimum life of 20,000 hours. The bearing housings are designed in such a manner that no liquid being pumped should enter the housing.

The bearing may be ball, roller or sleeve bearings. In the latter case, some sort of thrust bearings is necessary. If sleeve bearings are used, they are to be machined for close running fit. The bearings shall be so designed as to take up the necessary radial load as well as the net hydraulic axial thrust. Bearings shall be lubricated properly.

Where there is a possibility of fluid entering the bearing the pump shall be provided with suitable preventive arrangements for example deflectors.

### **STUFFING BOXES**

The stuffing boxes shall be extra deep and provided with a cooling water jacket if so required. In addition, provision for tapping off the leakage liquid shall also be made. The packing materials employed shall be suitable for withstanding special conditions such as temperature, corrosion due to the fluid being handled etc. Wherever possible, suitable mechanical seals may be used.

### **BASE PLATES**

The base plates which accommodate the pump and the prime mover, when provided shall be rigid so that alignment is not affected under normal working conditions.

### **PRIME MOVER**

The prime mover shall be of a such capacity to provide, under working site conditions a power which is more than maximum power required by the pump at any point in the specified range should be a specific margin be required by the customer in the power of the prime mover, he should go advise the manufacturer for obtaining the proper recommendations.



## NAMEPLATE

Every pump shall have a nameplate indicating:

Name and address of the pump manufacturer. Type, size and serial number of the pump and Speed, total head, capacity and corresponding pump input for the duty point.

For corrosive liquids the material of the nameplate shall be suitable to withstand the corrosive atmosphere.

## SPECIFICATIONS FOR PUMPS

(Following information to be submitted for different Pumps separately)

### 1. Performance Data

- (a) Manufacturer's Name
- (b) Model No. & No. of stages
- (c) No. of pumps offered.
- (d) Guaranteed performance data under Design conditions. For

50 Hz	51.5 Hz
-------	---------

- (i) Capacity .m3/hr
- (ii) Total head, MWC.
- (iii) Suction Pressure, Kg/cm<sup>2</sup>g
- (iv) Suction Temperature, °C
- (v) NPSH required, MWC
- (vi) Overall efficiency  
(excluding the drive motor). %
- (vii) Pump speed, RPM
- (e) Shut off head, MWC
- (f) Minimum continuous flow
- (g) KW requirement at
  - (i) 80% of design capacity
  - (ii) 100% of design capacity
  - (iii) 120% of design capacity
  - (iv) Run out flow condition

### 2. Technical Particulars

- (a) Pump casing
  - (i) Type of construction  
(Radial split/Axial Split/Single volute/Double Volute)
  - (ii) Hydrostatic test pressure Kg/cm<sup>2</sup>g
- (b) Pump rotating assembly
  - (i) Direction of rotation viewed from driven end
  - (ii) Diameter of impeller mm Min. ----

Rated ----

Max. -----

- (iii) Impeller radial clearance mm
- (iv) Shaft diameter, mm
- (v) Clearance at impeller wear rings mm  
(as fitted/Maximum permissible during operation)
- (vi) Static deflection of shaft at impeller wearing rings, mm
- (vii) Method of fastening of impeller to shaft
- (viii) Moment of inertia of rotating assembly,  $\text{kgm, m}^2$

(c) **Nozzle Connections :**

(1) **Suction**

- (i) Size, mm
- (ii) Rating
- (iii) Facing and drilling standard
- (iv) Position

(2) **Discharge**

- (i) Size, mm
- (ii) Rating
- (iii) Facing and drilling standard
- (iv) Position

(3) **Radial Bearings**

- (i) Nos. provided.
- (ii) Type
- (iii) Catalogue no. and manufacturer
- (iv) Design life at normal operating conditions, hrs.
- (v) Bearing diameters, mm
- (vi) Details of lubricant & method of lubrication.

(4) **Thrust Bearings**

- (i) Nos. provided.
- (ii) Type
- (iii) Catalogue no. and manufacturer
- (iv) Design life at normal operating conditions, hrs.
- (v) Bearing diameters, mm
- (vi) Details of lubricant & method of lubrication.

(f) **Shaft Sealing Arrangement**

- (i) Packing details - Make / Model
- (ii) No. of rings/lantern rings/Packing size

(g) **Coupling**

- (i) Type and manufacture
- (ii) Coupling guard provided?
- (iii) Whether sparking or Non sparking type guard

(h) **Materials of Construction**

- (i) Impeller

- (ii) Shaft
- (iii) Casing
- (iv) Shaft sleeve
- (v) Casing / impeller wear rings
- (vi) Base plate
- (vii) Stuffing box packing
- (viii) Gland
- (ix) Throat bush

Technical particulars of the drive have to be given inline with Annexure `B 'of Motor Specification PC-E-503 (for 6.6 KV Motors) and PC-E-501 and PC-E-502 (for 415 V Motors) as applicable.

(1) **Accessories**

- (i) Casing wearing rings provided?
- (ii) Impeller wearing rings provided?
- (iii) Common base plate provided?
- (iv) Sight gauge & grease fittings for bearings provided?
- (v) Air cock with priming funnel provided?
- (vi) Lifting lugs, eye, bolts etc., provided?
- (vii) Weights and dimensions

(2) **Weights**

- (i) Complete pump and drive assembly, Kg.
- (v) Rotating assembly of pump, Kg
- (vi) Motor, Kg
- (vii) Total Shipping Weight, Kg.

(3) **Overall Dimensions**

- (i) Complete pump and drive assembly,
  - Length mm
  - Width mm
  - Height mm
- (ii) Base Plate :
  - Length mm
  - Width mm
- (iii) Height of suction nozzles centre line above bottom of base plate, mm
- (iv) Height of discharge nozzle centre line above bottom of base plate, mm
- (viii) Distance of the connection flange faces from the pump centre line
  - Suction Nozzle, mm
  - Discharge Nozzle, mm

**2.1 Probabilistic Safety Analysis Input Data : Following data to be submitted**

- a Mean time between failures (MTBF) :
- b Test Frequency :
- c Impact of ageing on performance :

d No. of cycles of operation in life time:

2.2 **Drawings, Curves and Information required with Proposal**

The following information shall be submitted with the proposal separately for all type of Pumps.

2.2.1 General arrangements drawings for the complete pump and drive assembly, showing overall dimensions and locations of the various connections, supports and foundation arrangement of the pump assembly.

1. Cross-sectional drawing indicating the assembly of the pumps and their major parts, along with material specification.

2. Performance curves showing the total pump head, efficiency, power consumption and NPSH requirement against capacity for the range of zero to 120% of design capacity.

Tenderer shall use the system resistance curves for applicable pumping systems wherever enclosed and furnish the superimposed curves with H-Q Performance Curves of applicable Pumps indicating head and flow during one pump, two pumps and three pumps operations under various cases of operation indicated as applicable and at grid power supply frequency of 50 Hz and 51.5 Hz.

**Drawings, Data, Instruction Manual, Test Reports etc., Schedule of Submission**

The supplier shall submit various certified drawings and data for review of the Purchaser and afterwards for final distribution in quantities and in accordance with the procedure set up in Tendering and Contract conditions, according to the following schedule in respect of each project.

<b>Description</b>	<b>Sludge transfer pumps</b>	<b>All other pumps</b>	<b>High pressure pump</b>	<b>Chemical pumps</b>
Casing	CI FG - 260	SS 316	SS 316	SS 316/PP
Impeller	Bronze	SS 316	SS 316	SS 316/PP
Casing wear ring	Bronze	SS 316	SS 316	SS 316
Shaft	Carbon steel	SS 316	SS 316	SS 316
Shaft sleeve	Stainless steel	SS 316	SS 316	SS 316
Base plate	IS 2062	IS 2062	IS 2062	IS 2062
Gland packing	Non-asbestos	Mech. Seal	Mech. Seal	Mech. Seal



## **GENERAL SPECIFICATIONS - ELECTRICAL WORKS**

### **1.0 ELECTRICAL WORK**

#### **1.1 SCOPE:**

The scope of this section comprises of Design, Manufacturing, supply, erection, testing and commissioning of Electrical Power/ control panels, wiring and earthing of all air-conditioning equipment components and accessories, including supply, installation and wiring of remote control with indicating lamps.

The following exclusions from this contract may be provided by Owner, through other agencies, as per special conditions of contract.

b. Wiring and earthing of incoming breakers in the air conditioning plant room control panel.

ii. Supply, installation, wiring and earthing of 15 amps three pin socket in vicinity of each fan coil unit if any and each single phase ventilation fan.

#### **1.2 GENERAL:**

Work shall be carried out in accordance with the specifications of local rules, Indian Electricity Act 1910 as ammended upto date, and rules issued there under, regulations of the Fire Insurance Company and Indian Standard Code of practice No. IS: 732-1963 (revised).Wiring for items of work not covered by any of the above regulations, shall be carried out in accordance with the standard specifications.

#### **1.3 WIRING SYSTEM:**

All power wiring shall be carried out with 1100 volt grade XLPE insulated, armoured, overall, PVC sheathed aluminium conductor cables. Cables shall be sized for taking care of starting current and by applying proper derating factor. All control wiring shall be carried out by using 1100 volts PVC insulated copper conductor wires in wire ways or in conduit. Minimum size of control wiring shall be 1.5 sq.mm.

#### **1.4 CONSTRUCTION FEATURES:**

The control panel shall be metal enclosed sheet steel cubical indoor type, dead front, floor mounting/wall mounting type. The control panel shall be totally enclosed, completely dust and vermin proof, Gaskets between all adjacent units and beneath, all covers shall be provided to render the joints dust proof. Control panels shall be arranged in multitier formations. All doors and covers shall be locable. All mild steel sheets used in the construction of control panels shall be 2mm. thick and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet metal shall be seam welded, all slag grounded off and welding pits wiped smooth with plumber metal.

All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with hank nuts. Self threading screws shall not be used in the construction of panels. Base channel shall of 75mm x 75mm x 5mm thick shall be provided at the bottom.

Minimum clear space of 200mm between the floor of panel and bottom most unit shall be provided.

The panels shall be of adequate size with a provision of 25% spare space to accommodate possible future additional switch gear. Knockout holes of appropriate size and number shall be provided in the panels in conformity with the location of incoming and outgoing conduits/cables. All equipment such as meters and indicating lamps, etc shall be located adjacent to the unit with which it is associated and care shall be taken to achieve a neat and symmetrical arrangement. Facility shall be provided for termination of cables from both above and below the panel. Where cables enter below, cables boxes shall be fitted at the rear and arranged in tiers to facilitate making connections to the upper and lower units. Clamps shall be provided to support the weight of the cables. All incoming and outgoing feeders shall be brought out to a terminal block of adequate size at suitable location inside the panel. All wiring inside the panel shall be colour coded and labelled with approved plastic beads for identification. Circuit diagrams showing the arrangement of circuits shall be pasted on the inside of the panel door and covered with transparent plastic sheet and all labelling shall be provided on the front face of the panel board.

### **1.5 CIRCUIT COMPARTMENTS:**

Each circuit breaker, contactor and relay shall be housed in a separate compartment and shall be enclosed on all sides. Sheet steel hinged lockable door shall be duly interlocked with the breaker in the 'ON' position. Safety interlocks shall be provided to prevent the breaker or Contactor from being drawn out when the breaker is in the draw out portion of the panel. Instruments and indicating lamps shall not be mounted on the panel compartment door. Sheet steel barriers shall be provided between the tiers in a vertical section.

### **1.6 INSTRUMENT ACCOMODATION:**

Separate and adequate compartments shall be provided for accommodating instruments, indicating lamps, control contactors and control fuses etc. These shall be accessible for testing and maintenance without any danger of accident contact with live parts of the circuit breaker and bus bar.

### **1.7 BUS BARS AND BUS BAR CONNECTION:**

The bus bar and interconnections shall be of aluminium and of rectangular cross sections suitable for full load current for phase bus bars and half rated current for neutral bus bars and shall be extensible on either side. The bars and interconnections shall be insulated with heat shrinkable and colour coded PVC sleeve. All bus bars shall be supported on unbreakable, non-hygroscopic insulated supports at regular intervals, to withstand the forces arising in case of short circuit in the system. Bus bars shall be provided in separate chamber. Extra cross section of bus bars shall be provided if holes have to be drilled for making connections.

All bus bar connections in smaller control panels shall be done by drilling hole and connecting by brass bolts and nuts. Additional cross section of bus bars shall be provided in small control panels to cover up the holes drilled in the bus bars. Bus Bar shall be sized at 0.8 Amp/sqmm of the cross sectional area of aluminium conductor.



All connections between the bus bar and breaker and between breaker and contactor, shall be through aluminium strips of proper size to carry full rated current and shall be insulated with PVC sleeves.

#### **1.8 TERMINALS:**

The outgoing terminals and neutral links shall be brought out to a terminal block suitably located in the panels. The current transformer for instruments, metering and for protection shall be mounted on the terminal blocks. Separate cable compartment shall be provided for incoming and outgoing cables.

#### **1.9 WIRE WAYS:**

A horizontal wire way screwed covers shall be provided at the top to take in the connecting control wiring of different vertical sections.

### **1.10 CABLE COMPARTMENTS:**

Cable compartments of adequate size shall be provided in the panels for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate and proper supports shall be provided in cable compartments to support cables. All incoming and outgoing terminals shall be brought out to terminal blocks in the cable compartment.

### **1.11 MATERIALS:**

All materials shall be of the best quality complying with the appropriate Indian Institutions and British Standard specifications, Materials used shall be subject to the approval of the Architect/Consultant and sample of the same shall be furnished where required.

#### **a) AIR CIRCUIT BREAKERS:**

The air circuit breaker shall comply with the requirements of IS:13947-2 (1993) and shall have:

- i) A service short circuit breaking capacity shall be as specified and equal to short circuit withstand values. All short circuit ratings shall be Ics values.
- ii) A short circuit making capacity of 75 KA.
- iii) A short time withstand capacity of 35 KA for 1 second.
- iv) Mechanical and electrical endurance for 2000 operating cycles out of which 100 cycles should be for electrical endurance.
- v) Electrical overload performance at 6 times the rated current, 110% of the rated voltage as recovery voltage and 0.5 power factor.
- vi) Dielectric test of 2.5 KV applied for one minute on main circuits. Test evidence from a recognised independent laboratory/institution shall be furnished for compliance of the breakers with the above requirements.
- vii) Each pole of the ACB's shall be equipped with an inverse time delay thermal set micro over current trip device and an electro magnetic instantaneous over current trip device. The ACB's shall be equipped with under voltage trip release. The trip devices shall be direct acting. ACB shall be capable of providing short circuit overload and earthfault protection (in absolute values) if required, thru microprocessor based control unit sensing the true RMS values to ensure accurate measurement meeting the EMI/EMS requirement as per the standard.
- viii) Disconnecting devices of approved type shall be provided to facilitate the removal of the circuit breakers from the housing for test and maintenance purposes.
- ix) The ACB's shall be fitted with detachable type re- quenching device on each pole. The ACB's shall have auxiliary contacts for signalling, interlocking etc. The ACB's shall have slow close facilities for checking contact operation and contact gap adjustment.
- x) All contacts subject to arcing shall be tipped with arc resisting material. Main contacts shall be silver plated to ensure reliability in service.
- xi) Isolating contacts shall be of the silver plated, multifinger, spring loaded type. Facilities shall be provided to isolate the circuit breaker for inspection purpose. Feature of contact wear inspection indicating the life of contacts shall be provided. The ACB shall have double insulation (class-II) with moving and fixed contacts totally enclosed for enhanced safety and inaccessibility to live parts. The breaker shall have three distinct positons with in the cassette as follows:

- a) 'Service Position' - with main and auxiliary contacts connected.

- b) 'Test Position' - with power contacts fully disconnected and control circuit contacts connected.
  - c) 'Isolated position' - With both power and control circuit contacts fully disconnected.
  - xii) Interlocks shall be provided to :
    - a) Prevent the breaker from being isolated unless it is in the OFF position.
    - b) Prevent the breaker from being racked into the service position unless it is in the OFF position.
    - c) Prevent the breaker from being accidentally pulled completely OFF the guide rail.
  - xiii) Safety shutters of an insulation material shall be provided to prevent access to all live contacts, when the breaker is in the inspection position or completely withdrawn.
  - xiv) Facilities for pad locking the safety shutters when breaker is completely withdrawn shall be provided.
- Facilities shall be provided for earthing the circuit breaker.
- xv) Air circuit breaker shall be capable of clearing the maximum fault current which can occur.
  - xvi) All electrical closing of breaker should be with Electrical motor wound stored energy spring closing mechanism with Mechanical indicator to provide ON/OFF status of ACB.

For all ACBs the operating handle should be provided for charging the spring in continuous action. The spring shall be released with ON/OFF push button command in one operation at the correct speed independent of operator speed. A direct mechanical coupling should indicate the ACB in ON to OFF position thus qualifying to disconnection as per the IS/IEC indicating the true position of all the contacts. One set of NO/NC potential free contacts to be provided for operation on building management system. All accessories like shunt, undervoltage motorised mechanism etc shall be front mounted, requiring no adjustments and can be fitted at site.

#### **b) MOULDED CASE CIRCUIT BREAKERS (MCCB):**

MCCBs shall satisfy the requirements of IS-13947 and shall be of current limiting type. MCCB shall provide type 'C' protection to the contactors as per IEC 158-1B. MCCBs shall be quick make, quick break, independent manual type with trip free feature with mechanical ON, OFF, and TRIP indications. A trip button shall be provided for tripping the breaker. MCCB shall have thermal, magnetic, undervoltage and earth fault releases. Alarm and auxiliary contacts, terminal shrouds, sliding type front operation kit with facility for door interlocking and pad locking shall be provided. MCCB-above 250 Amp shall have microprocessor based release.

#### **c) FUSE SWITCH UNITS**

The fuse switch units shall be 3 pole double break type suitable for load break duty, quick make and break action. Separate neutral link shall be provided in the switch. All fuse switch units shall be provided with hinged doors duly interlocked with operating mechanism so as to prevent opening of the door when the switch is in "ON" position and also prevent closing of the switch when the door is not properly secured. All contacts shall be silver plated and all live parts shall be shrouded. The incoming and outgoing terminals of switch shall be adequately sized to receive proper size of cables. High rupturing capacity (HRC) fuse links shall be provided with switch fuse units and shall be in accordance with IS: 13703 and having rupturing capacity of not less than 57 MVA at 415 volts. HRC fuse links shall be provided with visible indicators to show that

they have operated. The switch fuse unit shall be manufactured in accordance with IS:13947 as amended to date.

**d) MINIATURE CIRCUIT BREAKER**

Miniature circuit breakers shall be quick make and break type and conform to IS:8828. The housing of MCBs shall be heat resistant and having a high impact strength. The fault current of MCBs shall not be less than 10000 amps, at 230 volts. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical "ON" and "OFF" indications.

The circuit breaker dollies shall be of the trip free pattern to prevent closing the breaker on a faulty circuit.

The MCB contacts shall be silver nickel and silver graphite alloy and tip coated with silver. Proper arc chutes shall be provided to quench the arc immediately. MCB's shall be provided with magnetic fluid plunger release for over current and short circuit protection.

The over load or short circuit devices shall have a common trip bar in the case of DP and TPN Miniature Circuit Breakers. All the MCB's shall be tested and certified as per Indian Standards, prior to installation.

**e) ROTARY SWITCHES**

Switches upto 60 amps shall be rotary type with compact and robust construction, built up from one or more stacks with contacts and a positioning mechanism, with stop as required. The terminals shall be shrouded with insulation to prevent accidental contact with live parts. Rotary switches shall be backed up with moulded type HRC fuse fittings of appropriate rating.

**f) SELECTOR SWITCH**

When called for, selector switches of rated capacity shall be provided in control panels, to give the choice of operating equipment in selective mode.

**g) SWITCHES**

Switches beyond 60 amps shall be panel mounted double break type and suitable for load break duty, quick make and break action, manufactured in accordance with IS: 13947 - Part 3. Switch contacts shall be silver plated and shall be backed up with HRC fuses of appropriate rating. The switch handles shall be located at the front. Switches shall be of Larson and Toubro, Siemens, English Electric make or approved equal.

**h) HRC FUSES**

Fuses shall be high Rupturing capacity and shall be in accordance with relevant ISS and having rupturing capacity of not less than 55.5 MVA at 400 volts. The back up fuse rating of each motor/heater/equipment shall be so chosen that the fuse does not operate on starting of motor/heater/equipment. Fuses shall be of the same make as the switches.

**i) STARTERS**

Each motor shall be provided with a starter of suitable rating. Starter shall be in accordance with the relevant ISS. Direct on line starters shall be provided for motors upto 10 HP. Star Delta Type starters shall be provided for motors 12.5 HP to 50 HP capacity. Motors having capacity more

than 50 HP shall be provided with Auto Transformer/Reduced Voltage/Starter Rotor. Starters contactors shall have 3 main and 3 auxiliary contacts and shall be air break type suitable for making and breaking contact a minimum power factor of 0.35. For design consideration of contactors, the starting current of connected motor shall be assumed to be 6 times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of star delta/reduces Voltage starters of class "E". Operating coils of contactors shall be suitable for 230/400 +/- 10% volts AC, 50 cycles supply system. The contactor shall drip out when voltage drops to 90% of the rated voltage. The housing of the contactors shall be heat resistant and having high impact strength. Each starter shall have thermal overload protection on all three phases. Starters shall be of Siemens/Larson and Toubro make or approved equal.

#### **j) CONTACTORS**

The contactors shall meet with the requirements of IS: 13947, Part 4.

The contactors shall be of MN series or equivalent only. The contactors shall have minimum making and breaking capacity in accordance with utilization category AC3 and shall be suitable for minimum class II intermittent duty. If the contactor forms part of a distribution board then a separate enclosure is not required, but the installation of the contactor shall be such that it is not possible to make an accidental contact with live parts.

#### **k) OVER LOAD RELAYS**

Contactors shall be provided with a three element, positive acting ambient temperature compensated time lagged hand-reset type thermal over load relay with adjustable setting. Hard reset button shall be flush with the front door for resetting with starter compartment door closed. Relays shall be directly connected for motors below 35 HP capacity. C.T. operated relays shall be provided for motors above 35 HP capacity. Heater circuit contactors may not be provided with overload relays.

#### **l) CURRENT TRANSFORMERS**

Current Transformer shall be of accuracy class - I and suitable VA burden for operation for the connected meters and relays.

#### **m) SINGLE PHASE PREVENTERS**

Single phase preventers shall be provided as per schedule of quantities and shall be in conformity with relevant IS standards. Single phase preventers shall act when the supply voltage drops down to 90% of the rated voltage or on failure of one or more phases.

#### **n) TIME DELAY RELAYS**

Time delay relays shall be adjustable type with time delay adjustment from 0-180 seconds and shall have one at auxiliary contacts for indicating lamp connection.

#### **o) INDICATING LAMP AND METERING**

All meters shall be digital type and indicating lamps shall be LED type. The meters shall be flush mounted and draw out type. Each main panel shall be provided with operated ammeter of suitable range with three Nos. CTs of suitable ratio with selector switch, phase indicating lamps,

and other indicating lamps as called for. Each phase indicating lamp shall be backed up with control SP MCB.

**p) TOGGLE SWITCH**

Toggle switches, where called for, shall be in conformity with IS: 3854-1969 and shall be of 5 Amps rating.

**q) PUSH BUTTON STATIONS**

Push button station shall be for manual starting and stopping of motors/equipment as called for. Red and Green colour push buttons shall be provided for starting and stopping operations. Start or stop indicating flaps shall be provided for push buttons. Push buttons shall be suitable for panel mounting and accessible from front without opening door, lock lever shall be provided for stop push button. One set of normally open and one set of normally closed contacts shall be provided in push button stations. The push buttons contacts shall be suitable for 15 Amps current capacity.

**r) CABLES**

M.V. cables shall be XLPE insulated PVC sheathed, aluminium conductor / copper conductor and armoured cables conforming to IS: 7098 part I. MV cables shall be armoured and suitable for laying in trenches, duct, and on cable trays as required. MV cables shall be termite resistant. Control cables, and indicating panel cables shall be termite resistant, PVC insulated copper conductor and armoured cables confirming to IS:1554 part -I.

**s) WIRES**

1100 volts grade HFLS insulated (Halogen Free Low Smoke) copper conductor wires in conduit shall be used.

**1.12 CABLE LAYING**

Cable shall be laid generally in accordance with Indian Standard Code of practice. Cable shall be laid on 14 gauge perforated M.S. sheet hot dip galvanized cable trays as approved by the owner. Easy access to all cables shall be provided to allow cable withdrawal/replacement in the future. Where more than one cable is running, proper spacing shall be provided to minimise the loss in current carrying capacity.

Cable shall be suitably supported with GI saddles and spacers when run on wall/floor ducts. When buried, they shall be covered with a layer of soft sand and protected with cement concrete tiles / bricks. Special care shall be taken to ensure that the cable are not damaged at bends. The radius of bend of the cables when installed shall not be less than 12 times the diameter of the cable.

**1.13 WIRE/CABLE SIZES:**

For all single phase/3 phase, 1100 volts grade XLPE insulated copper conductor cables shall be used. The equipment inside plant room and AHU room shall be connected to the control panel by means of HFLS insulated copper conductor wires/cables of adequate size in exposed conduits or on Cable Tray. Final connections to the equipment shall be through wiring enclosed in G.I. flexible conduits rigidly clamped at both ends. An isolator shall be provided near each motor/equipment wherever the motor/equipment is separated from the supply panel through a

partition barrier of through ceiling construction. HFLS insulated stranded copper conductor wires shall be used inside the control panel for connecting different components and all the wires inside the control panel shall be neatly dressed and plastic beads shall be provided at both ends for easy identification.

The minimum size of control wiring shall be 1.5 sq.mm. HFLS insulated stranded soft drawn copper conductor wires drawn through conduit to be provided for connecting equipment and control panels.

#### **1.14 EARTHING:**

Shall be in galvanised Iron Strips/wires, or copper strips/wires.

##### **G.I. Earthing:**

The main panel shall be connected to the main earthing system of the building by means of 2 Nos. 25mm x 6mm GI strips. All single phase metal clad switches and control panels shall be earthed with minimum 3mm diameter GI conductor wire. All 3 phase motors and equipment shall be earthed with two numbers distinct and independent GI wires/tapes as follows:

- i. Motors upto and including 10 HP rating.      2 Nos. 4mm dia GI wires
- ii. Motors 12.5 HP to 40 HP                              2 Nos. 6mm dia GI wires.
- iii. Motors 50 to 75 HP                                      2 Nos. 25 x 3mm GI strips.
- iv. Motor above 75 HP                                        2 Nos. 25mm x 6mm GI strips

All the switches shall be earthed with two numbers distinct and independent GI wires/tapes as follows:

1) 3 phase switches and control panels upto 60 Amps rating.	2 Nos. 4mm dia GI wires
2) 3phase switches & control panel 63 to 100 Amps rating.	2 Nos. 8mm dia GI wires
3) 3 phase switches & control panels 125 to 200 Amps rating.	2 Nos. 25x3mm GI tapes.
4) 3 phase switches & control panels, bus ducts above 200 A rating.	2 Nos. 25x6mm GI tapes.

##### **Copper Earthing:**

The main panel shall be connected to the main earthing system of the building by means of 2 Nos. 25mm x 3mm copper tapes. All single phase metal clad switches and control panels be earthed with minimum 2mm diameter copper conductor wired. All 3 phase motors and equipment shall be earthed with two numbers distinct and independent copper wires/tapes as follows:

- i. Motors upto and including 10 HP rating.      2 Nos. 3mm dia Copper wires
- ii. Motors 12.5 HP to 40 HP                              2 Nos. 4mm dia Copper wires
- iii. Motors 50 to 75 HP                                      2 Nos. 6 x 3mm Copper wires

iv. Motor above 75 HP

2 Nos. 25mm x 3mm Copper wires

All the switches shall be earthed with two numbers distinct and independent copper wires/tapes as follows:

- |   |                              |
|---|------------------------------|
| i) 3 phase switches and control panels upto 60 Amps rating.               | 2 Nos. 3mm dia copper wires  |
| ii) 3phase switches and control panel 63 Amps to 100 Amps rating.         | 2 Nos. 4mm dia copper wires  |
| iii) 3 phase switches and control panels 125 Amps to 200 Amps rating.     | 2 Nos. 6mm copper wires      |
| iv) 3 phase switches and control panels, bus ducts above 200 Amps rating. | 2 Nos. 6mm x mm copper wire. |

The earthing connections shall be tapped off from the main earthing of electrical installation. The overlapping in earthing strips at joints where required shall be minimum 75mm. These straight joints shall be rivetted with and brazed in approved manner. Sweated lugs of adequate capacity and size shall be used for all termination of wires. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned off paint and/or other only substance and properly tinned.

#### **1.15 TESTING:**

Before commissioning of the equipment, the entire electrical installation shall be tested in accordance with Code of practice IS: 732-1963 (Revised) and test report furnished by a qualified and authorised person. The entire electrical installation shall be got approved by Electrical Inspector and a certificate from Electrical Inspector shall be submitted. All tests shall be carried out in the presence of supervisor.

#### **1.16 PAINTING:**

All sheet steel work shall under go a process of degreasing, through cleaning, and painting with a high corrosion resistant primer. All panels shall then be backed in an over the finishing treatment shall be by application of synthetic enamel paint of approved shade.



## **GENERAL SPECIFICATIONS - INSTRUMENTATION**

Scope for instrumentation for water Treatment Plant covers design, engineering, manufacturing, supply and commissioning of the following items:

- a. Field Instruments and final control elements.
- b. Analysers - pH, ORP & Conductivity
- c. Instrument indicator Panel-cum-Junction box consisting of Indicator, etc.
- d. Complete instrumentation cabling (i.e power, control & signal cables of Instruments) from field instruments to junction box and to instrument indicator panel
- e. Air tubing for Final Control elements.
- f. A portable water analysis kit and SDI testing kit

The following field Instruments are minimum requirement for water treatment plant, any other instruments required for easy operation and specific design of the system shall also be included.

### **Pressure gauges**

Pressure gauges dial shall be white, non-rusting plastic with black figures. Pointers shall have micrometer adjustment. Gauges shall be weather proof with dial size of 150 mm and shall have features like screwed bezels, externally adjustable zero, over range protection and blow out discs. Sensing element shall be of SS-316 and movement of SS-304 as a minimum. Pulsation damper shall be of SS-304, floating pin type, externally mounted and externally adjustable. All connections shall be 1/2"NPT (M) bottom entry. Cases shall be cast aluminium alloy and weather proof to IP-55.

Pressure gauges with the above minimum specification shall be provided at the following points:

- Each pump discharge side
- Micron cartridge filter inlet
- Micron cartridge filter outlet
- RO skid inlet
- RO skid intermediate
- RO reject line
- RO chemical cleaning filter inlet
- RO chemical cleaning filter outlet
- UF inlet
- UF outlet
- UF reject
- Each blower discharge
- MEE & Boiler as per mfg recommendation

### **Level Switches**

- Float or displacer type level switches shall be provided for low level sensing of all dosing tanks and acid day tank.

### **Pressure switches**

- Pressure switch element shall be diaphragm or bellow type with SS316 material of construction as minimum. It shall be able to withstand over pressure of 130% of working pressure as a minimum. Body of switch shall be cast-aluminium. Process

and electrical connection shall be ½” NPT (F). Switch differential setting shall be fixed and contact rating shall be suitable for 230 VAC at 5 Amps.

- Pressure switches with the above specification shall be provided at the following points:
- RO High Pressure Pump Suction & Discharge
- Instrument air line

### **Flow meters**

All flow meters shall be Electro Magnetic type only. Wherever conductivity of the water is less than 5microsiemens, vortex flow meters may be used. Electromagnetic flow transmitter shall be integral with the flow tube. 24V DC two-wire transmitters shall be preferred. Process connection shall be flanged with suitable flange rating. All accessories to install the flow meter shall be supplied along with the meter. Local indication should be provided with the transmitters. Panel Mounted Indicator / Totalizer shall also be provided with all accessories. Indication shall be minimum 4 digits.

The same shall be provided at the following points:

- Raw water inlet
- UF inlet
- UF outlet
- RO - 1 & 2 outlet
- RO 1 & 2 - reject
- MEE Condensate

Rota meter type flow meters shall be provided at the following locations :

- a) PSF inlet line
- b) UF backwash line
- c) MEE feed line

### **Analysers**

Analyser sensor shall be either insertion or flow through cell type. Sensor shall be selected to suit the operating parameters. Integral cable of the sensor shall be suitable for remote installation. Analyser transmitter shall be 2-wire type with indication. Panel mounted indicator shall also be provided.

pH analyser shall be provided at the following locations.

- At raw water inlet / At RO 1 inlet and

Conductivity analysers with transmitter & controller shall be provided at the following points:

- a. RO 1 & 2 feed
- b. RO common outlet

One number of conductivity indicator with analyser (without transmitter and controller) shall be provided in the drain line of RO flushing.

ORP analyser shall be provided at **RO feed line**

**Turbidity analyser shall be provided at UF outlet**

**Solenoid operated On/Off control valve for the following:**

- a. RO feed dump
- b. UF valves

### **Specification for instrumentation cables**

All cables shall have PVC insulated primary insulation of 85 °C PVC per applicable international standard. Inner and outer jacket shall be 90 °C PVC Type ST-2 and outer sheath shall be fire retardant. Insulation grade shall be 1100 V and shall meet insulation resistance, voltage and spark test requirements as per BS 5308.

The completed cable maximum DC resistance of the conductor shall be 12.3 ohm/Km at 20 °C for 1.0 Sq.mm conductor. The mutual capacitance of the pair or adjacent core shall not exceed 250 pF/m at a frequency of 1 KHz. The capacitance between any core and screen shall not exceed 400 pF/m. L/R ratio of adjacent cores shall not exceed 40 microhenry/ohm for cables with 1.0 Sq.mm. The drain wire resistance including shield shall not exceed 30 ohm/Km. Running length of the cable shall be printed atleast at every meter interval.

### **Signal Cables (Pair/Triad)**

The single pair/triad and multi pair/triad cables shall be of 1.0 Sq. mm conductor size, made of electrolytic copper conductor of 7 strands with each strand of 0.43 mm diameter. All signal cables shall be shielded. Multi pair cables shall be both individually and overall shielded. Shield shall be aluminium backed Mylar/Polyester tape bonded together with the metallic side down, helically applied with either side having 25% overlap and 100% coverage. The minimum shield thickness shall be 0.05 mm. The drain wire shall be provided for both individual pair and over all shields and shall be 0.5 Sq.mm multi stranded bare tinned annealed copper conductor. The drain wire shall be in continuous contact with aluminium side of the shield. Pair identification shall be blue and white. Triad identification shall be blue, white and brown..

### **Control Cables**

The control cable shall be 1.5 Sq.mm conductor size made of electrolytic copper conductor of 7 strands with each strand of 0.53-mm diameter. The control cable shall be over all shielded. Shield shall be aluminium backed Mylar/Polyester type. Each core shall be identified by colour or by number at regular intervals.

### **SPECIFICATION FOR INSTRUMENT INDICATOR PANEL CUM JUNCTION BOX**

All flow indicators, totalisers and analyser indicators shall be mounted in a free standing Instrument Indicator panel.

Indicator panel shall have bottom mounted gland plates and IP 31 enclosure.

All analog transmitters shall be connected to signal isolators with 2 outputs, from which one retransmission signal shall be wired separately to terminal blocks for connection to DCS. Other signal shall be connected to respective indicator on the indicator panel.

All pressure, level switches and solenoid valve cables shall be terminated at junction box. Junction box shall be wall mounted with suitable cable gland plates.

### **PLC DETAILS**

A PLC shall consist of the necessary processors, Input/Output (I/O) modules, communication interface modules and man-machine interfaces (HMIs) required to perform the desired functions.

Parameter / Item	Particular
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Functions	As per the control logic and input/output list
Future Expandability	Provide an additional 20% of installed capacity
Interposing Relays	Shall be provided for all digital outputs (Dos) including spare Dos and for digital inputs wherever required.
Optical isolation for all digital inputs and outputs and galvanic isolation for analog inputs	Required
Mounting	Inside the control panels with a viewing glass on the door
CPU and power supply module redundancy	Required (In hot standby mode)
Processor:	
Diagnostic function performance	Required
Minimum 32 bit performance with floating point capability	Required
Memory module	Adequate to store programs, standard software to perform logic functions and diagnostic functions
Inputs and Outputs	Refer to the I/O schedule in the respective subsections of this Volume
System Loading	Max. 60% under the worst loading conditions
Power supply to sensor / transmitters	230v, 1ph, 50hz with a UPS back-up – 1 hr
Type of input	Binary, analog and pulsed as required.
Outputs	Binary signals (Relay outputs for driving MCC Starter coils, driving motorized valves etc.); analog and pulsed signals as required.

Spare I/O modules	20% of each type, wired to terminal block
Accessories	<p>(i) Laptop computer for programming along with all necessary adapters, carrying kit, cables, connectors and accessories (2 shall be furnished for common usage)</p> <p>(ii) Proprietary PLC programming and documentation software along with all cables and connectors for loading on laptop computer and on local PC based SCADA system</p>
Interface (Hardware and Software) to Local SCADA system	Required
Communication Port to be provided for interface to the Local SCADA system	RS 232 / RS 485 (with suitable converters as applicable)
Communication Port for interfacing with temperature scanners (for pumping stations)	Required
Communication Port for interfacing with Multifunction Meters/ Motor Protection Relays	Required
Communication Port for interfacing with flow indicators and totalizers	Required

## **SPECIFICATION FOR MEE & AFTD & LAB**

Capacity	– 40 KLD
Source	– RO II reject
Feed TDS	- > 30000 ppm
Product TDS	- <500 ppm
Type	- 3 Effect Forced circulation type

### **Operating parameters**

<b>S.No</b>	<b>Description</b>	<b>Unit</b>	<b>Technical details for 40 KLD</b>
1	Evaporator feed water capacity	lit /hr	2000
2	Water evaporation capacity	lit /hr	1600
3	Water reject capacity	lit /hr	400
4	Total solids in product feed	wt%	1.2
5	Total solids in reject	wt%	18
6	Concentrate outlet temperature	deg C	50-55
7	Cooling water inlet temperature	deg C	32
8	Cooling water outlet temperature	m3/hr	38
9	Cooling water quantity m3 / hr	kg/hr	62
10	Motive steam consumption	kg/hr	580
11	Motive <b>steam pressure</b>	kg/hr	6
12	Operating hours	hr/day	20

**Components of MEE system**

<b>S.No</b>	<b>Description</b>	<b>Qty for 40 KLD</b>
1	Calandria (3FCR)	3 Nos
2	Pre-heater (3FCR)	3 Nos
3	Flash vessel	3 Nos
4	Surface condenser	1 No
5	Balance tank	1 No
6	Condensate pot	1 No
7	Feed pump	1 No
8	Recirculation pump	3 Nos
9	Condensate pump	1 No
10	Reject pump	1 No
11	CT pump & necessary pipe & fittings	1 Lot
12	Vacuum pump	1 No
13	Process pipes & fittings	1 Lot
14	Condensate & non condensate pipes & fittings	1 Lot
15	Vacuum gaige	3 Nos
16	Temp gauge	3 Nos
17	Pressure gauge	3 Nos
18	View glass	3 Nos
19	Rotameter	2 Nos
20	Electrical panel & its accessories	1 Lot

21	TVR nozzle	1 No
22	Structural and platform materials	1 Lot

### Material description

SL.No	Description	MOC
1	Calandria	
	Tubes - Thk - 1.2 mm	SS 316L
	Tube sheet	SS 316
	Main Shell - 4 mm	SS 304
	Top Cover - 4mm	SS 316
	Bottom Bucket - 4 mm	SS 316
	Nozzles - Shell side Sch 10	SS 304
	Nozzles - Tube side Sch 10	SS 316
2	Pre-heater	
	Tubes - Thk - 1.2 mm	SS 316L
	Tube sheet	SS 316
	Main Shell - 4 mm	SS 304
	Top Cover - 4mm	SS 316
	Bottom Bucket - 4 mm	SS 316
	Nozzles - Shell side Sch 10	SS 304
	Nozzles - Tube side Sch 10	SS 316
3	Flash Vessel	
	Main Shell - 4 mm	SS 316
	Top cone - 4 mm	SS 316



	Bottom dish - 4 mm	SS 316
	Nozzles - Shell side Sch 10	SS 316
	Nozzles - Tube side Sch 10	SS 316
4	Surface Condenser	
	Tubes - Thk - 1.2 mm	SS 304L
	Tube sheet - 4 mm	SS 304
	Main Shell - 4 mm	SS 304
	Top Cover - 4mm	SS 304
	Bottom Bucket - 4 mm	SS 304
5	Balance tank	
	Shell - 4 mm	SS 316
	Flanges - T/E	SS 316
	Nozzle - Sh 10	SS 316
6	Feed pumps / recirculation / reject / condensate with motors	
	Casing	CF8M
	Impeller	CF8M
	Shaft	CF8M
	Impeller	CF8M
7	Vacuum pumps	
	Casing	SS 304
	Impeller	SS 304
	Shaft	SS 304
	Impeller	SS 304

8	CT pump with motor	
	Casing	CI
	Impeller	CI
	Shaft	SS 304
	Impeller	SS 304
9	Vapor ducts	SS 304
10	CT pipe & fittings	GI - B grade
11	Process pipes & fittings	SS 316
12	Condensate & non-condensate pipes & fittings	SS 304
13	All measuring gauges	SS 304
14	Platforms & structures	MS

### **AGITATED THIN FILM DRYER – 500 LPH**

<b>S.No</b>	<b>Description</b>	<b>Unit</b>	<b>Technical details for 40 KTD</b>
	Water evaporation capacity	lit /hr	350
	Product feed rate	lit /hr	500
	Concentrate outlet rate	kg/hr	150
	Total solids in product feed	wt%	20-30
	Total solids in Concentrate	wt%	Powder form
	Concentrate outlet temperature	deg C	52

	Cooling water inlet temperature	deg C	32
	Cooling water outlet temperature	m3/hr	38
	Cooling water quantity m3 / hr	kg/hr	42
	Motive steam consumption	kg/hr	425
	Motive steam pressure	kg/hr	6
	Operating hours	hr/day	20

**Components of ATFD**

<b>S.No</b>	<b>Description</b>	<b>Qty for 40 KLD</b>
	ATFD	1 No
	Surface Condenser	1 No
	Flash vessel	1 No
	Feed pump	1 No
	Recirculation pump	1 No
	Condensate pump	1 No
	Bottom flash vessel	2 Nos
	Stream trap	3 Nos
	Motor with gear box(ATFD)	1 No
	Valves	1 Lot
	Process pipes & fittings	1 Lot
	Vacuum gauge	1 No
	Temp gauge	4 Nos
	Pressure gauge	3 Nos
	View glass	3 Nos
	Electrical panel & its accessories	1 Lot
	Structural and platform materials	1 Lot

**Material Description of ATFD**

<b>SL.No</b>	<b>Description</b>	<b>MOC</b>
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1	ATFD	
	Main shell (steam side)	SS 304
	Main Shell (liquid side)	SS 316
	Rotary shaft & blades	SS 316
2	Flash Vessel	
	Main Shell	SS 316
	Top cover	SS 304
	Bottom	SS 316
	Nozzles	SS 316
3	Surface Condenser	
	Tubes - Thk - 1.2 mm	SS 304L
	Tube sheet - 4 mm	SS 304
	Main Shell - 4 mm	SS 304
	Top Cover - 4mm	SS 304
	Bottom Bucket - 4 mm	SS 304
4	Balance tank	
	Shell - 4 mm	SS 316
	Flanges - T/E	SS 316
	Nozzle - Sh 10	SS 316
5	Feed pumps / recirculation / reject / condensate with motors	
	Casing	CF8M
	Impeller	CF8M
	Shaft	CF8M

	Impeller	CF8M
6	Vacuum pumps	
	Casing	SS 304
	Impeller	SS 304
	Shaft	SS 304
	Impeller	SS 304
7	CT pump with motor	
	Casing	CI
	Impeller	CI
	Shaft	SS 304
	Impeller	SS 304
8	Condensate pot	
	Shell	SS 304
	Flanges	SS 304
	Nozzle	SS 304
9	Vapor ducts	SS 304
10	CT pipe & fittings	GI - B grade
11	Process pipes & fittings	SS 316
12	Condensate & non-condensate pipes & fittings	SS 304
13	All measuring gauges	SS 304

14	Platforms & structures	MS

## **Specification for Filter press & Screw pump**

### **Filter Press**

Type	: Rail slider
Plate Size	: 24 x 24
No. of Plates	: 21 Nos
No. of chambers	: 20 Nos
Area of Filtration	: 10 m <sup>2</sup>
Cake holding capacity	: 140 Litres Aprox
Operating pressure	: 7 kg/cm <sup>2</sup>
Plate closing	: Motor Hydraulics Plates
Size	: 610 x 610 mm
Type	: Recessed
Material	: Polypropylene
Thickness	: 65+/-2 mm
Cake thickness	: 30+/-2 mm
Feed	: Central
Discharge	: Single Side Open Discharge
Operating pressure	: 7 bar Max
Plate Moving	: Manual

### **Skid Structure**

Non Moving Block	: MS, Fabricated & machined
Moving block	: MS, Fabricated & machined
Closing block	: MS, Fabricated,& machined
Connecting bars	: MS, Fabricated & machined
Finish	: 2 coats of Epoxy after Primer wash
Nozzles	: MS Galvanized, Table D Drilled

### **Plate Closing System**

Load	: 25 Tons
Stroke	: 150mm
Load holding	: By Mechanical lock system
Operating Pressure	: 250 Bar, aprx.
Power pack	: 1 HP Motor Operated

### **Helical Screw Pump**

Type	: Helical (Progressive Cavity Pump)
Capacity	: 12-15 cu.m/hr @ 300 rpm max.
Suction	: Flooded
Size	: 100 x 100 mm
Max pressure	: 10 bar
Operating Pressure	: 07 Bar
Rotor	: SS 304 HCP
Rotating Parts	: SS 304 HCP
Stator	: Nitrile rubber stator
Drive	: V-Pulley, Belt Drive, with Over head Base Plate



Specification Sheet of UF	
Membrane Type	Hallow Fibre
Membrane Area	As per Mfg. Std.
Pour Size	0.04 – 0.1 mm
Avg. gross flux	<50 LMH
MOC	PVDF/MPES
Recovery	>90%
Back wash	As per Mfg.
CEB	As per Mfg.
Air scouring	As per Mfg.

Specification Sheet of RO membrane		
Sl.N	Item description	Specification
	Membrane Type	Thin film composite
	Membrane charge	Neutral
	Membrane area	350-400 sq.ft
	Avg. gross flux	<20 LMH
	Recovery	>70% RO I & >50% for RO II

	Element age	3 years
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## GENSET – 250 KVA MICROPROCESSOR BASED WITH ACOUSTIC ENCLOSURE

Prime Rating at rated rpm ( as per ISO8528) <sup>1</sup>		kVA	250
		kW	200
Frequency		Hz	50
Power factor		lagging	0.8
Voltage		V	415 3Ø
Governing class ( As per ISO 8528 Part-V)			G3
Noise level		dBA	< 75
Fuel Consumption*	At 100 % Load	Ltrs/Hr	56.9
	At 75 % Load		42.6
	At 50 % Load		29.9
Fuel Tank Capacity		Ltrs	460
Dry weight of genset with canopy (approx.)^		Kg	4100
Wet weight of genset with canopy (approx.)^		Kg	4500
Overall dimensions of genset (L x W x H)^		mm	4340 x 1740 x 1975
Height including Silencer		mm	2615
Electrical Battery starting voltage		Volts-DC	24
<b>ENGINE</b>			
Rated output (Prime Continuous rating as per ISO 8528-1)		kW	228
		HP	310
No. of cylinder		Number	6
Cubic capacity <b>2</b>		Ltrs	8.86
Bore x Stroke		mm	118x135
Rated Speed		RPM	1500

Aspiration	NA/TC/T A	TA
Lube Oil change period	hrs.	500
Lube oil Sump Capacity	Ltrs	27.0
Coolant Capacity	Ltrs	32.0
<b>ALTERNATOR</b>		
Insulation Class	Class H	
Ingression Protection	IP 23	
Alternator Efficiency (at 100% load) 0.8 pf**		93.6
Alternator Efficiency (at 75% load) 0.8 pf**		93.9
Permissible Voltage Dip at Full Load 0.8 pf Lag		$\leq 20\%$
Max Time to build up rated voltage at Rated RPM	< 5 sec provided engine reach the rated speed	
Short Circuit Ratio		0.629
Short Circuit With Stand Time	Sec	< 3 sec
Overload With Stand Capacity	%	10% overload for one hour once in 12 hours

**Note : UF system has been fully operated from PLC**

**RO monitoring and all instruments monitoring shall be done through PLC**

#### **ONLINE EMFM CONNECTIVITY**

<b>Sl.no</b>	<b>Particulars</b>	<b>Qty</b>
1	Supply of Electromagnetic flow meter for ZLD – line size 2”	13 nos
2	Supply of MODBUS for EMFM & RS 232-485 converter	1 lot
3	RS 232 for PC connectivity	100 m

4	Supply & commissioning of Bit flow software (WQWC_TNPCB)	1 no
5	Digital signature / Document signer – Class 2 certificate	1 no
6	10000 SMS package for alerts	1 no

#### **MINI LAB SET UP**

<b>Sl.no</b>	<b>Particulars</b>	<b>Qty</b>
1	pH meter – bench model	1 no
2	Conductivity meter	1 no
3	BOD incubator (400X450X600mm)	1 no
4	COD apparatus	1 no
5	Pipettes, burettes, and other glass ware	1 lot
6	Electronic balance	1 no
7	Jar test apparatus	1 set
8	Sampling bottles	10 nos
9	All types of laboratory glassware, accessories and other consumables and reagents for minimum one –year requirement.	1 lot



## ELECTRICAL LOAD DETAIL

ELECTRICAL LOAD DETAILS						
S.No	Description	Qty	Load per Unit	Operating Load	Standby Load	Total Load
1	Raw Effluent Transfer Pump	2	1.50	1.50	1.50	3.00
2	Sewage Transfer Pump	4	0.75	1.50	1.50	3.00
3	Chemical Dosing Pump	3	0.25	0.75	0.00	0.75
4	Flash Mixer	1	1.50	1.50	0.00	1.50
5	Stirrer	3	1.00	3.00	0.00	3.00
6	Air Blower	2	12.50	12.50	12.50	25.00
7	Clarifier	2	1.50	1.50	0.00	1.50
8	Filter Feed Pump	2	2.25	2.25	2.25	4.50
9	UF Feed Pump	2	2.25	2.25	2.25	4.50
10	Dosing System	3	0.25	0.75	0.00	0.75
11	UF Backwash Pump	2	2.25	2.25	2.25	4.50
12	RO1 Feed Pump	2	2.25	2.25	2.25	4.50
13	Dosing System - RO1	3	0.25	0.75	0.00	0.75
14	High Pressure Pump - RO1	2	15.00	15.00	15.00	30.00
15	Cleaning Pump - RO1	1	2.25	2.25	0.00	2.25
16	RO 2 Feed Pump	2	0.75	0.75	0.00	0.75
17	High Pressure Pump - RO2	2	11.00	11.00	11.00	22.00
18	Dosing System - RO2	3	0.25	0.50	0.25	0.75
19	RO3 Feed Pump	1	0.75	0.75	0.00	0.75
20	High Pressure Pump - RO3	2	7.50	7.50	7.50	15.00
21	Dosing System - RO3	3	0.25	0.50	0.25	0.75
22	Evaporator	1	26.50	26.50	0.00	26.50
23	ATFD	1	8.50	8.50	0.00	8.50
	TOTAL			106.00		164.50

The total connected Load works out to 165 kW with additional load of 50 kW for lighting depends upon site condition. Considering the connected load, it is proposed to provide Generator back-up of 250 KVA as standby power to cater to the anticipated demand.

**BILL OF QUANTITIES**

**CIVIL &**

**ELECTROMECHANICAL**

**UNITS**





BILL OF QUANTITIES CIVIL UNITS						
No	Equipment	Number in each	Rate / unit	Total Value	Delivery Period	Manufacturer Details
	<b>Civil Units</b>					
1	Collection tank – 1 (Zn+Ni)	1 No				
2	Collection tank – 2 (Cr)	1 No				
3	Collection tank – 3	1 No				
4	Mixing tank	1 No				
5	Flocculation tank	1 No				
6	Chemical preparation tank	1 No				
7	Primary clarifier	1 No				
8	Aeration tank	2 Nos				
9	Secondary clarifier	1 No				
10	Filter feed tank	1 No				
11	UF feed tank	1 No				
12	UF feed tank	1 No				
13	RO-1 reject tank	1 No				
14	RO-2 reject tank	1 No				
15	RO permeate tank	1 No				
16	Sludge drying beds	5 Nos				
17	MCC Room					
18	Chemical House					
19	Foundations, ladders/ supports etc.,	1 lot				

BILL OF QUANTITIES ELECTROMECHANICAL UNITS						
No	Equipment	Number in each	Rate / unit	Total Value	Delivery Period	Manufacturer Details
	<b>Electro-mechanical</b>					
1	Raw effluent Feed Pump	2 Nos				
2	Raw effluent Feed Pump	2Nos				
3	Combined effluent transfer pump	2Nos				
4	Air grid for tanks	1 lot				
5	Chemical dosing pump	2 Nos				
6	Chemical dosing pump	2 Nos				
7	Agitator	3 Nos				
8	Sludge recirculation pump	4 Nos				
9	Air blower for At +SHT	3Nos				
10	Air grid for AT & SHT	1 lot				
11	Mechanism for primary and secondary clarifier	2 Nos				
12	Filter feed Pump	2 Nos				
13	Pressure sand filter	1 No				
14	Pressure sand filter	1 No				
15	Filter Feed Screw Pump	1 No				
16	Filter Press	1 No				
17	UF feed pump	2 Nos				
18	Bag filter	1 No				
19	Dosing pump	3 Nos				
20	Dosing tank	2 nos				
21	UF skid	1 set				
22	UF membrane	120 1 lot				
23	UF backwash pump	2 Nos				

No	Equipment	Number in each	Rate / unit	Total Value	Delivery Period	Manufacturer Details
24	RO-1 feed pump	2 Nos				
25	Dosing pump	4 Nos				
26	Dosing tank	3 nos				
27	Micron cartridge filter	2 Nos				
28	RO – 1 Skid	1 set				
29	RO membranes	1 lot				
30	RO – 1 pressure tubes	1 lot				
31	High pressure pumps	2 Nos				
32	RO-2 feed pump	2 Nos				
33	Dosing pump	1 Nos				
34	Dosing tank	1 nos				
35	Micron cartridge filter	2 Nos				
36	RO – 2 Skid	1 set				
37	RO membranes	1 lot				
38	RO – 2 pressure tubes	1 lot				
39	High pressure pumps	2 Nos				
40	RO –CIP pump	1 No				
41	Dosing tank with agitator	1 nos				
42	Micron cartridge filter	2 Nos				
43	Triple effect MEE with boiler	1 lot				
44	ATFD	1 lot				
45	Boiler with accessories	1 lot				
46	Cooling tower with pumps	1 lot				
47	Genset – 250 KVA	1 No				
48	Online EmFM connectivity	1 Set				

No	Equipment	Number in each	Rate / unit	Total Value	Delivery Period	Manufacturer Details
49	Valves and Interconnection Piping	1 Lot				
50	Electrical and Instrumentation	1 Lot				
51	Canopies for Motors & Instruments	1 Lot				
52	Lab with Instruments					
	TOTAL VALUE					
	GST % ON TOTAL VALUE					
	TOTAL VALUE INCLUDING TAX					

**SPECIFICATIONS**

**CIVIL &**

**ELECTROMECHANICAL**

**UNITS**

Supply of Electromechanical Equipments as per BOQ in Tender Vol-2. (The Cost should include the Transportation, Packing & Forwarding, Insurance and any other charges applicable)

**SPECIFICATIONS OF ELECTRO-MECHANICAL UNITS**

S. No	Description of stores as specified in the Schedule	Number in each	Rate per unit	Total Value	Delivery Period	Manufacturer Details
1	Raw effluent Feed Pump / SS316 / PP / 10 m3/hr @ 20 m / Centrifugal, coupled with mechanical seal	2 Nos (1W+1S)				
2	Raw effluent Feed Pump / SS316 / PP / 1.0 m3/hr @ 20 m / Centrifugal, coupled with mechanical seal	2Nos (1W+1S)				
3	Combined effluent transfer pump / SS316 / PP / 10 m3/hr @ 20 m / Centrifugal, coupled with mechanical seal	2Nos (1W+1S)				
4	Air grid for tanks / MS & PVC	1 lot				
5	Chemical dosing pump / PP wetted part / 0- 100 LPH with suction strainer / discharge NRV and PRV	2 Nos				
6	Chemical dosing pump / PP wetted parts / 0- 10 LPH with suction strainer / discharge NRV and PRV	2 Nos				
7	Agitator / SS 316/ MSRL / 1.0 HP	3 Nos				
8	Sludge recirculation pump / Cast iron / Centrifugal, Non clog- semi-open impeller	4 Nos (2W+2S)				

9	Air blower for At +SHTCI-FG260 / 250 m3/hr @ 0.45m / Common base frame, Suction Filter, Suction& Discharge Silencer, NRV, V-belt, V-belt Guard, Drive & Driven pulleys, Inter connecting piping, Set of foundation bolts, Safety valve, Pressure gauge	3Nos (2W+1S )				
10	Air grid for AT & SHT / MS & PVC / Suitable	1 lot				
11	Mechanism for primary and secondary clarifier / MSEP / 4.5 m dia X 2.75 m SWD + FB, Platform in MSEP / with railings.	2 Nos				
12	Filter feed Pump / SS 316 / 10 m3/hr @ 30 m / Centrifugal / coupled with mechanical seal	2 Nos (1W+1S )				
13	Pressure sand filter / MSEP / 1.2 m Dia X 1.8 m ht with manual BFV, / media graded sand and & pebbles to a height of 1m min	1 No				
14	Pressure sand filter / MSEP / 1.2 m Dia X 2.0m ht with manual BFV, media cocnut shell carbon with IV > 900 to height of minimum 800 mm	1 No				
15	Filter Feed Pump / Wetted Part SS316 + EPDM, Screw Pump / 12 m3/hr @ 8 bar	1 No				
16	Filter Press / MS Body with virgin PP Plate with center feed and side outlet / 610 mm X 610 mm plates of thickness 73 ± 5 mm / hydraulically operated	1 No				
17	UF feed pump / SS 316 / 10 m3/hr @ 30 m / Centrifugal, coupled with mechanical seal	2 Nos (1W+1S )				
18	Bag filter / PP / 10 m3/hr	1 No				



19	Dosing pump / PP wetted parts / 0- 6 LPH with suction strainer / discharge NRV and PRV	3 Nos (2W+1S )				
20	Dosing tank / LDPE / 50 ltrs	2 nos				
21	UF skid / MSEP / With Auto valves & piping in CPVC	1 set				
22	UF membrane / PVDF / Hollow fibre, op. flux / 50 LMH	As reqd				
23	UF backwash pump / SS 316 / 15 m3/hr @ 30 m / Centrifugal, coupled with mechanical seal	2 Nos (1W+1S )				
24	RO-1 feed pump / SS 316, / 10 m3/hr @ 30 m / Centrifugal / coupled with mechanical seal	2 Nos (1W+1S )				
25	Dosing pump / PP wetted parts, / 0- 6 LPH with suction strainer / discharge NRV and PRV	4 Nos (3W+1S )				
26	Dosing tank / LDPE / 100 ltrs	3 nos				
27	Micron cartridge filter /PP / 10m3/hr – 5 micron & 1 micron rating	2 Nos				
28	RO – 1 Skid / MSEP / With high pressure piping in SS 316 and low pressure piping in in CPVC	1 set				
29	RO membranes / TFC / As required recovery >70% - 8 inch flow – 7 m3/hr	1 lot				
30	RO – 1 pressure tubes / FRP / 8 inch – 450 psi	1 lot				
31	High pressure pumps / SS 316, /4 m3/hr @ 180 m / Vertical / coupled with mechanical seal	2 Nos (1W+1S )				

32	RO-2 feed pump / SS 316 / 4 m3/hr @ 30 m / Centrifugal / coupled with mechanical seal	2 Nos (1W+1S)				
33	Dosing pump / PP wetted parts / 0- 6 LPH with suction strainer / discharge NRV and PRV	1 Nos (1W)				
34	Dosing tank / LDPE / 100 ltrs	1 nos				
35	Micron cartridge filter / PP / 4 m3/hr – 5 micron & 1 micron rating	2 Nos				
36	RO – 2 Skid / MSEP / With high pressure piping in SS 316 and low pressure piping in in CPVC	1 set				
37	RO membranes / TFC / As required recovery >70% - 4 inch flow – 4 m3/hr	1 lot				
38	RO – 2 pressure tubes / FRP / 4 inch – 800 psi	1 lot				
39	High pressure pumps / SS 316 / 5 m3/hr @ 500 m, Vertical, coupled with mechanical seal	2 Nos (1W+1S)				
40	RO –CIP pump / SS 316 / 10 m3/hr @ 35 m, Centrifugal, coupled with mechanical seal	1 No(1W)				
41	Dosing tank with agitator / LDPE / 500 ltrs	1 nos				
42	Micron cartridge filter / PP / 4 m3/hr – 5 micron & 1 micron rating	2 Nos				
43	Triple effect MEE with boiler / 40 KLD as per specs detailed in tender	1 lot				
44	ATFD / 500 lph as per specs detailed in tender	1 lot				

45	Boiler with accessories / 1.3 tons steam capacity					
46	Cooling tower with accessories and circulation pump To suit MEE	1 lot				
47	Genset – 250 KVA	1 No				
48	Online EmFM connectivity	1 Set				
49	Valves and Interconnection Piping / CI valves with non-corrosive coating and CPVC piping	1 Lot				
50	Electrical and Instrumentation / Suitable	1 Lot				
51	Canopies for Motors and Instruments / Suitable	1 Lot				
52	Lab with Instruments	1 Lot				
	Total					

Supply of Electromechanical Equipments as per BOQ in Tender Vol-2. (The Cost should include the Transportation, Packing & Forwarding, Insurance and any other charges applicable)					
SPECIFICATIONS FOR CONSTRUCTION OF ETP TANK					
SI No	Description of Items	Qty	Unit	Rate	Amt
	<b>Sub-Head 1: Earthwork Excavation &amp; Filling</b>				
<b>1.1</b>	Surface dressing of the ground including removing vegetation and inequalities not exceeding 15 cm deep and disposal of rubbish, lead up to 50 m and less upto 1.5 m.	624.0	Sq.m		

<b>1.2</b>	Earth work excavation in all types of soil including backfilling foundation trenches with excavated earth in layers not exceeding 150 mm in depth, watering, consolidation and disposal of surplus earth as directed etc., complete upto depth below existing ground level as specified below, complete.				
1.2.1	0.0 to 2.00 m depth	1277.17	Cum		
1.2.2	2.00 m to 3.00 m depth	590.00	Cum		
1.2.3	3.00 m to 4.00 m depth	590.00	Cum		
1.2.4	4.00 m to 5.00 m depth	590.00	Cum		
<b>1.3</b>	ReFilling with available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers of depth up to 5M, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift up to 1.5 m.	407.40	Cum		
<b>1.4</b>	Supplying and filling in foundation and basement with <b>manufacturing sand</b> in layers not exceeding 150 mm in depth including watering, consolidation etc., complete.				
1.4.1	Below Base slab 1 & 2 / Supporting bed/Sludge drying bed/Mixing Tank etc..	97.36	Cum		
<b>1.5</b>	Supply and filling gravel, muram Or good earth in layers under floors not exceeding 150 mm in depth including watering, consolidation etc., complete.	170.38	Cum		
	<b>SUB-HEAD TOTAL</b>				
	<b>Sub-Head 2: Plain &amp; Reinforced Cement Concrete</b>				
<b>2.1</b>	Plain cement concrete 1:4:8 using 40mm and below size broken stone jelly for foundation & under floors including machine mixing, laying compacting and curing etc., complete.				
2.1.1	Below footing & Base of ETP Tank	97.36	Cu.m		

2.2	Providing and laying in position machine batched and machine mixed design cement concrete for reinforced cement concrete work, using cement content as per approved design mix, including pumping of concrete to site of laying but excluding the cost of centering, shuttering, finishing and reinforcement, including admixtures in recommended proportions as per IS: 9103 to accelerate, retard setting of concrete, improve workability without impairing strength and durability as per direction of Engineer-in-charge.				
	<b>M30</b>				
2.2.1	UP TO BASEMENT LVL	620	Cu.m		
2.3	<b>Centering and shuttering including strutting, propping etc. and removal of form for:</b>				
2.3.1	Foundations, footings, bases of columns, Grade Beam, walls & suspended cover slabs etc. for mass concrete.	1989.00	Sq.m		
	<b>SUB-HEAD TOTAL</b>				
	<b>Sub-Head 3: Reinforcement</b>				
3.1	Providing and fixing high yield strength ribbed cold twisted tor steel of various diameters of grade Fe500 conforming to BIS Specification including cutting, bending, fabricating and placing in position according to drawings and binding the reinforcement with the use of 18 gauge galvanised annealed binding wire of double fold (double strands) and providing precast cement cover blocks of adequate sizes for main reinforcements to ensure specified cover according to relevant IS code. The rate to include wastages, necessary laps, spacers as per IS as specified complete in all floors. The measurements will be in accordance with IS Code.	46	MT		
	<b>SUB-HEAD TOTAL</b>				
4	<b>Sub-Head 4: Masonry Works</b>				

4.1	Providing and constructing 450mm/300mm thick brick work using approved first quality table moulded chamber burnt Bricks with strength 35-50 kgs / sqcm in cement mortar (1cement : 6 coarse sand) laid to line and levels including all leads and lifts, for all floor levels we]ng the bricks properly by immersing in water before laying, curing, scaffolding, all materials, labour complete at all floor levels and as per the instructions of the Architect / Engineer in charge.	15.27	Cum		
	<b>SUB-HEAD TOTAL</b>				
5	<b>Sub-Head 5: Finishing Works</b>				
5.1	Providing waterproof plaster to internal walls of ETP Tanks, columns, etc. in waterproof cement mortar 1:4 (using approved waterproofing compound added as per manufacturers instructions) applied in two coats, first coat of 12mm thick, second coat of 6mm with water proof compound to be applied after application of first coat, finished to line and level to approved texture, including all leads, lifts, scaffolding and curing complete. The rate is inclusive of forming of drip moulds, architectural grooves 16mm. Supplying and Fixing 150mm width Plaster Mesh made out of galvanized iron of nominal thickness 0.35mm with a zinc coating of 120 gms/ Sqm of Arpitha make at the junctions of masonry and RCC works with Galvanized nails etc., as per the directions of the Architect/ Engineer in charge.	1229.09	Sq.m		
	<b>SUB-HEAD TOTAL</b>				
	<b>SUB-HEAD TOTAL</b>				
	<b>GRAND TOTAL</b>				

# **DRAWINGS**

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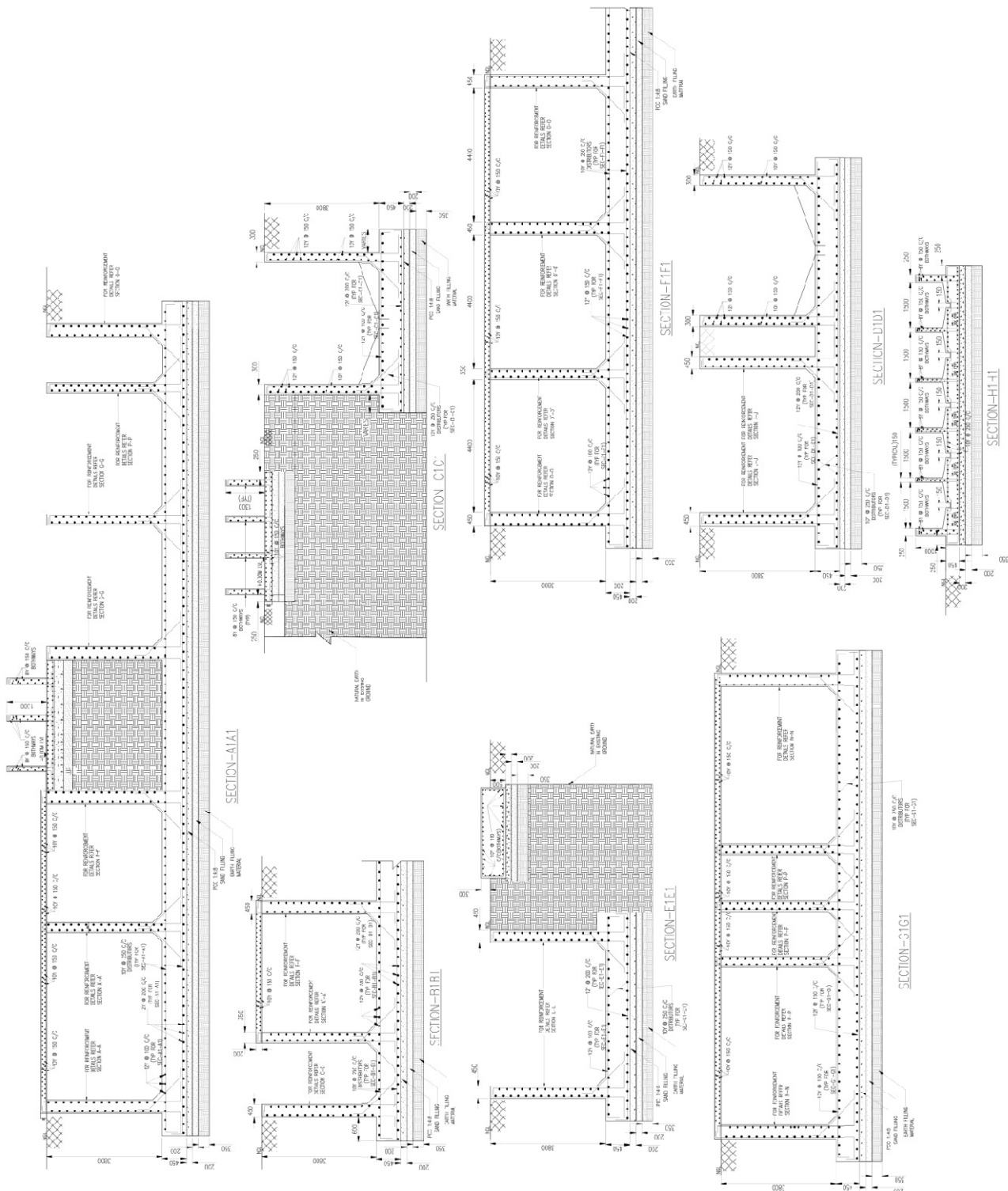
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STRUCTURAL CONSULTANT				
CSP STRUCTURAL CONSULTANTS				

PROJECT # PROPOSED EFFLUENT TREATMENT TANK AT

SIDCO INDUSTRIAL ESTATE THIRUVIDYAKKAM

Date	Scale	Job No.	Orig No.
27 06 2021	NTS	202104	202104_RFDDETAIL 01

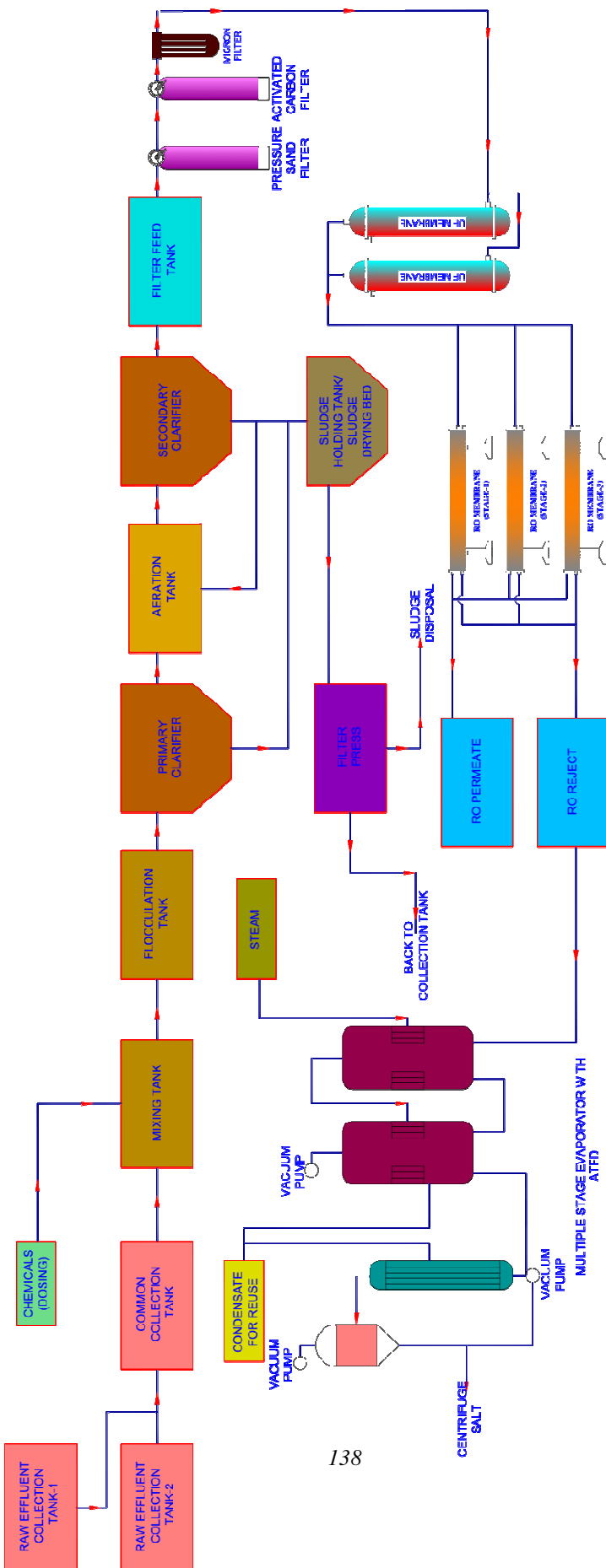
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## PROCESS FLOW DIAGRAM



## PRICE BID

S. No.	DESCRIPTION	AMOUNT IN Rs.
<b>A</b>	<b>DESIGN, ENGINEERING, CONSTRUCTION, SUPPLY, INSTALLATION, COMMISSIONING AND O&amp;M FOR ONE YEAR OF 200 KLD COMMON EFFLUENT TREATMENT PLANT WITH ZERO LIQUID DISCHARGE.</b>	
	<b>Price Break-Up of (#A) for payment purpose only</b>	
	Supply of Electromechanical Equipments as per BOQ in Tender Vol-2. (The Cost should include the Transportation, Packing & Forwarding, Insurance and any other charges applicable)	
	Construction and testing of all Civil Structures and Installation & Commissioning of all Electromechanical Equipments as in the Civil and Electromechanical Equipments BOQ in Tender Vol-2	
	<b>TOTAL VALUE</b>	
	<b>GST @ 6% ON TOTAL VALUE</b>	
	<b>TOTAL VALUE INCLUDING TAX</b>	
	<b>TOTAL O&amp;M COST FOR 2ND &amp; 3RD YEAR (#1 + #2)</b>	
	2nd Year Operation & Maintenance Cost of the CETP with ZLD	
	3rd Year Operation & Maintenance Cost of the CETP with ZLD	