

# Tender

## For

Comprehensive Maintenance & operation of  
850kLD MBR based S.T.P. including  
Effluent treatment tanks,  
Water softening plant,  
Inlet tank, pump room, outgoing tank for residential complex  
installed at A.I.I.M.S., Jodhpur.

N.I.T. No.	:	Admn/Tender/156/2017-AIIMS.JDH
NIT Issue Date	:	10 <sup>th</sup> July, 2017
Pre Bid Meeting	:	17 <sup>th</sup> July, 2017 at 11:00 AM
Last Date of Submission	:	31 <sup>st</sup> July, 2017 at 03:00 PM
Bid Opening Date	:	01 <sup>st</sup> August, 2017 at 03:00 PM

Tender documents may be downloaded from institute's web site  
[www.aiimsjodhpur.edu.in](http://www.aiimsjodhpur.edu.in) (for reference only) and CPPP site  
<https://eprocure.gov.in/eprocure/app>



## All India Institute of Medical Sciences, Jodhpur

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## ALL INDIA INSTITUTE OF MEDICAL SCIENCES, JODHPUR

## NOTICE INVITING TENDER

S. No.	Particular	Remarks
01	Name of work	Comprehensive Maintenance & operation of 850kLD MBR based S.T.P. including Effluent treatment tanks, Water softening plant, Inlet tank, pump room, outgoing tank for residential complex installed at A.I.I.M.S., Jodhpur
02	Tender No.	Admn/Tender/156/2017- AIIMS.JDH
03	Contract period	01 year (further extended to 1 year)
04	Estimated Cost	Rs. 26,00,000/-
05	Earnest money deposit	Rs. 52,000/-
06	Tender documents	Download from following websites- <a href="http://www.aiimsjodhpur.ac.in">www.aiimsjodhpur.ac.in</a> <a href="http://eprocure.gov.in">http://eprocure.gov.in</a>
07	Pre-bid meeting	17 <sup>th</sup> July, 2017 at 11:00 AM at Committee room, Administration Block, Medical College, AIIMS, Jodhpur.
08	Website for online submission	<a href="https://eprocure.gov.in/eprocure/app">https://eprocure.gov.in/eprocure/app</a> .
09	Last date and time place of Online submission	31 <sup>st</sup> July, 2017 at 03:00 PM at Administration Block, Medical College, AIIMS, Jodhpur.
10	Date time and place of tender opening	01 <sup>st</sup> August, 2017 at 03:00 PM at Committee room, Administration Block, Medical College, AIIMS, Jodhpur.

**Please read carefully the notes given with the tender Notice.**

Administrative Officer  
AIIMS, Jodhpur

**ALL INDIA INSTITUTE OF MEDICAL SCIENCES, JODHPUR****NOTICE INVITING TENDER**

All India Institute of Medical Sciences (AIIMS), Jodhpur, Rajasthan, an apex healthcare institute established by an Act of Parliament of India under aegis of Ministry of Health & Family Welfare, Government of India, invites Online bids in two bid system for tenders of Comprehensive Maintenance & operation of

1. 850kLD MBR based S.T.P. including
2. Effluent treatment tanks,
3. Water softening plant,
4. Inlet tank, pump room, outgoing tank for residential complex installed at A.I.I.M.S., Jodhpur.

**Instructions for the Bidder/ The service provider/ Bidders:-**

1. **Bids shall be submitted online only at CPPP website: <https://eprocure.gov.in/eprocure/app>.**
2. The complete bidding process is online. Bidders should be possession of valid digital Signature Certificate (DSC) of class II or III for online submission of bids. Prior to bidding DSC need to be registered on the website mentioned above. For any assistance for e-bidding process, if required, bidder may contact to the helpdesk at 0291-2740741.
3. **Bidder/service provider are advised to follow the instructions provided in the ‘Instructions to the service providers/Bidders for the e-submission of the bids online through the Central Public Procurement Portal for e-Procurement at <https://eprocure.gov.in/eprocure/app>’.**
4. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.
5. **Criteria of eligibility:** Bidder who fulfill following requirement shall be eligible to apply. Joint ventures are not accepted:  
*Note: Completion certificate to be attached.*  
**“Similar works mean Comprehensive Maintenance & Operation of MBR based Sewerage Treatment Plant of atleast 425kLD capacity.”**
  - a. **The bidder must have completed atleast three similar works in last seven years ending 30.06.2017 with Government or Reputed Semi-government company (As per Annexure-III)**
  - b. **Satisfactory job completion certificate that should have been signed by Executive Engineer or rank above; certifying the detailed scope of work handled to include electrical installations, programmable logic control panels, pumping station, digester, Chlorination and having maintained an on-site pollution testing laboratory.**
  - c. **Bidder should have annual turnover of 10times the tender value for the last 3 years.**
  - d. **Atleast 3 jobs of 50% Tender value in the last 3 years.**
  - e. **Bank solvency of Rs. 50lakh or equal to tender value, whichever is less.**
6. **EMD Payment:**  
The bidder shall be required to submit the Earnest Money Deposit (EMD) for an amount of **Rs. 52,000/- (Rupees Fifty Thousand only)** by way of demand drafts or Bank Guarantee only. The demand drafts or Bank Guarantee shall be drawn in favour of **“All India Institute of Medical Sciences, Jodhpur”**. The EMD of the successful bidder shall be returned after the successful submission of Bank Guarantee/ Security Deposit and for unsuccessful bidder(s) it

would be returned after award of the contract. **The demand drafts or Bank Guarantee for EMD must deliver to AIIMS, Jodhpur on or before last date/time of Bid Submission.**

- a) Bidder shall not be permitted to withdraw his offer or modify the terms and conditions thereof. In case the Bidder fail to observe and comply with stipulation made herein or backs out after quoting the rates, the aforesaid amount of earnest money will be forfeited.
- b) The Firm who are registered with National Small Industries Corporation (NSIC) / OR Small Scale Industries (SSI) are exempted to submit the EMD (Copy of registration must be provide along with technical bid).
- c) The EMD, in case of unsuccessful Bidders shall be retained by AIIMS, Jodhpur till the finalization of the tender. No interest will be payable by AIIMS, Jodhpur on the EMD.

**7. The Hard Copy of original instruments in respect of cost of earnest money deposit etc. must be delivered to the AIIMS, Jodhpur on or before last date/time of Bid Submission as mentioned above (submitted only in Dispatch/Received section). The bid without EMD will be summarily rejected.**

**8. Submission of Tender:**

The tender shall be submitted online in two part, viz., technical bid and financial bid. All the pages of bid being submitted must be signed and sequentially numbered by the bidder irrespective of nature of content of the documents before uploading.

- ✓ **The offers submitted by Telegram/Fax/email shall not be considered. No correspondence will be entertained in this matter.**

**I. Technical Bid**

The following documents are to be furnished by the bidder along with **Technical Bid** as per the tender document:

- a) Duly filled format of Technical Bid as per Annexure – I.
- b) Copy of constitution or legal status of the bidder manufacturer / Sole proprietorship / firm / agency etc.
- c) The technical bid should be accompanied by demand draft of **Rs. 52,000/- (Rupees Fifty Thousand Only)** (Refundable) against EMD. The Demand Draft of EMD should be prepare separately and drawn in favour of All India Institute of Medical Sciences, Jodhpur.
- d) Copy of GST/VAT/CST/ST/Other Taxes Registration Certificate.
- e) Copy of Income Tax Return Acknowledgement for last Three years.
- f) Copy of PAN Card / Service Tax Registration.
- g) Copy of Sales tax / VAT registration certificate.
- h) Certificate as per Annexure-I, II, III.
- i) Duly Signed Tender document and their annexures.
- j) All other document mentioned in tender document.

**II. Financial Bid**

- a) Price bid Form [As per Annexure-V duly filled and signed] - Price must be quoted as per format specified; failing which tender shall be summarily rejected.

## General Conditions of Contract

1. **"Pre –Bid Meeting"** with the intending bidders shall be held on 17<sup>th</sup> July, 2017 at 11:00 A.M. at Committee room, Administration Block, Medical College, AIIMS, Jodhpur. All the prospective bidders are requested to send/submit their comments/ representations on or before pre-bid meeting.
2. **Rate:** Prices of individual items should be inclusive of all taxes and duties including, Customs Duty, Excise Duty, etc. It should also include packing, forwarding, transport, insurance, loading/ unloading, installation etc. GST/ VAT/ local taxes shall be extra. Rate should be quoted only in Indian Rupees (INR) on DOOR Delivery Basis at AIIMS, Jodhpur, Rajasthan, Inclusive of all the Charges, with break-ups as:
  - Basic Cost.
  - GST/VAT/CST/ST/Other taxes.
  - Total Cost (F.O.R. at AIIMS, Jodhpur).
3. **Validity:** The quoted rates must be valid for a period for 180 days from the date of closing of the tender. The overall offer for the assignment and bidder(s) quoted price shall remain unchanged during the period of validity. If the bidder quoted the validity shorter than the required period, the same will be treated as unresponsive and it may be rejected. In case the tenderer withdraws, modifies or change his offer during the validity period, bid is liable to be rejected and the earnest money deposit shall be forfeited without assigning any reason thereof. The bidder should also be ready to extend the validity, if required, without changing any terms, conditions etc. of their original tender. In case the last date of sale / of receipt of tender / of opening the tender is declared as Holidays, the respective dates shall be treated as postponed to the next working day accordingly.
4. **Technical Evaluation:**
  - a) Detailed technical evaluation shall be carried out by Institute pursuant to conditions in the tender document to determine the substantial responsiveness of each tender. For this clause, the substantially responsive bid is one that conforms to all the eligibility and terms and condition of the tender without any deviation.
  - b) The Institute's determination of bid's responsiveness is to be based on the contents of the bid itself without recourse to extrinsic evidence. The Institute shall evaluate the technical bids also to determine whether they are complete, whether required sureties have been furnished, whether the documents have been properly signed and whether the bids are in order. The Director, AIIMS, Jodhpur shall have right to accept or reject any or all tenders without assigning any reasons thereof.
5. **Financial Evaluation:**
  - (a) The financial bid shall be opened of only those bidders who have been found to be technically eligible. The financial bids shall be opened in presence of representatives of technically eligible bidders, who may like to be present. The institute shall inform the date, place and time for opening of financial bid.
  - (b) Arithmetical errors shall be rectified on the following basis. If there is a discrepancy between the unit price and total price that is, the unit price shall prevail and the total price shall be corrected by the Institute. If there is a discrepancy between words and figures, the lesser amount shall be considered as valid. If the Supplier does not accept the correction of the errors, his bid shall be rejected.

- (c) After due evaluation of the bid(s) AIIMS, Jodhpur will award the contract to the lowest evaluated responsive tenderer. Conditional bid will be treated as unresponsive and will be rejected.
6. The bidders are requested to visit site and get familiarized with local condition before submission of tender.
7. Right to issue and to accept or reject any or all tenders without assigning any reason thereof is reserved by the Competent Authority.
8. **Award of Contract:** The Institute shall consider placement of orders for jobs on those bidders whose offers have been found technical and financially acceptable. The Institute reserves the right to counter offer price(s) against price(s) quoted by any bidder.
9. **Signing of Contract:** The successful bidder shall be required to execute the Contract Agreement accepting all terms and conditions stipulated herein on a non-judicial stamp paper of Rs. 500/- (Rs. Five Hundred only) within fifteen days of the issue of the Letter of notification of award along with performance security. In the event of failure on the part of the successful bidder to sign the Contract within the period stipulated above, the EMD shall be forfeited and the acceptance of BID shall be considered as cancelled.
10. **Performance bank guarantee:** The successful tenderer will be required to furnish a Performance bank guarantee @ 10% of order value in the form of Fixed Deposit Receipt or Bank Guarantee from any Nationalized Bank duly pledged in the name of the "All India Institute of Medical Sciences, Jodhpur" after receipt of supply order. The Performance bank guarantee can be forfeited by order of this Institute in the event of any breach or negligence or non-observance of any condition of contract or for unsatisfactory performance or non-observance of any condition of the contract. Performance bank guarantee will be discharged after completion of all the contractual obligations. The Performance bank guarantee amount will not carry any interest.
11. **Authority of person signing document:** A person signing the tender form or any documents forming part of the contract on behalf of another shall be deemed to warranty, that he has authority to bind such other and if, on enquiry, it appears that the person so, signing had no authority to do so, the Director, AIIMS, Jodhpur may without prejudice to other Civil and criminal remedies cancel contract and held the signatory liable for all cost and damages.
12. **Right of acceptance:** The Director, AIIMS, Jodhpur reserve the right to accepting the whole or any part or portion of the bid; and the bidder shall provide the same at the rates quoted. The Director, AIIMS, Jodhpur reserve the right to reject any or all tenders /quotations or all offers received in response to the tender or cancel or withdraw the tender notice without assigning any reason thereof and also does not bind itself to accept the lowest quotation or any tender and no claim in this regard shall be entertained
13. **Inspection:**
- (a) AIIMS, Jodhpur shall have the right to inspect and/or to test the goods to confirm their conformity to the NIT Specifications at no extra cost to the Purchaser.
- (b) AIIMS, Jodhpur right to inspect, test and, where necessary, reject the Goods after the goods arrival at the final destination shall in no way be limited or waived by reason of the Goods having previously been inspected, tested and passed by AIIMS, Jodhpur prior to the goods shipment.

(c) The Director, AIIMS, Jodhpur shall be the final authority to reject full or any part of the supply which is not conforming to the specification and other terms and conditions.

14. Information and instruction for Service provider for tendering forming part of NIT and to be posted on website.
15. Right to issue and to accept or reject any or all tenders without assigning any reason thereof is reserved by the Competent Authority.
16. **Rates:** Rate should be quoted in Indian Rupees (INR) on DOOR Basis Delivery at AIIMS, Jodhpur inclusive of all charges. Where there is a difference between the rates in figures and words, lower of the two rates shall be taken as valid and correct rate. The service provider shall take into account all the costs involved in compliance of all the special conditions and as stated above while quoting his rates in his tender for this work
17. **Taxes:** GST/VAT/WCT/CST/ST/Other taxes if payable extra should be clearly mentioned otherwise no GST/VAT/CST/ST/Other taxes charges will be paid
18. **Opening of Tender:** The bidder is at liberty either himself or authorizes not more than one representative to be present at the opening of the tender. The representative attending on the opening of the tender on behalf of the tender should bring with him a letter of authority from the bidder and proof of identification. The late received tenders by AIIMS, Jodhpur will be ignored. Further, AIIMS, Jodhpur does not accept any liability and responsibility for the tenders in case the same are not properly sealed and marked and/or sent as above.
19. **Subletting of Work:** The firm shall not assign or sublet the work/job or any part of it to any other person/party or will first obtain permission in writing from the Competent Authority of AIIMS, Jodhpur, which will be at liberty to refuse if thinks fit. The tender is not transferable. Only one tender shall be submitted by one bidder.
20. **Breach of Terms and Conditions:** In case of breach of any terms and conditions as mentioned in tender, the Competent Authority, will have the right to reject the bid at any stage without assigning any reason thereof and nothing will be payable by AIIMS, Jodhpur in that event the EMD shall also stands forfeited.
21. **Insolvency etc.:** In the event of the firm being adjudged insolvent or having a receiver appointed for it by a court or any other order under the Insolvency Act made against them or in the case of a company the passing any resolution or making of any order for winding up, whether voluntary or otherwise, or in the event of the firm failing to comply with any of the conditions herein specified AIIMS, Jodhpur shall have the power to terminate the contract without any prior notice.
22. The bidder should furnish a copy of GST/S.T./C.S.T/V.A.T./E.P.F. registration number. Tenders not complying with this condition will be rejected.
23. The taxes or any other charge if payable extra should be clearly mentioned otherwise no extra charge will be paid.
24. The items will have to be supplied at Institute site. No transportation/ cartage charges will be provided for the same.

25. Signed & stamped compliance sheet of the technical specification of the goods with technical printed literature must be enclosed with technical bid.
26. Bidder shall submit a copy of the tender document and corrigendum/addendum thereto, if any, with each page of this document should be signed and stamped to confirm the acceptance of the entire terms & conditions as mentioned in the tender documents.
27. After the evaluation of the bid(s) AIIMS, Jodhpur will award the contract to the lowest evaluated responsive bidder on composite basis. Conditional bid will be treated as unresponsive and will be rejected.
- 28. Applicable Law:**
- The contract shall be governed by laws and procedures established by Govt. of India, within the framework of applicable legislation and enactment made from time to time concerning such commercial dealings/ processing.
  - The contractor shall follow all the government labour laws, minimum wages, labour safety, labour insurance etc. A
  - Any disputes are subject to exclusive jurisdiction of competent court and forum in Jodhpur, Rajasthan, India only.
  - The Arbitration shall be held in accordance with the provision of the Arbitration and conciliations Act, 1996 and the venue of arbitration shall be at Jodhpur. The decision of the Arbitrator shall be final and binding on both the parties.
  - Force Majeure: Any delay due to Force Majeure will not be attributable to the service provider.
29. **Guarantee / Warrantee Period:** Service provider must provide one (01) year comprehensive on-site warranty for all the items which shall be replaced and it will be started from the date of the satisfactory installation the item against any defect, workmanship and poor quality. The replaced component/s will be handed over to AIIMS, -Jodhpur
30. Bidder shall submit delivery challan (TAX invoice) for the material to be supplied along with lot number mentioned on it.
31. Any information / document required for verification shall be provided by the bidder.

**Administrative Officer**  
**AIIMS, Jodhpur**



**SCOPE OF WORK**

<b>Sr. No.</b>	<b>Description</b>	<b>Scope of Work</b>	<b>Remarks</b>
<b>A. Operational services</b>			
A01	Day to day operation 24x7 for 365 days & routine maintenance and to follow daily checks.	<b>Service Provider</b>	
A02	Provide professional, skilled & semi-skilled manpower for all the installed equipments operation.	<b>Service Provider</b>	Trained manpower shall only be deputed at the site.
A03	Preparation & Dosing Chemical Solutions of required concentration and quantity.	<b>Service Provider</b>	
A04	Collection, removal and disposal of sludge. Maintain the MLSS level in Bio reactor.	<b>Service Provider</b>	
A05	Sampling- Collecting water/ effluent sample.	<b>Service Provider</b>	
A06	Submission of operation data as per Clients requirement.	<b>Service Provider</b>	
A07	Procurement, handling and unloading of chemicals.	<b>Service Provider</b>	
A08	Operations of air blowers, pumps & softening agitator tank.	<b>Service Provider</b>	
A09	Operation of all electrical & mechanical machinery including electrical panels	<b>Service Provider</b>	
A10	General cleaning and house-keeping	<b>Service Provider</b>	
<b>B. Maintenance services</b>			
B01	Preventive/minor maintenance of pumps, blower, motors and other equipments.	<b>Service Provider</b>	Not in case if breakdown is caused due to strikes, lockouts, civil commotion, war, theft, floods, riots, explosion or act of God or cause beyond human control.
B02	Clean / Preventive / minor the air filters on Air Blowers regularly. Change the Air Filters Periodically.	<b>Service Provider</b>	
B03	Maintenance of civil structures, roads etc.	<b>AIIMS, Jodhpur</b>	
B04	Painting of equipments, pipes and buildings etc.	<b>AIIMS, Jodhpur</b>	
B07	Provision of heavy lifting equipments like Hydra, Crain's, Forklifts, Chain pulley block with tripod etc.	<b>As per orders of AIIMS, Jodhpur</b>	
B08	Provision of general Tool Kits	<b>Service Provider</b>	As per list given below

B09	Provision of Special Tool & Tackles	Service Provider	
B10	Overhauling & Breakdown maintenance of equipments	Service Provider	
B11	Calibration of Lab/ field equipments instruments	Service Provider	
B12	Oil & grease chamber, all screen bars (manual & auto) and all tank cleaning	Service Provider	
B13	All type of valves (Solenoid, butterfly, gate, non-return etc.)	Service Provider	If required to be replaced then the work should be done as per orders of AIIMS, Jodhpur
B14	Preventive & breakdown maintenance of softening agitator tank & pump	Service Provider	
B15	Maintenance of air blowers, pumps & softening agitator tank.	Service Provider	
<b>C. Laboratory services</b>			
C1	Provision of well-equipped laboratory	AIIMS, Jodhpur	All required test kits & meters for on-site laboratory e.g. pH, BOD, COD, TS, TDS, SS, DO, Temperature, conductivity ,chlorine demand, residual chlorine, MLSS, MLVSS, SVI etc. will be provided by the service provider.
C2	Analysis of various samples of water / waste water as applicable.	Service Provider	
C3	Testing by external agency if required.	Service Provider	
<b>D. Material supply</b>			
D1	Supply of proprietary chemicals (DWPE) for the plant for operations.	AIIMS, Jodhpur	
D3	Supply of required other commodity chemicals (Hypo, Citric acid, NaCl) for the plant operation.	AIIMS, Jodhpur	
D4	Supply of major and minor spares of the plant operation like lubricants, cotton waste, oil & grease, kerosene etc.	AIIMS, Jodhpur	
D5	Supply of maintenance consumables like rustoline, gaskets, packing, v-belts etc.	Service Provider	
D6	Supply of adequate Personal Protective Equipments	Service Provider	
D7	Any equipment replacement	As per orders of AIIMS, Jodhpur	
<b>E. Statutory requirements &amp; clearness</b>			

E1	All statutory & Environmental clearances & taxes.	<b>AIIMS, Jodhpur</b>	To obtain necessary clearance from pollution control board the service provider will provide all necessary documents & will cooperate during inspection.
E2	Monthly payment of O&M Bills	<b>AIIMS, Jodhpur</b>	
E3	Ensuring availability of raw water as per design specifications, electrical power etc. required for operation of the plant.	<b>AIIMS, Jodhpur</b>	
E4	Statutory norms as per applicable labor law	<b>Service Provider</b>	
E5	Plant security round the clock	<b>AIIMS, Jodhpur</b>	
E6	Transportation within the complex.	<b>Service Provider</b>	
E7	Any medical facility on site	<b>Service Provider</b>	
F1	Maintaining Daily / Weekly / Monthly reporting and log book. All the running records of effluent quality; laboratory test, chemical consumption record etc. in standard format shall be maintained by the service provider as directed / as per updated guidelines of pollution control board.	<b>Service Provider</b>	All reports and log book will be checked by AIIMS, Jodhpur.
F2	In house technical expertise	<b>Service Provider</b>	
F3	Availability of all spares and equipments as per requirement	<b>Service Provider</b>	Tracking/monitoring stocks available and ensuring procurement on time.
<p>❖ The service provider will ensure that effluent shall be suitable before feeding it to STP for further treatment. The service provider will maintain all the design outlet parameters of MBR Based STP Plant as per manufacturer manual. (to be handed over during handing over of the site)</p> <p>❖ The service provider will ensure that the hardness of softening water should not exceed from 50 to 60 PPM.</p>			

- All the details regarding equipment installed at STP, AIIMS, Jodhpur is given in Annexure-IV.
- The equipment / plant shall be handed over by AIIMS, Jodhpur to the service provider at the start of the contract and shall be maintained in line with manufacturer maintenance manual (to be handed over during handing over of the site)
- AIIMS, Jodhpur will provide space, power, water, Lab building, illumination, water of right quality, security of plant etc. as per service provider recommendation and requirements.
- This contract is non-transferable and is applicable only to the units mentioned in this proposal.

5. Any instructions given in operations & maintenance manual shall be followed.
6. The Contractor's plant manager who is present at the site from 9:00 AM to 5:00 PM on all working days shall carry mobile telephone(s) to enable the Engineer-in-charge to have easy and quick communication. Nothing extra shall be paid to the contractor on this account and his quoted rates for various items under this contract will be inclusive of this obligation.
7. Agency shall avail the facility of existing one no. telephone & one internet/broadband connection provided by the department. However the payment of bills for the same shall be borne by the agency itself.
8. All the preventive & remedial measures to mitigate occupational safety & health risks shall be provided by the service provider / bidder in STP/WTP/ETP operations. All the personnel protective equipments shall be provided by the service provider / bidder.
9. **Technical / Operational team (qualification below is minimum)**

Name of designation	Qty.	Unit	Type of labour	Qualification
Plant manager	01	Nos.	Highly Skilled	Environmental engineer / B.Sc. Chemistry with minimum 3 years working experience in relevant field.
Plant Operators	04	Nos.	Skilled	I.T.I. (in electrician / fitter trade) with minimum 2 years working experience in relevant field.
Electrical / Mechanical technicians	01	Nos.	Skilled	I.T.I. (in electrician / fitter trade) with minimum 1 year working experience in relevant field.
Laboratory analyst	02	Nos.	Semi-skilled	Laboratory analyst is a qualified individual who has knowledge of water and waste water chemistry and is trained in preparations of laboratory chemicals, use of laboratory instruments, collection and preservation of water / waste water samples and analysis for various environmental parameters such as pH, SS, BOD, COD, TDS etc.
Helper	02	Nos.	Unskilled	N.A.
<b>Total No of</b>	<b>10</b>	Nos.		
❖ <b>NOTE: The number of highly skilled / skilled/ semiskilled / unskilled labour can be increased / reduced as per actual necessity of site with the approved of Engineer-in-charge without any additional charges.</b>				

10. **Penalty for non-availability of manpower:**

The contractor will maintain attendance records of the staff, which will be checked by the Engineer-in-charge or his representative. In case of absence of any staff recovery shall make at the following rates:

- i. Highly skilled labour @ Rs. 1,000/- per day per person.
- ii. Skilled labour @ Rs. 800/- per day per person.
- iii. Semi-skilled @ Rs. 600/- per day per person.
- iv. Unskilled @ Rs. 400/- per day per person.

11. The Agency shall be solely responsible for compliance to the provisions of various Labour and industrial laws, such as, wages, allowances, compensations, EPF, Bonus, Gratuity, ESI etc. relating to personnel deployed by it at AIIMS, Jodhpur site or for any accident caused to them and the institute shall not be liable to bear any expense in this regard. The Agency shall make payment of wages to workers engaged by it by the stipulated date irrespective of any delay in settlement of its bill by the Administrative Officer, at AIIMS, Jodhpur for whatever reason. The Agency shall also be responsible for the insurance of its personnel. The Agency shall specifically ensure compliance of various Laws / Acts, including but not limited to with the following and their re-enactments / amendments / modifications: -

- (a) The Payment of Wages Act 1936
- (b) The Employees Provident Fund & MP Act, 1952
- (c) The Contract Labour (Regulation) Act, 1970
- (d) The Payment of Bonus Act, 1965
- (e) The Payment of Gratuity Act, 1972
- (f) The Employees State Insurance Act, 1948
- (g) The Employment of Children Act, 1938
- (h) The Motor Vehicle Act, 1988
- (i) Minimum Wages Act, 1948

12. **Penalty for quality of treated water:**

S. No.	Testing	Treated water characteristics	if outlet parameters exceeds >10%	if outlet parameters exceeds >20%
1.	pH	6.5 -8.5	1.5% penalty on monthly billing	2% penalty on monthly billing
2.	BOD <sub>5</sub> @ 20°C	≤ 5 mg / liter	1.5% penalty on monthly billing	2% penalty on monthly billing
3.	COD (Cr)	≤ 20- 30 mg / liter	1.5% penalty on monthly billing	2% penalty on monthly billing
4.	TSS	≤ 5 mg / liter	1.5% penalty on monthly billing	2% penalty on monthly billing
5.	Turbidity	< 2 NTU	1.5% penalty on monthly billing	2% penalty on monthly billing
6.	Oil & Grease	< 5 mg/liter	1.5% penalty on monthly billing	2% penalty on monthly billing
7.	Colour	Clear/ Unobjectionable	1.5% penalty on monthly billing	2% penalty on monthly billing
8.	Ecoli	Removal to the level of log <sub>6</sub>	1.5% penalty on monthly billing	2% penalty on monthly billing

13. It shall be responsibility of the service provider / bidder to ensure the quality of treated water / effluent to comply with local authority requirement & following characteristics whichever is stringent.

S. No.	Item of analysis	Unit in mg/l or otherwise
1.	Temperature of discharge	45 °C
2.	Colour	7 lovibond / unit
3.	pH value	6.0 to 8.5
4.	B.O.D. (5day at 20°C)	10.0
5.	C.O.D.	50.0
6.	Total Suspended Solid	2.0
7.	Total Dissolved Solid	2000.0
8.	Residual Chlorine	>1.0
9.	Sulphate (as SO <sub>4</sub> )	500.0
10.	Sulphite (as sulphure)	0.2
11.	Cyanide (CN)	0.1
12.	Detergent (linear alkylate sulfonate as methylene blue active substances)	15.0
13.	Grease & oil	10.0
14.	Arsenic	1.0
15.	Barium	5.0
16.	Tin	10.0
17.	Iron (Fe)	20
18.	Beryllium	0.5
19.	Boron	5.0
20.	Manganese	5.0
21.	Phenolic compound	0.2
22.	Cadmium	0.1
23.	Chromium (trivalent & hexavalent)	1.0
24.	Copper	0.1
25.	Lead	0.1
26.	Mercury	0.05
27.	Nickel	1.0
28.	Selenium	0.5
29.	Silver	0.1
30.	Zinc	1.0
31.	Metals in total	1.0
32.	Chlorine (free)	1.0
33.	Phosphate	5.0
34.	Calcium	200.0
35.	Magnesium	200.0
36.	E-coli	Nil
37.	Hardness Inlet (For water softening plant)	400 mg/l
38.	Hardness Outlet (For water softening plant)	Commercial zero
39.	Regeneration period (For water softening plant)	12 hours
40.	Quantity of soft water between two regenerations (For water softening plant)	850,000 liters
41.	Operation pressure (For water softening plant)	3 kg/cm <sup>2</sup>
42.	Test pressure (For water softening plant)	4.5 kg/cm <sup>2</sup>

**Administrative Officer**  
**AIIMS, Jodhpur**

**Annexure - I****Technical Bid**

<b>S. No.</b>	<b>Details of the Bidder / Bidder</b>	
1.	Name of Firm /Service provider / service provider	
2.	Complete Address:	
3.	Name of Proprietor/ Partner/ Managing Director / Director.	
4.	State clearly whether it is sole proprietor or partnership firm or a company or a Government Department or a Public Sector Organization	
5.	Details of Earnest Money Deposit (EMD) (Yes/No) DD No.: Dated: Drawn on Bank: Amount: (Rupees.....)	
6.	Whether each page of NIT and its annexure have been signed and stamped	
7.	Whether the firm is a registered firm Yes/No (attached copy of certificate).	
8.	Copy of VAT/CST/ST Registration	
9.	Permanent Account No. (Copy must be provided)	
10.	Sale Tax Registration No. (Copy must be provided)	
11.	TIN No.(Copy must be provide)	
12.	VAT No. (Enclose the attached copy of VAT certificate)	
13.	Copy of Income Tax Return Acknowledgement for last Three years	
14.	Any other information, if necessary	
15.	Name and address of service centre nearby Jodhpur	
16.	Email ID	
17.	Contact No.	

**Note: All pages should be numbered & indexed.**

Date:

Place:

Name :

Business Address :

Signature of Bidder :

Seal of the Bidder :

**Annexure-II****UNDERTAKING CERTIFICATE  
(To be submitted on letter head of the company / firm)**

I hereby certify that the above firm has not been ever blacklisted by any Central / State Government / Public Undertaking / Institute on any account.

I also certify that firm will supply the item as per the specification given by Institute and also abide all the terms and conditions stipulated in tender.

I also certify that the information given in the bid is true and correct in all aspects and if in any case at a later date it is found that any detail/s provided are false and incorrect, any contract given to the concern firm or participation may be summarily terminated at any stage, the firm will be blacklisted and Institute may imposed any action as per NIT rules.

Date:

Place:

Name :

Business Address :

Signature of Bidder :

Seal of the Bidder :



**Annexure-III**

**Details of all works of similar class completed during the last seven years ending last day of the month ending April, 2017.**

**Attached certified copies of experiences  
(Can use extra sheet if necessary)**

S. N .	Name of Work / Project	Owner or Sponsoring Organization	Cost of work (lac)	Date of Commencement as per contract	Stipulated date of completion	Actual date of completion	Litigation/ arbitration pending / in progress with details	Name and address/ telephone number of officer to whom reference may be made	Remark
1	2	3	4	5	6	7	8	9	10

\* Indicate gross amount claimed and amount awarded by the Arbitrator.

\* Please attach completion & performance certificates from authorized person.

Date:  
Place:

Name :  
Business Address :  
Signature of Bidder :  
Seal of the Bidder :

**Annexure-IV****OPERATION & MAINTENANCE MANUAL FOR SEWAGE TREATMENT PLANT (MBR)****Water & Waste Solutions****MAKING INDUSTRY GREEN AND COMPETITIVE**

Cost competitive and Environment friendly technology innovated and developed through continuous research to keep industry green and competitive. Excellence in Technology and stringent quality control measures are the hallmarks in all projects undertaken by Thermax Water & Waste Solutions Division. Thermax Water & Waste solutions division takes on Retrofitting and Revamping orders to extend life of all aging plants. Our comprehensive service program is the first of its kind in India. It is a program that evaluates and then enhances the economical performance of all water & waste treatment plants. Thermax Water & Waste Solution Division's wide spectrum of products and technology covers

- \_ Pretreatment
- \_ Process Water Treatment
- \_ Ion Exchange Resins
- \_ Reverse Osmosis and Electrodialysis
- \_ Condensate Polishing
- \_ Thermal Desalination
- \_ Waste Water Treatment
- \_ Sewage Treatment
- \_ Recycling of water
- \_ Range of Cooling Water Chemicals
- \_ Range of Polyelectrolytes
- \_ Incinerators.

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**Why do we treat sewage?**

The main reason that we developed the sewerage system was to protect human health. We did this by ensuring that our sewage and water supply were kept apart. Originally wastewater was collected into sewers and discharged into the nearest waterway. This improved our health but it caused environmental problems. Our rivers were suffering because natural processes were too slow to keep up with the impact of our waste. Various methods were introduced to clean the sewage before disposing of it. The technology available to do this has become more efficient and effective over the years and new methods are still being found today.

**We treat Sewage to;**

- Avoid drinking water contamination
- Avoid food contamination
- Avoid ecological damage via eutrophication

Traditionally we have tried to keep our drinking water supply and wastewater separate — As far apart as possible — both physically and mentally. As a consequence, we think about the urban water ‘cycle’ as a straight line from dam to disposal. There are problems at both ends of the pipeline — a shortage at one end and pollution and waste at the other. The separation is an illusion. In most parts of the western world water has been recycled for many decades when a town upstream discharges its effluent to become the water supply for the next town downstream. Increasing population and climate change have put pressure on our water supplies and we are facing shortages. We need to change the way we think about urban water management, acknowledge that recycling is already happening and do it more and better.

**Pollution and Waste**

Organic pollution comes from organic waste matter, such as dead plants and animals. This is biodegradable and so is broken down by natural processes, for example, by bacteria. Inorganic pollution is usually man-made and non-biodegradable so can harm the environment in the long term.

The main sources of waste are;

**Domestic Waste**

- Washing powders and detergents add phosphates to our waste
- Some dishwasher detergents are caustic and can kill useful bacteria in the sewage works
- Using too much bleach also kills bacteria in the sewage works
- Left-over DIY chemicals and engine oil must not be poured down the drain – they should be disposed off correctly by taking them to your local refuse centre
- Unused medicines must not be put down the toilet - they should be returned to the pharmacist for safe disposal

**Agricultural waste**

- Farmers use fertilizers, pesticides and herbicides on their fields. When it rains, these harmful chemicals can run off the land into rivers and streams where these poisons can kill life in the rivers and harm birds and animals that feed on river animals.
- Farmers use nitrate fertilizers to fertilize fields during the growing season and these nitrates can run off into rivers in winter. The levels of nitrate fertilizer in the water is rising in some areas. This can lead to nitrates in drinking water being above the set limits. High levels of nitrates can also promote weed and algae growth that can choke rivers and lakes. Herbicides are often used to control weeds and pests on farms, roadsides and railway tracks. However, some are non-biodegradable which means they stay in the environment and are not broken down by the action of bacteria. Water companies then have to install expensive treatments to remove them from drinking water.

**Industrial waste**

- Toxic chemicals from manufacturing processes can sometimes be discharged into rivers where they can kill river life. If discovered, the companies can be prosecuted.
- A large power station uses 5 million liters of water a day in its cooling towers. This water is returned to the river several degrees warmer than when it left. Warm water holds less oxygen which is vital for animals and plants.
- Detergents are used by almost every factory and industry. When released into rivers, this can lead to an increase in bacteria and algae which use up dissolved oxygen.

*New technology allows us to reclaim water so that it can be recycled. We cannot longer afford to use water once and throw it away.*

#### **Applications**

Sewage discharged from almost any and every source has to be treated. Some examples are; Domestic complexes, Hospitals, Institutes, Malls, Offices, Industries, Schools, Marine, etc.

#### **Technical Specifications**

##### **QUALITY — NOT DEGREE OF TREATMENT**

Effluent quality is currently described in terms of the degree of treatment it has received

- Primary, secondary, advanced secondary and tertiary. The terms are not well defined and are meaningless to the layperson who wants to know what the water can safely be used for. At present in our country the technical specifications of treated sewage are maintained as per the Pollution Control Board norms. This Plant has been designed based on the below inlet and outlet characteristics.

## PROCESS DESIGN BASIS WITH ASSUMPTIONS

This treatment scheme has been designed to treat the sewage generated from Hospital which is summarized below:-

### RAW SEWAGE CHARACTERISTICS

Flow	850 m <sup>3</sup> /day
BOD mg/l	200-300
COD mg/l	: 400-550
TSS mg/l :	150-200
Oil & Grease mg/l : 20	Oil & Grease mg/l : 20
pH : 6.5 - 8.5	pH : 6.5 - 8.5
Total Coliform : 10 <sup>6</sup> X 10 <sup>7</sup>	Total Coliform : 10 <sup>6</sup> X 10 <sup>7</sup>
Turbidity (NTU) : Not Mentioned	Turbidity (NTU) : Not Mentioned

### TREATED SEWAGE CHARACTERISTICS

Flow	850 M <sup>3</sup> /day
BOD mg/l	<5
COD mg/l	<20
TSS mg/l	<5
Oil & Grease mg/l	<5
pH	6.5 - 8.5
Ammonia	<1
Total Coliform	Removal to the level of log 6
Turbidity (NTU)	<2

### ASSUMPTIONS:

- All other pollutants other than mentioned above have been considered as nil at the inlet of S.T.P which exceed the disposal standard as well as will adversely affect the performance of biological treatment.
- Invert level considered is EL – 1.5 mts.
- The plant design does not account for any toxic contamination from industries.
- The plant shall function in anoxic - aerobic condition only.
- Plant is installed in basement.
- We have considered entire sewage will be discharged into the sewage treatment plant in closed pipe. Thus avoiding grid chamber.
- Oil present if any shall be in free & floating form.
- Phosphate, Sulfur is not guarantee in this sewage treatment plant.
- Phase 1 shall have average flow of 35m<sup>3</sup>/hr. and Phase 2 shall have average flow of 35 m<sup>3</sup>/hr. in combination of both the phases the average flow shall be 70m<sup>3</sup>/hr. on 20 hrs basis. However plant shall operate on 24 hrs. of operation (i.e 29.2 m<sup>3</sup>/hr flow rate).
- The sewage generation is for 20 hrs. but plant shall operate on 24 hrs. basis.
- Sample shall be analyzed after every 15 days for 3 months. (i.e. 6 samplings).
- Minimum 30% flow of rated capacity shall be available for efficient operation of plant.

13. Both the phases (i.e. 1 and 2) are considered at same location.  
14. Clear height requires in basement to install the plant is 7.5 mts.

**UNIT DETAILS**

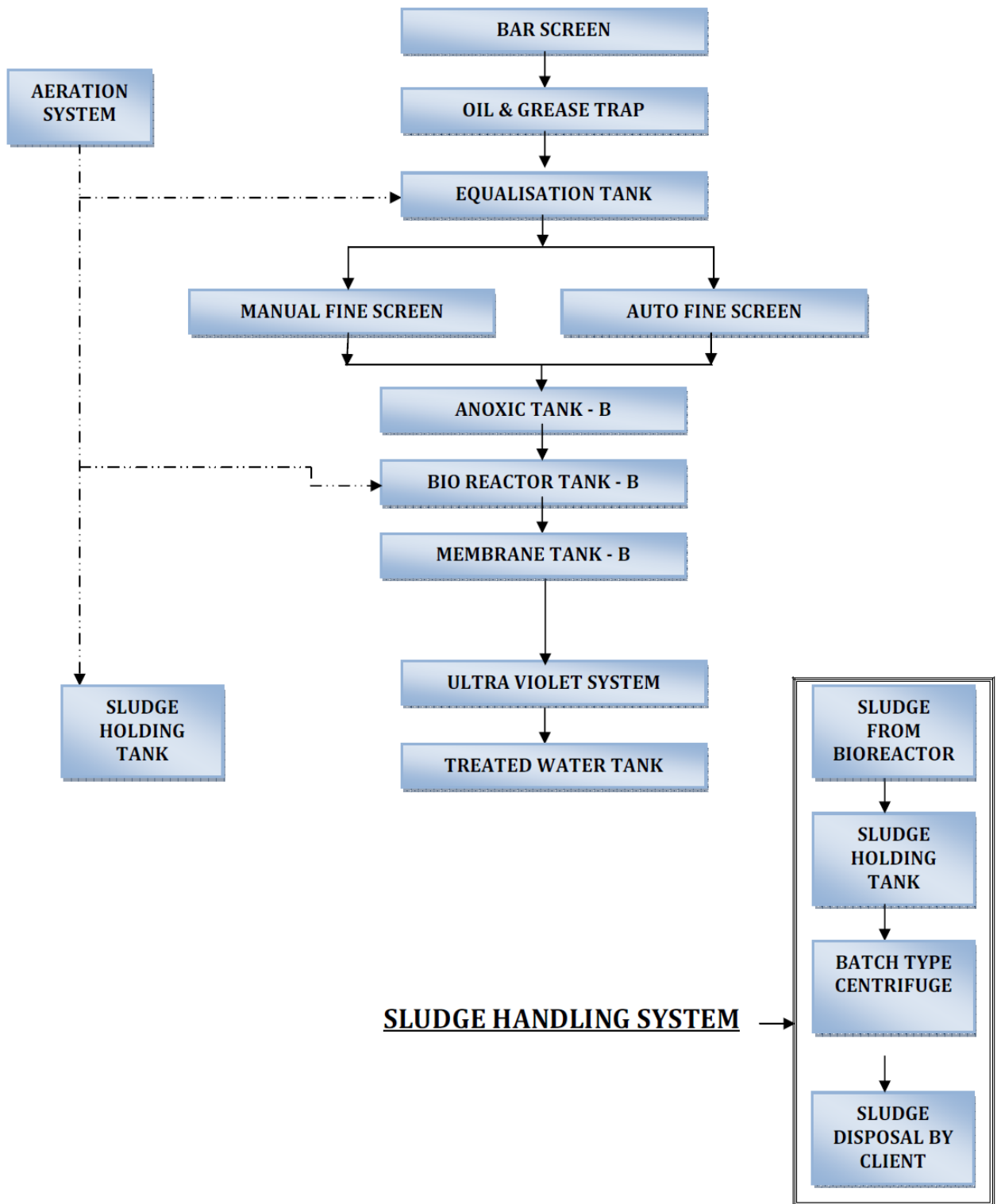
TAG NO.	DESCRIPTION	SIZE / CAPACITY	QTY.
T-1010	Coarse bar screen	0.8 x 1.8 x 0.8M SWD	01 no.
T-1020	Oil & grease trap	5.45 x 1.8 x 1.8M SWD	01 no.
T-1030	Equalization tank	9.4 x 6.5 x 3.5M SWD	01 no.
T-1040A	Fine bar screen-Auto	1.0 x 1.0 x 0.5M SWD	01 no.
T-1040B	Fine bar screen-Manual	1.0 x 1.0 x 0.5M SWD	01 no.
T-1050	Anoxic tank	4.4 x 4.4 x 3.7M SWD	01 no.
T-1060	Bio reactor	8.1 x 10.0 x 3.5M SWD	01 no.
T-1070	Membrane tank (GE MEM)	3.1 x 4.4 x 3.0M SWD	01 no.
T-1090	Permeate tank	4.4 x 4.4 x 3.0M SWD	01 no.
T-1100	Sludge holding tank	2.95 x 2.6 x 3.0M SWD	01 no.
-	Space for centrifuge	Suitable	01 no.

S. No.	DESCRIPTION	MARK	SIZE / CAPACITY	NOS. OFF
1.	Bar screen 6 mm	BS-1010	TL STD.	
2.	Slotted Pipe Oil Skimmer	OS-1020	TL STD	
3.	Air grid – equalization tank	ADG-1030	TL STD	
4.	Diffuser	-	TL STD	
5.	Bio reactor feed pimps	P-1011/12	35.5M <sup>3</sup> /HRO 12MHC	
6.	Fine Screen (Auto) 2mm	BS-1040A	TL STD	
7.	Fine Screen (Manual) 2mm	BS-1040B	TL STD	
8.	Air Blower for EQT, SHT, Bio Reactor	AB-1011/12	650M <sup>3</sup> /HRO4000MM WC	
9.	Air Blower for membrane.	AB-1013/14	450M <sup>3</sup> /HRO4000MM WC	
10.	Agitator for Anoxic Tank.	AG-1050	Suitable	
11.	Air grid for – Bio reactor	ADG-1060	TL STD	
12.	Diffuser	-	TL STD	
13.	Membrane	MEM-1070	Suitable	
14.	Membrane Skid		Suitable	
15.	Sludge recirculation pumps	P-1021/22	143M <sup>3</sup> /HRO10MWC	
16.	Permeate pumps cum backwash pumps with VFD	P-1031/22	38-45M <sup>3</sup> /Hyo10MWC	
17.	Hypo dosing tank	T-1080	150 liters	
18.	Hypo dosing pump	P-1080	6LPH	
19.	U.V. systems	UV-1010	Suitable for 38-36M <sup>3</sup> /Hyo10MWC	
20.	Air grid sludge holding tank	ADG-1100	TL-STD	
21.	Diffuser	-	TL-STD	
22.	Centrifuge feed pump	P-1041/42	5.0 M <sup>3</sup> /Hyo10MWC	
23.	Centrifuge (Batch type)	CF-1010	45kg per batch solid handling capacity	

24.	DWPE dosing tank	T-1130	100 liters	
25.	DWPE dosing pump	P-1130	0-50LPH	
26.	Agitator DWPE dosing tank	AG-1130	Suitable	
27.	Air compressor for DWE dosing tank	AG-1130	Suitable	
28.	Air compressor with dryer	COMP-1010	2CFM, 7.0MWC	
29.	Hypo dosing tank for maintenance	T-1110	300 liters	
30.	Hypo dosing pump for maintenance	T-1110	150 LPH 2BAR	
31.	Citric dosing tank for maintenance	T-1120	300 liters	
32.	Citric dosing pump for maintenance	T-1120	150 LPH 2BAR	



**PROCESS FLOW DIAGRAM**



**Treatment Philosophy**

To treat the sewage the following treatment philosophy is adopted

Bar Screen	: To trap any free floating debris.
Oil & Grease removal tank	: To trap free & floating oil if any.
Equalization tank	: To equalize the sewage quantitatively & qualitatively.
Fine Screen	: To trap any free floating debris above 2 mm.
Anoxic Tank	: To bring de-nitrification to release the N <sub>2</sub> in atm. By the virtue of bacteria's
Bio-Reactor COD	: Treatment of organic matter to reduce BOD / aerobically.
Membranes	: To filter the treated water from MLSS.
Chlorination and U.V.	: For Disinfection.
Sludge Holding Tank	: For Storage of sludge.
Batch Type Centrifuge	: To dewatering of sludge.

## Process description

### Bar Screen:-

Raw sewage from the source is usually received into the bar screen chamber by gravity. Screen provided will remove all floating and big size matter, which may otherwise choke the pipeline and pumps.



### Oil & Grease Trap:-

The sewage generated includes maximum quantity of waste from kitchen and canteen, there is a possibility of higher concentrations of oil and grease in the raw sewage. It needs to be removed before biological treatment as it otherwise may cause problems for biological treatment and membrane filtrations. Usually, a small civil construction tank with a baffle wall and slotted oil pipe skimmer is provided. The oil and grease floats under gravity to the surface, which is removed by the oil skimmer.



### Equalization Tank

Usually, Sewage generation is more during peak hours. Visually no Sewage is generated during shift change hours. Any biological system needs constant feed for bacteria to work efficiently. Hence, it is important to put an equalization tank to collect the excess flow during peak hours and feed Sewage in lean hours. A typical equalization tank has a capacity of 4-24 hours of average flow rate. The tank is generally of civil construction by client. Provision of air grid is to be made for thoroughly mixing the sewage to make it of homogenous quality and to keep the suspended matter in suspension and to avoid septic conditions. The well mixed sewage is then pumped into the fine screen with the help of pumps.



### Fine Screen :-

To reduce and safe guard membrane from the hair, sharp objects such as grit, wood , etc above 2 mm size, we have installed the fine screen (punched hole type) to remove all the object above 2 mm before it enters into the Bioreactor tank. From Fine screen the treated sewage flows to bio reactor under gravity.



### Bio-reactor Tank – Activated Sludge Process

The main pollutants in the raw sewage are represented in the form of Bio-chemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). The ammonical nitrogen, nitrate nitrogen and phosphorous present also represent as polluting substances. The bacterial ability to synthesize the organic matter to harmless end products like carbon di-oxide and water molecules is utilized to treat the raw sewage. The bio-reactions are carried out in controlled environment in the bio-reactor. The bio-reactor comprises of a tank, fitted with aeration grid. The bacterial activity needs dissolved oxygen, to synthesize the

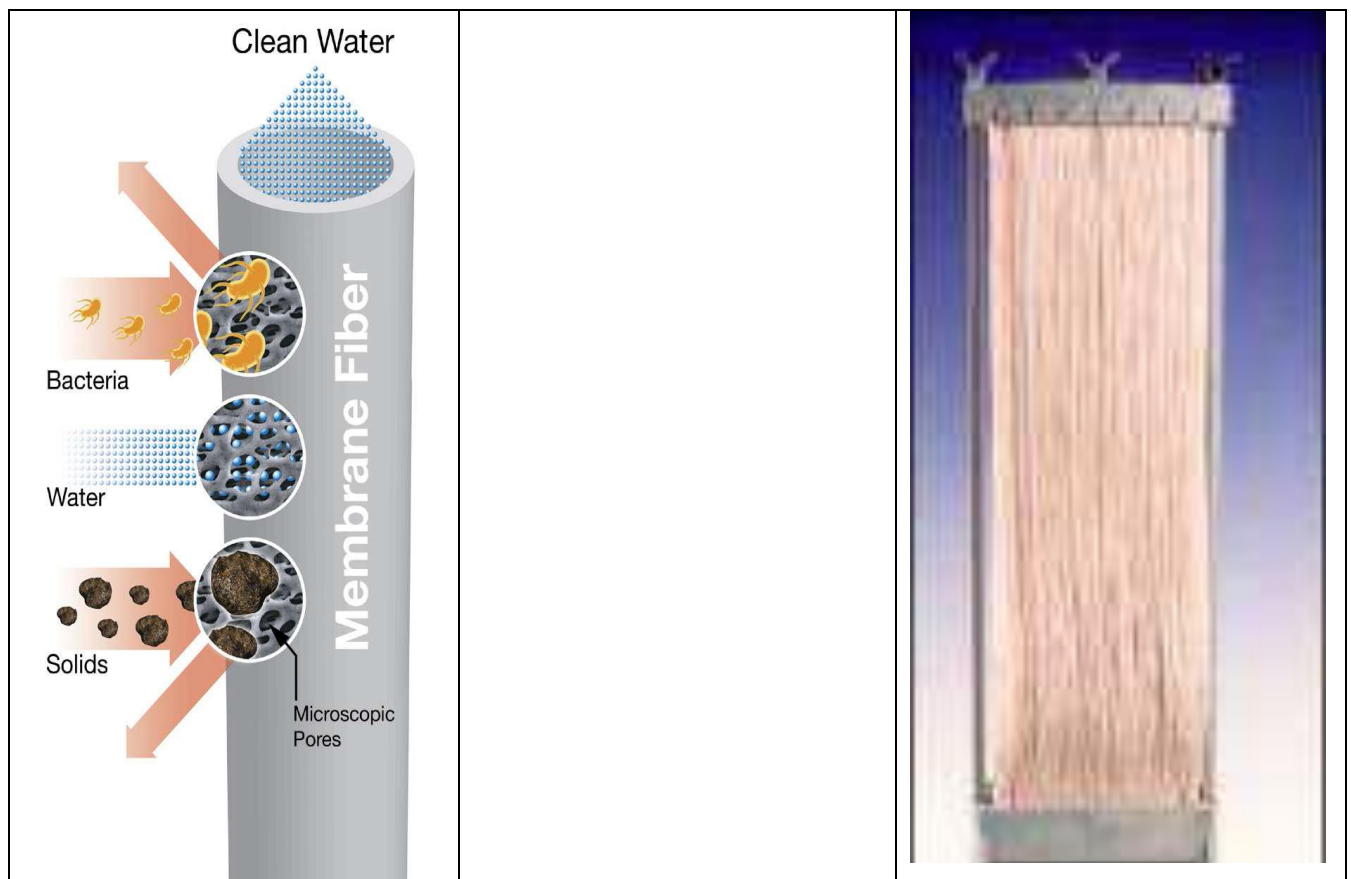


organic matter. This is supplied by passing air in form of small bubbles with the help of diffusers. The air is passed at the bottom of the tank, so that complete volume of tank is utilized. Oxygen dissolves in liquid, which can now be used by the bacteria. The bacterial population is present in suspension, which forms an integral part of the reactor system. The bacteria which are in suspension, by using the organic content in the raw sewage, and the dissolved oxygen available bring down the BOD- COD level in the sewage. Due to constant aeration, the bacteria are set in whirling motion, so that continuous mixing takes place. From the Bio reactor the treated sewage mixed with MLSS is flow under gravity to Membrane tank.

### Membrane:-

#### ZeeWeed® Overview

The ZeeWeed® membrane filtration system replaces the solids separation function of secondary clarifiers and tertiary sand filters in a conventional activated sludge system. The ZeeWeed® 500 series membrane is a reinforced hollow fiber ultrafiltration membrane with a nominal pore size of 0.04  $\mu\text{m}$  (Figure 1). The membrane fiber has a tensile strength close to 100 lbs and is highly resistant to chemicals, including acids, bases and chlorine, which are used for membrane cleaning. This membrane is designed specifically for high solids applications such as membrane bioreactors. The membrane is manufactured and assembled into discrete units called “modules”, (Figure 3). These are the basic building blocks of the membrane system that are manifolded together to create a “cassette”. The ZW500d cassette (Figure 4), which is proposed can contain up to 48 modules. Each module has 370  $\text{ft}^2$  of membrane area, for a maximum membrane area of 17,760  $\text{ft}^2$  per cassette. Cassettes may also be partially filled with a minimum of 24 ZeeWeed® modules. The 500d cassette is Seller’s latest generation of proven ZeeWeed® 500 membrane configuration.



**Off, Permeation and Stand-by Modes off Mode**

In OFF mode, devices are off. However, for membrane protection, the first two steps in OFF mode are to ensure the membranes are submerged. This is done by opening the feed valves. When the water level is above the membranes the feed valves are closed. The last step in OFF mode has all equipment associated with the train in positions programmed in the PLC; these devices cannot be manually or automatically controlled.

**Filtration/Production/Permeation Mode**

Filtration, or permeation, consists of drawing clean water from the mixed liquor through the membrane fibers via the permeate pump. Water is produced from each train during the filtration period for a duration of 11 minutes, followed by a 30 second relaxation/ backpulse. The filtration duration cycle is based on GE's extensive experience with the numerous GE's MBRs in operation throughout the world. There is permeate/process pump per train with 50% standby pump for filtration purposes. The vacuum generated by the permeate pump draws permeate from the outside-in through the membranes and discharges it to the Permeate Storage Tank. The variable speed pumps are controlled by GE's supplied PLC to maintain the permeate-flow demand. The PLC continuously runs a PID loop for Trans Membrane Pressure (TMP) while in production. The PLC uses the lower of the control outputs from the flow loop and TMP loop. All the permeate pumps are controlled at the same flow set points and are complete with premium efficiency VFD rated motors and discharge flow meter. Maximum pump capacity for permeation is achieved at the highest design level in the process tanks. All pump speeds will gradually decrease as the liquid level in the process tanks decreases. If during low flow conditions this level drops below the design minimum, and the pumps cannot be slowed down any further, one or more trains will automatically go into standby mode. During or below average day flow conditions, all Two (2) trains will be in operation provided any trains are not required to go into stand-by mode. All permeate pumps and Mixed Liquor RAS pumps will be operating. All permeate pumps will discharge into a common permeate collection header. The Permeate Storage Tank and the Backpulse Tank are both fed from the common permeate header. Cleaning and Maintenance Procedures As the feed is drawn through the membranes during filtration, solids are removed which accumulate on the membrane surface. As the solids accumulate, they restrict the flow through the membranes and eventually membrane cleaning is required in order to maintain the filtered water flow rate. Membrane cleaning is absolutely critical to ensure sustainable operation over the life of the plant regardless of membrane type. GE's MBR system is designed with the most comprehensive cleaning toolbox, which represents the culmination of years of experience in long-term MBR operation for uncompromised performance over the life of the membranes. Features include the following:

- **Membrane Air Scouring:** used as a mechanical cleaning action, Seller has developed and patented the most energy efficient membrane air scouring method in the industry.
- **Relax mode**
- **Back pulse Ability:** The ability to ensure an even distribution of chemicals across the fibers through back pulsing under pressure. This reduces the potential for preferential flow of cleaning chemicals.
- **Cleaning:** The ability to clean not only the inside of the membrane surface with maintenance cleaning, but also the outside of the surface with recovery cleaning. Ability to clean quickly and easily through fully automated processes such as relaxation, back pulsing, maintenance and recovery cleaning; and GE's multilevel approach to maintaining membrane performance is summarized in the following sections.

➤ **Membrane Scouring by Aeration**

Whenever a membrane train is in production, membrane scour aeration is required to maintain consistent permeability of the membrane. Specially designed highly efficient coarse bubble aeration is used to scour the outside surface of the membrane and move mixed liquor solids away from the membrane fibers. This is accomplished by a Seller's patented cyclic aeration system that uses a factory installed coarse bubble aeration grid which is integrated into the base of each ZeeWeed® 500d cassette.

The membrane cassette is aerated to provide a mechanical cleaning action. This air scour removes foulants that may deposit on the outside of the fiber, maintaining membrane permeability. The aeration also minimizes the effect of concentration polarization which is recognized as a significant membrane fouling mechanism. The system has been designed to supply Air to each air header of a membrane train at 10 seconds ON and 10 seconds OFF (10:10) aeration mode. Based on GE's experience in various MBR systems, a 10-30 aeration mode will be operated during normal operation of the plant resulting in overall decreased aeration energy consumption. The process is PLC-automated and provide among the lowest MBR energy consumption in the industry without sacrificing any performance.

**Relaxation**

Relaxation mode combined with air scouring is the routine cleaning mode during normal production. The combined stoppage of permeation and air scouring effectively removes solids that have accumulated on the membrane surface or within the fibers and reduces electrical costs. While operating in relaxation mode, permeation for each train is stopped sequentially for a short period of time (30-60 sec) every 10-12 minutes to allow air scouring of the membranes without permeation. No chemical or permeate is used during relaxation mode. This is the normal operating mode of ZeeWeed® MBR systems. The relaxation function is fully automated by the PLC with no operator intervention.

**Back pulse or Backwash**

Backpulsing is a cleaning tool which allows for reliable system performance during unexpected influent or process operating scenarios. Backpulsing involves reversing the flow through the membranes to dislodge any particles that may have adhered to the membrane surface. As with relaxation, the backpulse functionality is fully automated by the PLC with no need for operator intervention. The backpulse system has also been incorporated into the automated membrane cleaning systems included in the proposed design. Backpulsing is particularly critical for efficient membrane cleanings. Without backpulse, deep chemical cleaning of membrane pores is impossible for any type of membrane, and can run the risk of membranes becoming deeply and irreversibly fouled with organic matter. The backpulse tank is automatically filled with permeate which is used for the backpulse process. If required, hypochlorite may be added to the backpulse tank to maintain a concentration of < 5.0 mg/L to prevent bacterial growth.

**Maintenance Clean**

Over time, the membranes can experience fouling caused by accumulation of organic matter or crystallized salts within the membrane fiber pores. Cleaning of the membranes in this circumstance to restore the permeability requires use of a Clean-In-Place system. Clean-In-Place (CIP) membrane cleaning is a standard operational procedure for most membrane systems including the ZeeWeed® system. A maintenance clean is a regularly scheduled, fully automated cleaning that involves an extended backpulse combined with low concentration of chemical addition. Maintenance cleans are intended to maintain membrane permeability and extend the time between recovery cleans. The maintenance cleaning procedure is entirely automated and will be scheduled to occur during off-peak hours of the day. The ZeeWeed® membrane filtration system includes the capability to perform maintenance cleans using sodium hypochlorite (NaOCl) and citric acid to target organic and

inorganic foulants respectively. The maintenance cleaning procedure incorporates the following features:

- Fully automated;
- Performed without draining the membrane tank;
- Low chemical concentration.

A maintenance clean consists of a series of short backpulses with chemical solution, followed by a backpulse with only permeate to flush the headers and membranes.

**Table below provides anticipated cleaning frequency and chemical dosing concentration**

<i>Maintenance Cleaning</i>	<i>Sodium Hypochlorite</i>	<i>Citric Acid</i>
<b>Frequency</b>	2/Week	1/Week
<b>Chemical Concentration</b>	200 mg/ltr	2000 mg/ltr

### **Recovery Clean**

Recovery cleaning is required to restore the permeability of the membrane once the membrane becomes fouled. The recovery cleaning procedure consists of a chemical backpulse sequence, followed by a chemical soak period.

**Key features of the recovery cleaning procedure for ZeeWeed® MBR are:**

- Fully automated once initiated by the operator;
- Cleans all membrane cassettes in a train at the same time;
- Requires moderate chemical concentration
- Thoroughly cleans the surface of the membrane

**Table below provides anticipated recovery cleaning frequency and chemical dosing concentration.**

<i>Recovery Cleaning Sodium Hypochlorite Citric Acid</i>	<i>Recovery Cleaning Sodium Hypochlorite Citric Acid</i>	<i>Recovery Cleaning Sodium Hypochlorite Citric Acid</i>
<b>Frequency</b>	2/Annum	1/Annum
<b>Chemical Concentration</b>	1000 mg/ltr	2000 mg/ltr

### Advantages of the new Z-weed™ - Module:

- Absolute separation of bacteria and suspended solids
- Separation of adsorbed viruses
- Resistant to clogging e.g. with hairs and fibers or sludge
- High packing density due to self-supporting membrane sheets
- Efficient use of surface area by a hydro - dynamically optimized design
- Effective membrane cleaning with permeate

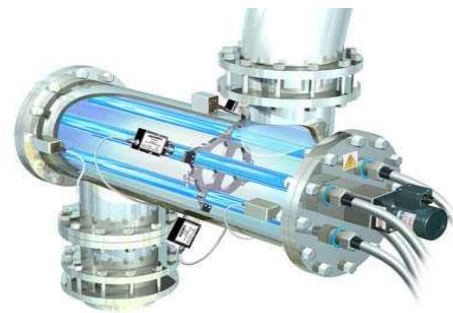
The characteristic of the MBR process is the use of revolutionary submerged membranes in the biological process water tank, so as to produce high quality permeate from domestic sewage, primary and secondary waste water, cooling tower blow down etc. The new Z-weed™ is also ideal for retrofitting/augmenting capacity/quality of existing wastewater plants. The MBR can handle very high sludge concentrations in the aeration tank because of which the size of the aeration tank reduces four to five folds. As the membrane acts as a fine filter, it does not require any further treatment using sand filters, activated carbon filters, etc. The new Z-WEED™ MBR is available in standard and customized modules.

Activated sludge in the aeration tank is clearly removed by the submerged membrane. The membrane module consists of housing, aeration diffuser, permeate water manifold and membrane elements. The membrane element consisting of flat sheet membranes sandwiching a support panel is set up vertically. Feed water including activated sludge is filtrated by hollow fibre membranes with pore size of 0.04 micron meter. The air bubbles supplied from the bottom of the membrane elements continuously scour off cake of activated sludge accumulated on the membrane surface. This is continuous filtration operation. The air bubbles are also used for the biological reaction to decompose organic substances included in the raw sewage.

The material of the membrane is PVDF which has high stability for chemicals and good physical strength. The form of membrane is fiber reinforced flat sheet membrane. The membrane has small and uniform pore size. Therefore, the rejection property of this membrane is excellent. Almost all particles with sizes more than 0.04 micron meter can be removed effectively using this membrane.

#### **Disinfection System:-**

After the filtration of treated sewage via ultra-filtration membrane, bacteria are filtered and remains in the process tank (Bio Reactor Tank). Thus the treated sewage (water) is free from Bacteria, but for an safety, it is again passed under Ultra Violet rays (System), so that treated water is totally free from Bacteria



#### **Sludge Handling System:**

The sludge from the Bioreactor is to be removed with the help of pump and transfer to Sludge holding tank, and then pumped to Batch type centrifuge for dewatering of sludge, the filtrate shall be taken back to equalization tank.



❖ **Note: - All pictures are only for pictorial presentation only and may not resemble the original tanks or equipments exactly.**

#### **PRE COMMISSIONING CHECKS**

Before a new plant is put under operation, it is necessary that all operation and maintenance personnel understand the function and location of each process unit, mechanical equipment and piping.

**Following checkups should be made before the commissioning of the Sewage treatment plant.**

Check all the internals of Bio Reactors i.e. Inlet /outlet nozzles, air grids, air grid supports etc.

- Direction of the flow is marked clearly on the pipes.
- All the mechanical equipment is tested and are in good working condition properly lubricated.
- All the civil tanks are tested for leakages.
- All the tanks and piping are clean and free of debris.
- All the process units and mechanical equipment should be tested with water for the normal operation of each unit and hydraulic system. Only after this, wastewater should be introduced to the system.
- All the lights, meters, indicators, etc. are operational.
- Check all lines for leaks. Any repairs needed are easier to make before wastewater is added.
- Operation and maintenance manual have been read by the operators and stored in one location for ready reference.



## **PLANT STARTUP MECHANICAL START-UP**

Before starting the plant trials on full load, it is essential that mechanical performance of the equipment have to be established to ensure their proper functioning when effluent is taken in. To achieve these following steps should be observed –

### **No load runs of motors**

This is carried out to ensure that the motors are running smoothly without any problems either in their bearings or in stator - rotor combination. To carry out this activity, disconnect the coupling pins/valves from the driven equipment. Then the motors are kick started and stopped to observe their direction of rotation. If the direction is not as required by the driven equipment, then reverse the phase connections. The motors are once again kick started to ensure the required direction of rotation. After ensuring the direction of rotation, no load run shall be carried out for 4 to 8 hours depending on their ratings. If the motors capacities are of smaller size then there is no need of going for no load test. During the no-load run, current drawn by motor, vibration, noise and bearing temperature shall be observed and noted. If all these readings are within limits, then motors are coupled with driven equipment for further step. Otherwise, possible causes for defects should be found out and rectified as given in Motor Manuals.

### **On Load Trial (With Clear Water)**

The effluent normally has density equal to density of water. It, thus, suffices to run these on clear water for sufficient time to prove the adequacy of mechanical equipment. This is done as follows: All tanks in which equipment is supposed to run on load are filled up with clear water. Lines are flushed with water. Then the respective equipment are run as mentioned below:

### **PUMPS**

Open suction valves in pump suction. Start the pump with delivery valve closed. Open the valve slowly observing the pressure gauge so as to set the delivery pressure to design limit. The pump will thus be running at designed duty point. Allow the pump to run. It will run for the duration, which will be determined by capacity of holding tank and pump for rate, unless fresh water is fed into holding tank. During this period observe motors temperature; pump bearing temperature, vibration, noise, etc. In case of any problems, study/follow the equipment manual enclosed.

### **BLOWERS**

Close the discharge valve.  
Open vent valve fully  
Start the Blower  
Open the discharge valve gradually  
Close the vent valve gradually.

### **COMMISSIONING / OPERATION**

The supplied plant has two different stages of treatment.

#### **• Primary Treatment**

The primary treatment basically involves physical treatment like screening and oil & grease removal.

#### **• Secondary Treatment**

The secondary treatment is a biological process where the major COD & BOD, nitrogen reduction takes place. The biological treatment provided in this plant is in the Aeration tank - Bio Reactor which is suspended growth process. After the biological treatment there is an MBR tank where Z-weed membranes are installed, the biologically treated water passes through these hollow fibre membrane cassettes to produce clear treated sewage which conforms to the design standards based on

the inlet effluent parameters UV system also provided which helps in disinfection. The treated sewage from the permeate tank is further transferred to the RO systems which are detailed in the subsequent chapters.

#### Culture Preparation

The culture preparation is a critical and long drawn process. This is the main activity of commissioning and has to be done very carefully. It takes around 10-15 days for the culture preparation and another 7 days for stabilization. The procedure has been explained below on day to day basis. Culture development & commissioning of Bio Reactor

##### a) Day-1-

Start the Feed pump at Equalization Tank & fill the sewage in the Bio reactors up to 25% volume of Bio reactor. Start the Air Blower & Supply the air to reactors through air grids supply of air should be kept on continuously.

##### b) Day-3

Fill each Bio reactor up to 50% of its volume. Keep the air on, if the sewage is lean, add nutrients in form of DAP, Jaggery.

##### c) Day-5

Fill the Bio reactor up to 75% of its volume. And follow the same procedure as for the 3rd day.

##### d) Day-7

Fill the Bio reactor up to 100% of its volume i.e. upto outlet level. And follow the same procedure as for day 5

##### e) Day 8, 9, 10

Keep the air continuously on, the culture will should get developed by 10th or 12th day. This can be checked with the level of MLSS with help of measuring cylinder.

##### f) Day –12,13

Start feeding the sewage to the Bio reactor at 25% of hourly flow rate.

##### g) Day-14,15

Increase the sewage feed rate to 50% of hourly flow rate.

##### h) Day-16,17

Increase the sewage feed rate to 75% of hourly flow rate.

##### i) Day-18,19

Increase the sewage feed rate to 100% of hourly flow rate & keep on running the plant at this rate. After completion of the above period and culture development activity the water will over flow into the downstream system, When the sewage is to be taken into the membrane tank, the MLSS level should be atleast 6000.

### **CENTRIFUGE MACHINE**

A centrifuge is most often used for the separation of particles from solutions according to their size; shape, density, viscosity of the medium and rotor speed. These machines utilize the natural separation realities present in a high-speed circular G-force environment. Like a high-powered clothes dryer, these exceedingly fast machines spin in order to separate materials from one another. The denser materials separate from the less dense during the centrifugation process. This is helpful for the cleaning and separating of slurries, which are present in many industries. The dairy industry uses centrifuges to separate milk from whey, and the food and beverage industry uses them for the washing of edible oils and the clarification of wine and juices. Centrifuges vary in size and power depending on the substances involved in the process. Some are able to run continuously, feeding in slurry to be separated and sending the divided substances through to outside chambers to be removed. Sometimes centrifuges are used as a step in a larger filtering process or system. Basket centrifuges work by a process in which the liquid/solid slurry is fed into the rotating basket with a filtering cloth on the slotted jacket. The liquid passes the cloth and solid is left on the basket walls. When the basket is full of material, the machine speed is decreased and the solid is scraped from the walls of the machine. The washing and cleaning of metal parts can also take place inside in what is considered an industrial centrifuge, as washers are put in a bath of

cleaning solvent and then run at gforce speeds, both cleaning and separating the excess and sludge from the metal. The dairy, wine, beverage, and edible oil and fat industries also use industrial centrifuges for the degumming and purification of their respective products. Power and wastewater plants use centrifuges for the separation and cleansing of fuels and lubricants. The industrial sectors of society, such as wastewater treatment plants, use centrifuges extensively for the clarification of wastewater. Power plants use them for the purification of fuel and lubricants as well as for the cleansing of metal parts, using the centrifuge like a washing machine of sorts. The primary use of centrifuges is done by the chemical, biotechnical and pharmaceutical sectors of society. They use small laboratory centrifuges for the analyzing of proteins and drugs, and they use larger centrifuges for the purification of solvents and the concentration of other biomasses. Many of the manufacturers of centrifuges specialize in one type, e.g. laboratory or industrial, yet others do design a wider range of types. Custom work with the manufacturer is possible in order to achieve best results. The manufacturer will work with the customer to build a proper centrifuge for his or her needs, based on the materials, the volume and feed rates necessary and any cost limits. Many shops also deal in the distribution and maintenance of used centrifuge units. These may be a more cost effective way of purchasing a new or replacing an old centrifuge beyond repair capabilities.

### **INSTALLATION PROCEDURE**

A lot of care has to be taken while installing any m/c in the industry.

- Centrifuge being rotating assembly which is to be given at most care at the time of installation to avoid regular brake down and to facilitate the user with norms advantages.
- Ensure safe unloading from the vehicle with means of crane or a chain block.
- Check proper positioning of centrifuge by fixing it to the required place
- The outlet should be at gutter end.
- Motor is to be placed near the wall side.
- The lid, the brake should have more working place.
- Check the height of the feed pipe from the reactor or vessel, for the free gravitational flow should be possible.
- Machine should be placed on proper foundation with matching 3nos of foundation holes provided at 3.
- Check the level of machine at all three corners on base channel with the help of water tube or spirit level.
- Place the FLP operating panel closer to the centrifuge as per the demand of user.
- Nail the local panel contain the drive in the MCC ROOM.
- Check the working of basket it should be clockwise when seen from top.
- Cable both the panel as per the cable lay out as shown in the below.
- Check the limit switch properly connected and working.
- Always run the m/c on jacks ensuring the trolley wheels do not touch the floor.
- Ensure that the safety control provided are properly connected as per the
- Runs the machine empty & check for unwanted noise.
- Take a water trial for finding any leakage.

### **Centrifuge machine Operation**

1. No fixed piping is allowed on the Centrifuge machine. Use flexible hosepipes.
2. The direction of rotation of the basket should always be clockwise when seen from top.
3. It is indicated on the machine nameplate also.
4. The basket nut opens clockwise (Reverse threaded). This basket nut also acts as a grease cup. Always keep it full of grease.
5. The bearing of the main shaft of the centrifuge machine are:  
TOP : 30307 x 1 no SKF  
BOTTOM : 6306 x 1 no SKF

**OIL SEALS USED ARE:**

TOP : 80 x 60 x 7

BOTTOM : 55 x 25 x 7

**6. TO DISMANTLE THE BEARING HOUSING:**

- a) Remove the lid and the top cover.
- b) Unscrew the basket nut and the basket check nut.
- c) Lift the basket up the shaft with the help of basket puller supplied as spare with four bolts passing through the holes of the puller and fixing it to the tap holes provided on the central cone of the basket.
- d) Unbolt all the bolts on the central flange on the bearing housing by loosening the nut from below the machine. & Remove the bearing housing cap.
- e) Lift the housing up the machine and take it out.
- f) Unscrew the top and the bottom covers of the housing.
- g) Support the housing upside down on central flange.
- h) Press the shaft out of the housing.
- i) The shaft shall come out with the top bearing.
- j) Remove the bottom bearing from housing by pressing from top downwards.
- k) Entire bearing housing is free for inspection.... **IMPORTANT**...there is a check nut below the bottom bearing. Always remove it before the shaft is to be pulled out.

**7. TO ASSEMBLE THE BEARING HOUSING:**

- a) Fix the top and the bottom bearings in its position of the housing.
- b) Screw down the bottom housing cover in its position.
- c) Insert the shaft into the bearing housing from top of the housing to the bottom bearing.
- d) See that the top collar of the shaft is touching the top bearing at the top and it is tightly seating on its ring.
- e) Unscrew the bottom housing cover. Tighten the check nut below the bottom bearing.
- f) Screw down the top and the bottom housing covers.
- g) Always see that the bearings are full of grease. Grease the bearing housing once a month.

1. It is always good to feed the slurry into the centrifuge while it is running.

The motor starts with very high starting current if the basket is loaded first and then switched on. Use low speed to do imbalance work Feeding should be at basket speed of around 500-RPM.

2. Never allow the liquid to accumulate in the body. It may enter bearing and damage it.

10. Never allow the machine to vibrate abnormally.

11. If the machine gives unwanted sound when switched on or if vibration is there when started empty always check the basket nut and the bearing. Either of them might have been loosened.

12. If the machine vibrates with the load then set the cake evenly By hand.

13. Apply the brake preferably at lower speed. Special braking chopper and braking resistor is provided to get braking with a push button. Use hand brake only in case of power failure.

14. Try to avoid the breaking at the full speed.

15. Check the temperature of the shaft, the top and the bottom part of the housing and the motor, while it is put to use. Do not allow it to be excessively heated. while the machine is running.

17 Always see that the motor pulley belt is tight.

18. The motor plate is bolted on four no's bolts on the body. This motor plate can be moved near or away from the body to check the belt tension.

19. See that there is no big hole in the filter cloth bag, otherwise solid passes through it. It causes lot of vibration also.

20. Use flame proof control panel placed on the machine. set the proper speed of the basket as per requirement with the help of rotary potentiometer control knob in the flp panel.

21. Set the flp control panel in m.c .c room. the vfd has the control plate, which can give necessary speeds current, voltage readings and the cycle variations as per requirement. This panel has a resistance, which gets hot while braking.

22. Mount the vfd panel in either a.c environment or good ventilated area to safe guard the vfd against heating.

23. Always start the machine with zero speed and increase the speed slowly.
24. The machine is mounted on a trolley wheels (4 nos). take the machine Support on trolley wheels with the help of screw jacks. Take off the wheel supports before switching on the machine.
25. The machine is halar lined on all contact area. Never rub sharp objects on halar surface, it may damage it, and the failure of halar surface even in pin hole size may fail the surface

### UV SAFETY INSTRUCTIONS

WARNING- to guard against injury, basic safety precautions should be observed, including the following:

1. Read and follow all safety instructions.
2. Danger- To avoid possible electric shock, special care should be taken since water is present near electrical equipment. Unless a situation is encountered that is explicitly addressed by the provided maintenance and troubleshooting sections, do not attempt repairs yourself. Instead, please contact our technical support division.
3. Carefully examine the water sterilizer after installation. It should not be plugged in if there is water on parts not intended to be wet.
4. Do not operate the water sterilizer if it has a damaged cord or plug, if it is malfunctioning or if it is dropped or damaged in any manner.
5. Always disconnect water flow and electrically unplug the UV system before performing cleaning or maintenance activities.
6. Do not use this UV disinfection system for any other purpose other than disinfection of water. The use of attachments not approved, recommended or sold by the manufacturer / dealer may cause an unsafe condition.
7. Intended for indoor use only. Do not install this UV disinfection system where it will be exposed to the weather or to temperatures below freezing. Do not store this system where it will be exposed to the weather. Do not store this system where it will be exposed to temperatures below freezing unless all water has been drained from it and the water supply has been disconnected.
8. If an extension cord is necessary, a cord with a proper rating should be used. A cord rated for less Amperes or Watts than the UV system rating may overheat. Care should be taken to arrange the cord so that it will not be tripped over or pulled. Congratulations on choosing the EcoStream range of ultraviolet systems from Alfa UV. Each unit is designed to provide safe, reliable disinfection performance year after year with minimal maintenance.

### OVERVIEW

Each UV system is designed to treat water at specified flow rates as outlined in the specification sheet. All EcoStream units are provided with two main component parts, specifically the ultraviolet reactor chamber and the main controller.

#### Reactor Chamber

The reactor chamber is manufactured from stainless steel 316L and houses the ultraviolet lamp and quartz sleeve. All EcoStream UV systems use only a single UV lamp. The lamps used in the Alfa EcoStream Models ECS60R - ECS150R are of a special high intensity, high output germicidal type. The chamber is designed to mount both horizontally or vertically and should be secured to a suitable support.

#### Control Panel

The main controller is made of aluminum. The controller is connected to the chamber via 2 meters of cable to allow for application flexibility. The panel can be mounted either horizontally or vertically on the wall.

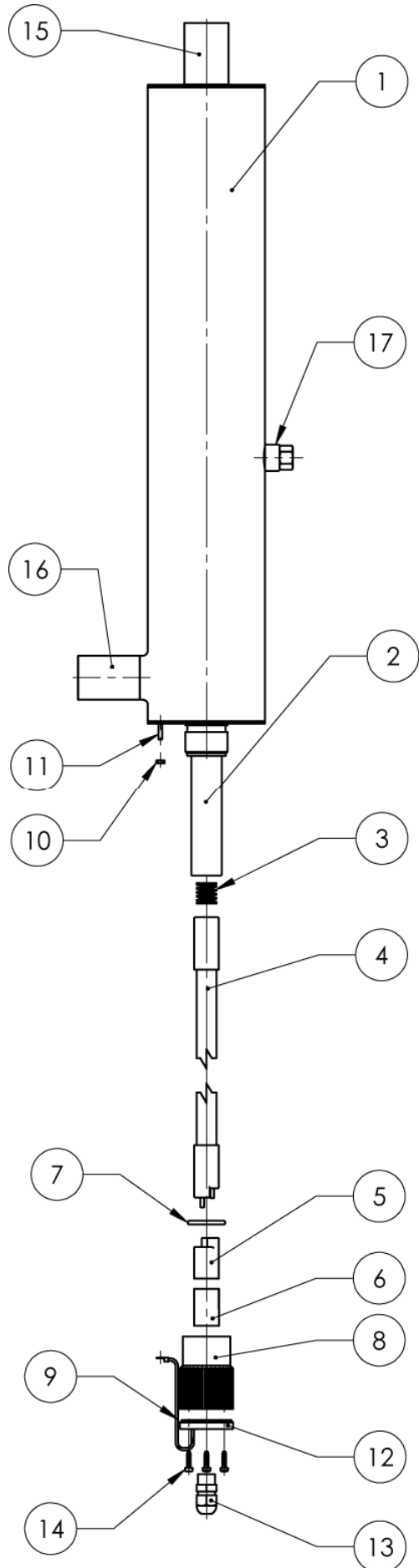
#### Standard Electronics

1. All EcoStream control boxes are equipped with a soft start on/off switch. When the main power to the system is turned on, the lamp will turn on directly. However, if required, the lamp can be turned

off (and subsequently on) by using holding down the "power" button on the EcoStream Control box for 2 seconds.

2. A separate user accessible fuse is also provided as protection for the electronics.
3. A seven segment LED display monitors the remaining number of useful hours of the UV lamp (Time Elapse Meter) and the days the UV system has been in operation.
4. An audio-visual "Lamp Life Over" and "Lamp Failure" indicator

**REACTOR CHAMBER COMPONENTS DIAGRAM**



Sr. No.	Description	Qty.
1	UV Reactor	1
2	Quartz Sleeve	1
3	Lamp Centering Spring	1
4	UV Lamp	1
5	Lamp Connector	1
6	Lamp Locator	1
7	Quartz Sealing O-ring	1
8	Quartz Compression Nut	1
9	Earthing Wire	1
10	Earthing Nut	1
11	Earthing Stud	1
12	Sealing Nut End Cover	1
13	Cable Gland	1
14	End Cover Screws	3
15	Reactor Inlet	1
16	Reactor Outlet	1
17	Drain / UVM Port	1

## PRODUCT APPLICATION

Ultraviolet disinfection provides a simple, inexpensive way of destroying bacteria, mold, virus, algae and fungi without the use of heat or chemicals. Each EcoStream system is designed to achieve a specific energy dose to properly destroy microorganisms. The dosage which applies to ultraviolet disinfection is proportional to energy, time, and area. The total UV energy is attributed to the amount of energy emitted from all sides of a UV lamp and is expressed in micro watts. The exposure is expressed in seconds and represents the total time it takes for the water to flow through the UV chamber. The final factor in determining the dosage relates to the total area and is expressed in centimeter squared. To summarize, the total dosage is expressed in QW-sec/cm<sup>2</sup> or micro watt second per centimeter squared. UV Disinfection is affected by many factors and the following should be looked at prior to the installation of the UV system:

1. UV Transmission (transmittance) deals with the effectiveness in which the 254 nanometer wavelength of ultraviolet light is transmitted through the water. The higher the transparency of the water, the more effective the UV system becomes. This optical clarity is evaluated by performing a test which passes incident light through a 1 cm depth of water and recording this against the same test using distilled water as a reference. This is done using a spectrophotometer. The basic designs of the units have taken into account a typical transmission at the desired wavelength. In practical terms this means that a system designed to disinfect a flow of about 3 m<sup>3</sup>/hr (e.g. ECS60R) at a typical transmissibility (98%), could actually have a lower flow rate in liquids with a lower transmissibility. As a general guideline, the following are some typical UV transmission rates:

Deionized or reverse osmosis water: 90 - 98%

Typical filtered fresh water: 90 - 94%

Lakes, wells, or other private sources: 70 - 90% Other liquids (constituent dependant) : 0 - 95%

### \*\*\* WARNING -- DO NOT UNDERSIZE UNITS \*\*\*

1. If exact transmission quality needs to be determined, have samples tested at a suitable lab using a proper spectrophotometer. Alternatively, you may contact Alfa UV for a sample analysis.
2. Suspended Solids will act against a UV system by effectively shielding microorganisms from the ultraviolet light. Dirt, rust, turbidity, etc. all have the ability to block out the UV light. It is absolutely necessary to properly control the level of suspended solids by properly pre- filtering the liquid prior to disinfection (pre-filtration down to 5 micron is considered the minimum).
3. Total Dissolved Solids of around 500 ppm can drastically reduce the rated flow rate of the unit by absorbing UV energy. Proper pretreatment of high TDS levels must be taken into account.

## INSTALLATION

Please cross reference the numbers in brackets [] with the reactor component diagram provided.

1. Pick a suitable location for the reactor [1] and the control panel. Make sure that there is a minimum allowance of 1.2 meters (4 feet) of clear space at the connection end of the chamber to facilitate lamp replacement and servicing.
2. In an effort to adequately protect the electrical components inside the reactor, the unit must be connected to an electrical outlet which is protected by an earthing line as well as a surge suppressor.
3. Once the reactor is securely mounted, plumb the inlet [15] and outlet [16] ports to the supply and delivery lines with the appropriate connections. Make sure Teflon tape or an equivalent is used on the threads to ensure an adequate seal. When making connections, be sure not to drop anything into the reactor chamber that may damage the quartz sleeves/lamps or contaminate the reactor chamber.
4. After all connections are made, SLOWLY turn on the inlet valve and SLOWLY fill the reactor chamber with water. Once the chamber is full, check for leaks from the fittings. If a leak is evident, drain system and reconnect the fittings.
5. Secure the control panel to the appropriate wall making sure the panel is mounted within 2 meters (6 feet) of the connection end of the reactor chamber. Install the UV lamps as described in the lamp installation/replacement section and make all the necessary lamp connections. Do not forget to



connect the earthing wire [9] to the earthing stud [11] on the UV reactor using the provided earthing nut [10].

6. Next, plug the reactor into the appropriate outlet (230V) and check to see if all the UV lamps are illuminated. Do not look directly at the burning UV lamp without the use of protective eyewear. Once it is determined that the UV lamps are illuminated and that the lamp LEDs are illuminated, disconnect panel from power source until all plumbing connections are final.

7. The system should now be thoroughly flushed to clean out any particulate matter that may have entered the reactor chamber during installation as well as flushing out any air that may have accumulated during the "filling" of the reactor.

**WARNING: SUDDEN OPENING OF THE INLET FLOW MAY SERIOUSLY DAMAGE**

## UV LAMPS OR QUARTZ SLEEVES

### MAINTENANCE

The basic unit is designed to operate with minimal maintenance requirements providing the minimum water characteristics are met as are outlined in the section "Application Guidelines". However there are two regular maintenance requirements common to all UV systems: cleaning and lamp replacement.

#### Cleaning

Minerals in the water will eventually coat the quartz sleeve (which protects the lamp), as well as the sensor (if the system is equipped with one). This coating reaching the water, thereby reducing disinfection performance. Once a month, check the sleeve and clean it if you can see a mineral coating starting to form. If sleeve requires cleaning, refer to Lamp Replacement instructions but re-install the original lamp. If system is equipped with a sensor, be sure to also clean the sensor each time the sleeve is cleaned.

#### Quartz Sleeve Replacement/Cleaning

Please cross reference the numbers in brackets [] with the reactor component diagram provided.

1. If the lamp is in the system, remove the lamp and carefully set it aside as described in the lamp installation/replacement section.
2. Shut off the upstream water supply that feeds water into the reactor chamber. Depressurize and drain the system by disconnecting the inlet/outlet from the reactor chamber.
3. Unscrew and remove the QG sealing nut [8] from the top of the reactor. Make sure to remove the QG sealing O-ring [7] and keep it carefully.
4. Carefully slide the sleeve out of chamber. In case it is initially tight, gently try rotating the QG while also pulling it out. Also make sure that the sleeve is not at an angle as otherwise pressure will be applied on the sides of the sleeve and against the reactor chamber causing the sleeve to fracture.
5. Clean the quartz sleeve, or replace them with a new one. To clean the sleeve, use a mild acid solution such as 10% Citric Acid or household cleaners such as vinegar.
6. Reinstall the quartz sleeve in reverse order. Carefully slide the quartz sleeve into the reactor through the QG socket until it is locked into place in the internal QG holder. Ensure that the sleeve is inserted straight and not at an angle as doing so will put pressure on the wall of the sleeve and can cause it to crack. Install the quartz sealing o-ring [7] onto the sleeve until it rests against the QG socket.
7. Reinstall the QG socket compression nuts [8] by turning clockwise. This nut should be hand tightened only.
8. Slowly turn on the water and pressurize the reactor to verify that there are no leaks.
9. Reinstall the lamp as described in the lamp installation/replacement section and reconnect all the electrical connections to ensure that the system is operating properly.

#### Lamp Replacement

The UV lamp intensity decreases over time. The UV lamps used in the Alfaa EcoStream Models ECS60R - ECS150R are rated for approximately 9,000 hours of continuous use (approximately one year). Replace the lamp after this time frame. The built in "Lamp Life Remaining" counter and "Replace Lamp" reminder aids in this task by continually monitoring the running time of the unit.

#### Lamp Installation/Replacement

Please cross reference the numbers in brackets [] with the reactor component diagram provided.

1. To replace the lamp, there is NO need to disconnect the system from the water supply, or to drain the water from the reactor chamber. Lamp replacement is easy requiring no special tools. The UV lamp must be replaced after 9,000 hours of continuous operation in order to ensure adequate disinfection.

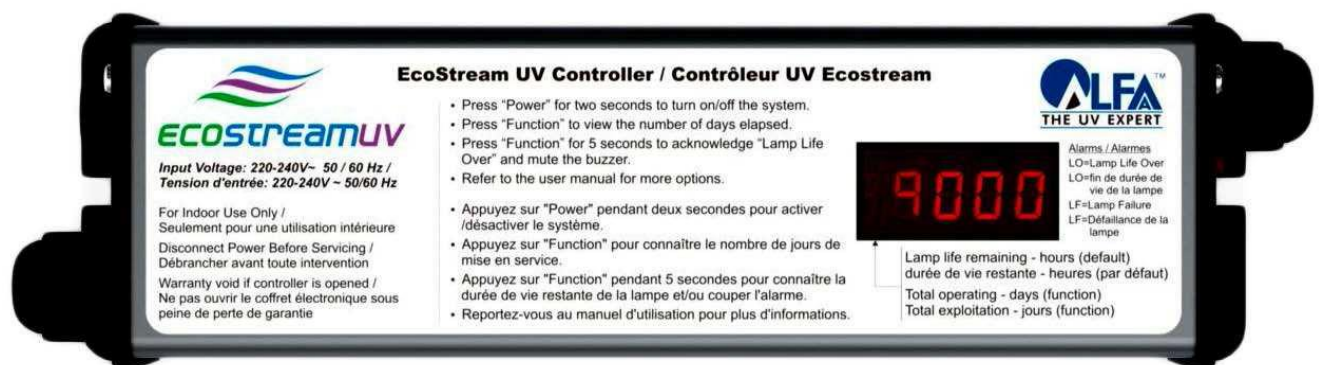
2. Disconnect the main power source and allow the unit to power down. From the side where the lamp connections are made, disconnect the earthing wire [9] from the earthing stud [11] on the reactor and then unscrew the QG socket end cover screws [14].
3. Now gently pull out the lamp harness and extract the lamp connector [5] and UV lamp [4] from the UV reactor [1]. Once you can visually see the lamp, separate the lamp from the connector by pulling them apart. Do not try twisting the connector as it will break. While it is OK to touch the ceramic ends of the lamp, avoid touching the UV lamp "glass" with your fingers. Wipe off any oils with alcohol and a soft cloth. Warning: Depending on when the system was powered down the UV lamp might still be very hot. In this case please take care by using gloves or other protective gear.
4. Carefully remove the lamp from the reactor chamber taking special care not to angle the lamp as it is removed. If the lamp is removed at an angle, pressure will be applied on the inside of the quartz sleeve, causing the sleeve to fracture and break.
5. If the QG is going to be removed then also remove the lamp centering spring[3].
6. To install a new lamp, first remove the lamp from its protective packaging again being careful not to touch the lamp "glass" itself. Before inserting the lamp into the reactor vessel (actually inside the quartz sleeve) make sure that the lamp centering spring [3] is inserted into the quartz sleeve in the reactor. Now, insert the lamp fully into the chamber (with the pins on the connection side) leaving about two inches of the lamp protruding from the chamber.
7. Secure the lamp connector [5] on the UV lamp [4] ensuring that the connector is fully seated onto the pins. Finally, screw the socket cover [12] back onto the QG socket compression nut using the provided screws [14].
8. Connect the earthing wire [9] to the earthing stud [11] on the UV reactor using the provided earthing nut [10]. The system may now be powered up and tested.

## USING THE ECOSTREAM CONTROLLER

The EcoStream controller incorporates a high performance electronic lamp controller along with a 5 digit seven segment LED display to update the user with the status of the UV system.

The controller also includes two soft-switches as follows:

1. Power
2. Function



## Basic Operation

All EcoStream control boxes are equipped with a soft start on/off switch. When the main power to the system is turned on, the lamp will turn on directly. However, if required, the lamp can be turned off (and subsequently on) by using holding down the Power button on the EcoStream Control box for 2 seconds. In this case the display will show "iPOOO" on the screen indicating that the power to the lamp has been turned off.

## Display Messages

1. (Default) When the system is in operation the standard display shows the "Lamp Life Remaining" in hours.
2. To see the total number of days the UV system has been in operation (across lamp changes), then press the Function key once. The display will switch to this information. Wait for 10 seconds for the display to default back to the main screen again.

3. In case of a situation where the lamp life is over, the screen will show the message "LO" and the buzzer will also beep intermittently. To mute the audio alarm temporarily, press the Function button for 5 seconds.
4. Once a new lamp has been installed, to reset the Lamp Life Counter, keep the Power and Function buttons pressed at the same time for 10 seconds. This will reset the Lamp Life Counter back to 9000 hours and remove the alarm message.
5. In case of lamp failure, the display will show the message "LF". The buzzer will also sound continuously. In this case turn the system off immediately and check the lamp condition. Replace the lamp with a new one if required by following the instructions in the Lamp Replacement section.



## ALFAAA UV : ECS SERIES SPECIFICATIONS

Model No		ECS02L	ECS05L	ECS08L	ECS12L	ECS30L
Flow Rate @ 95% UVT EOL	US Public Health - 16 mJ/cm <sup>2</sup>	0.2 m <sup>3</sup> /hr	0.5 m <sup>3</sup> /hr	0.75 m <sup>3</sup> /hr	1.4 m <sup>3</sup> /hr	2.5 m <sup>3</sup> /hr
	<b>AUV Standard - 30 mJ/cm<sup>2</sup></b>	0.12 m <sup>3</sup> /hr	0.3 m <sup>3</sup> /hr	0.5 m <sup>3</sup> /hr	0.75 m <sup>3</sup> /hr	1.7 m <sup>3</sup> /hr
	NSF / EPA - 40 mJ/cm <sup>2</sup>	0.1 m <sup>3</sup> /hr	0.2 m <sup>3</sup> /hr	0.5 m <sup>3</sup> /hr	0.5 m <sup>3</sup> /hr	1.2 m <sup>3</sup> /hr
Dimensions	Reactor (LxH)	375x85 mm	375x90 mm	493x90 mm	493x101 mm	720x105 mm
	Control Panel	213 x 168 x 60 mm	213 x 168 x 60 mm	213 x 168 x 60 mm	213 x 168 x 60 mm	213 x 168 x 60 mm
Electrical	Inlet / Outlet Size	1/4" BSP (F)	1/2" BSP (M)	1/2" BSP (M)	3/4" BSP (M)	3/4" BSP (M)
	Voltage	230V / 50-60Hz	230V / 50-60Hz	230V / 50-60Hz	230V / 50-60Hz	230V / 50-60Hz
Maximum Operating Pressure	Power Consumption	13 W	22 W	27 W	27 W	40 W
	Total Running Time Counter	75 psi	75 psi	75 psi	75 psi	75 psi
UV Intensity Monitor	Optional	Optional	Optional	Optional	Optional	Optional
Chamber Material	n/a	n/a	n/a	n/a	n/a	n/a
	SS304	SS304	SS304	SS304	SS304	SS304



### Technical Specifications Sheet

Model	ECS60R	ECS100R	ECS150R	ECS250R	ECS310R
US Public Health - 16 mJ/cm <sup>2</sup>	6	11	15	25	25
<b>AUV Standard - 30 mJ/cm<sup>2</sup></b>	<b>3.4</b>	<b>6.2</b>	<b>8.9</b>	<b>15</b>	<b>18.5</b>
NSF / EPA - 40 mJ/cm <sup>2</sup>	2.6	4.7	6.7	11	13.5
Reactor (LxH)	582x155 mm	834x155 mm	1033x155 mm	1150x175 mm	1150x175 mm
Control Panel	250 x 75 x 60 mm	250 x 75 x 60 mm	250 x 75 x 60 mm	300 x 150 x 120 mm	300 x 150 x 120 mm
Inlet / Outlet Size	1" BSP	1" BSP	1.5" BSP	2" BSP	2" BSP
Electrical	Voltage	220-240V / 50-60Hz	220-240V / 50-60Hz	220-240V / 50-60Hz	220-240V / 50-60Hz
	Power Consumption	55	74	110	195
	Lamp Power	48	70	95	172
Maximum Operating Pressure	100 psi	100 psi	100 psi	100 psi	100 psi
Ambient Water Temperature	4-40°C	4-40°C	4-40°C	4-40°C	4-40°C
Total Running Time Counter	Yes	Yes	Yes	Yes	Yes
Lamp Life Remaining Counter	Yes	Yes	Yes	Yes	Yes
Lamp Replacement Reminder	Yes	Yes	Yes	Yes	Yes
UV Intensity Monitor	Optional	Optional	Optional	Optional	Optional
Chamber Material	SS316L	SS316L	SS316L	SS316L	SS316L
Control Box Material	Aluminum M.S. Powder Coated				



## Immersed Hollow Fibre Filtration Cassette ZeeWeed® 500d-48

### Cassette Specifications

Permeate connection size	4" pipe vertical branch or 8" pipe horizontal
Typical cassette shipping weight	1201 kg (2648 lb)
Typical cassette shipping weight including crate	1561 kg (3442 lb)
Typical wet cassette weight †	1450 kg (3197 lb)
Displaced volume during MIT	290 L (77 gal)
Standard cassette configuration is 48 modules. Number of modules may be reduced in increments of 4. Frame size remains unchanged.	

† Wet cassette weight does not include any accumulation of solids during operation.

### Aeration Specifications

Maximum air temperature: 65°C (150°F)

The aeration manifold consists of two parallel channels which can be operated alternately with 2 x 3" pipe connection for intra-cassette cycling or simultaneously with 1 x 4" pipe connection for whole cassette cycling.

	Sequential (within cassette)	Cyclic (whole cassette)
Air connection size	2 x 3" pipe	1 x 4" socket
Maximum instantaneous air flow*	425 dm <sup>3</sup> /hr (250 dcfm)	850 dm <sup>3</sup> /hr (500 dcfm)
Minimum instantaneous air flow*	270 dm <sup>3</sup> /hr (160 dcfm)	540 dm <sup>3</sup> /hr (320 dcfm)
Aerator pressure loss @ maximum air flow (excluding hydraulic head)	0.05 bar 0.8 psig	0.05 bar 0.8 psig

\*Air flow depends on application consult design manual for specific requirement  
dcfm = cubic feet per minute at point of discharge (aerator submergence)  
dm<sup>3</sup>/hr = cubic meters per hour at point of discharge.

### Operating Specifications

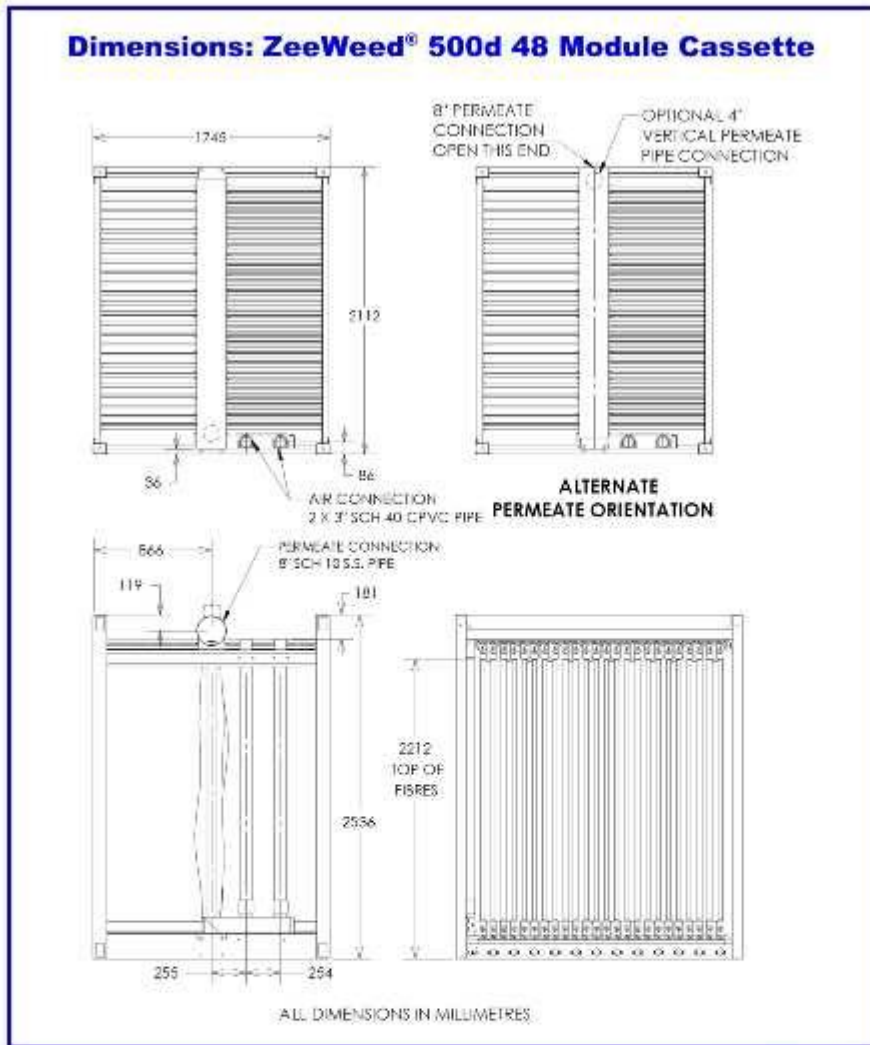
Maximum permeation transmembrane pressure	83 kPa (12 psig)
Typical operating transmembrane pressure	7-70 kPa (1 to 10 psig)
Maximum backpulse transmembrane pressure	69 kPa (10 psig)
Maximum operating temperature	40°C (104°F)



Water for the World

Tech.ZW500d48M.V2.4.0





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ZENON is a global leader in the development and manufacturing of membrane technologies and systems for water treatment, wastewater treatment and water reuse. With thousands of installations worldwide, ZENON is providing cost-effective and reliable solutions to challenges faced by municipalities, industry and government agencies.

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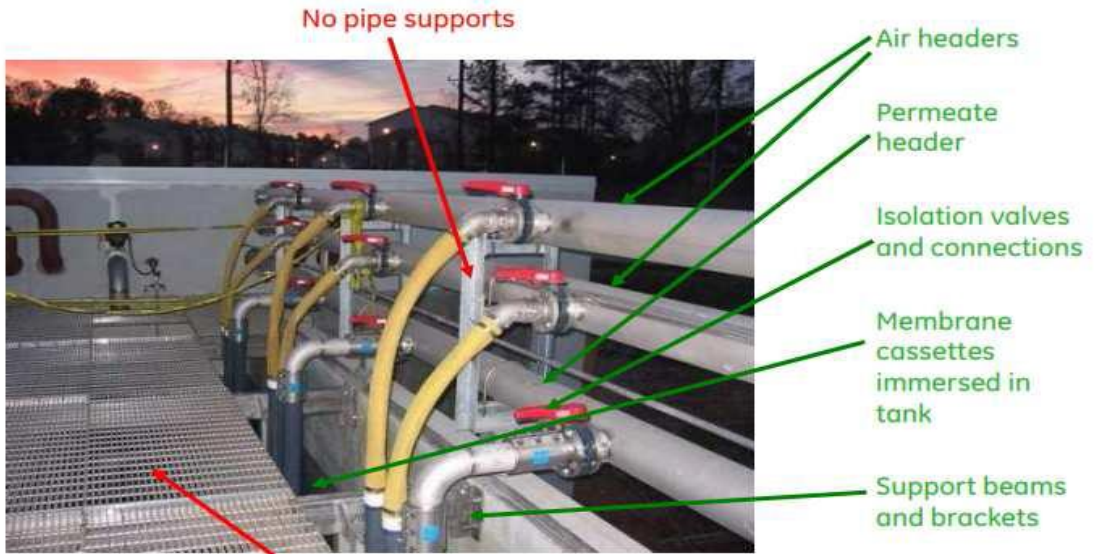
Represented by:



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## GE 'Typical' Scope: Membrane Basins



**No grating or special grating supports**  
(but can be supported on beams with proper review)

Dec 01, 2008 <sup>1</sup>

## ZeeWeed 500d – The Module



Dec 01, 2008 <sup>8</sup>

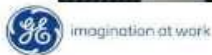
## ZeeWeed 500d – The Cassette

- Central permeate header
- Permeate collection tubes (top and bottom connections)
- Air piping
- Aerator tubes
- Stainless steel frame



9  
Dec 01, 2008

## ZeeWeed 500d – The Cassette



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## ZeeWeed 500d – Installation



**Cassette levelling is critical – ensure all supports are levelled prior to opening cassette crates (beams and levelling pins typically by GE-ZENON)**



12  
Dec 01, 2008

## ZeeWeed 500d – Installation



13  
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## ZeeWeed 500d – Installation



15  
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## ZeeWeed 500d – Installation



14  
Dec 01, 2008

## ZeeWeed 500d – Installation



Lifting Bracket  
(by GE-ZENON)

Install Hanger Arm  
Extensions (provided  
by GE-ZENON)



## ZeeWeed 500d – Installation

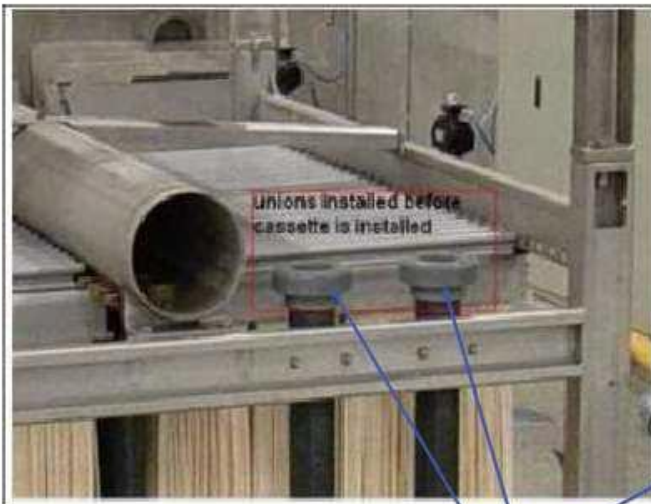


## ZeeWeed 500d – Installation



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## ZeeWeed 500d – Installation



**Make up piping connections  
prior to installation**



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## ZeeWeed 500d – Installation



20  
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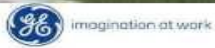
## ZeeWeed 500d – Installation



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## ZeeWeed 500d – Installation



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## ZeeWeed 500d – Installation



Make up air  
connection hoses to  
suit



23  
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## ZeeWeed 500d – Installation



Complete Permeate header connection



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## ZeeWeed 500d – Installation



Cassettes installed in Membrane Zone



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**Control Philosophy for VFD based drives**

Following VFD drives will be operated based on respective process parameters / manually as:-

A) Membrane tank blowers (AB - 1031 / 32/ 33) will be operated with manual intervention through VFD controlled operation manually. Two blowers will be operated for both phases keeping 3rd blower stand by. Same will be Comes into service base don the signal / input received from flow switch installed at the piping discharge for respective phase. At respective low flow switch input at the discharge of AB - 1031 / 32 OR AB - 1032 / 33, stand by blower will come into service provided blower is selected in REMOTE mode. A delay of 6 sec will be there for flow switch consideration. After 6 sec if the will remain low, stand by pump will start and existing will stop.

B) Membrane bioreactor blowers (AB - 1021/22/23) will be operated based on respective dissolved oxygen meter (DOA - 501/502) through auto VFD controlled operation. Set point will be 3 PPM. Out of 3 blowers, two will be working for both phases and 3rd one will be stand by always. DO set point will be settable from HMI.

C) Membrane backwash pumps (P - 1041/42 OR P - 1043/44) will be operated based on respective flow transmitter (FT -103/104) through auto VFD controlled operation. Set point will be 56 M3/Hr. One pump will be working and other one will be stand by always. FT set point will be settable from HMI.

D) Flushing water transfer pumps (P - 1061/62/63) will be operated based on respective flow transmitter at the discharge line through auto VFD controlled operation. Set point will be 36 M3/Hr. Two pumps will be working and other one will be stand by always. FT set point will be settable from HMI.

E) Flushing water transfer pumps (P - 1051/52/53) will be operated based on respective flow transmitter at the discharge line through auto VFD controlled operation. Set pointwill be 20 M3/Hr.Two pumps will be working and other one will be stand by always. FT set point will be settable from HMI.

F) EQT / SHT blowers (AB - 1011/12) will be operated with manual intervention through VFD controlled operation manually.

**Note: -**

1. All analog parameters will be displayed and recoded at HMI.
2. Auto and semi auto operation provision has to be given for all drives / valves including single phase dosing pumps at HMI.
3. All drives will be tripped at respective tanks low level.

# STP SEQUENCE

ZMOD 320516 Operations Sequence Chart

OPERATING STATE		Step #	Disturbance Devices												Step	Comments & Requesting Logic	
Step Description	Tag Numbers	AB-103114	VAG	VAM	VAM	MP-102122	MP-1120	P-1110	UV-1030	P-1080	UV-1010	UV-1010	UV-1010	UV-1010	UV-1010		
OFF	Valve alignment	Step 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Stops all rotating equipment, and leaves valves as they were. Waits for step duration, and then proceeds to the next step. Train remains in this mode until the operator changes the train to ON mode. If the ON button is pressed proceeds to STANDBY - Step 1. Necessary condition is Level Above Membrane otherwise prompt operator to start bioreactor feed pump and raise level. If the CIRC or HYPO clean button is pressed proceeds to H.CLEAN - step 1. If PRIME TANK pollution is present proceeds to PRIME - step 1. Sequence complete.
		Step 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SHUT DOWN ( FAULT)	Valve alignment	Step 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Stops all rotating equipment, and leaves valves as they were. Waits for step duration, and then proceeds to the next step. Train remains in this mode until the operator changes the train to ON mode (resets the alarm list). After resetting fault the plant goes into off mode. If the CIRC or HYPO clean button is pressed proceeds to H.CLEAN - Step 1. If PRIME TANK pollution is present proceeds to PRIME - step 1. Sequence complete.
		Step 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
STANDBY	Valve alignment	Step 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Necessary condition is Level Above Membrane. Hold this step for 3 seconds then proceeds to next step. The train remains in this step indefinitely until one of the following occurs: # If start train trigger (TRAIN START), the train proceeds to PRIME - Step 1. # If the M.CLEAN WITH CTRIC ACID or SODIUM HYPOCHLORITE button is pressed, proceeds to M. CLEAN - Step 1. # If Backpulse button is pressed proceeds to BACKPULSE - Step 1. # If the Relax button is pressed proceeds to RELAX - Step 1. # If the Membrane button is pressed, MEMBRANE FREQUENCY to be considered for Membrane tower and RAS pump. (See Note below)
		Step 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
PRIME	Priming	Step 1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	Holds this step for Timer 1 (PRIME) then proceeds to PRODUCTION - step 1. # PRIME is initiated from OFF then proceeds to OFF - step 1. # PRIME was initiated from OFF then proceeds to OFF - step 1.
		Step 2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	Holds this step for 3 seconds then proceeds to next step.
PRODUCTION	Valve alignment	Step 1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	Slants P103132 and controls the flow rate at PERMEATE FLOW SP. PID Loop to be considered and trend to be displayed on HMI. If a MAINTENANCE CLEAN request is active proceeds to MAINTENANCE CLEAN - step 1. When backpulse is not available ( Eg. Tank level Low), the train goes to RELAX.
		Step 2	1	0	1	1	0	0	0	0	0	0	0	0	0	0	
BACKPULSE	Valve alignment	Step 1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	Holds this step for 15 seconds then proceeds to next step. Holds the flow rate at BACKPULSE FLOW SP. PID Loop to be considered and trend to be displayed on HMI. Hold this step for Timer 3 (BACKPULSE TIMER).
		Step 2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	Waits for step duration, for flow to stop, then proceeds to the next step. # 'START TRAIN' command is active proceeds to PRODUCTION - step 1. # If the BACKPULSE was initiated from OFF, proceeds to OFF - step 1. # If the BACKPULSE was initiated from STANDBY, proceeds to STANDBY - step 1.
		Step 3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	

ZMOD 320516 Operations Sequence Chart

Step #	Step Description	Tag Numbers	Disturbed Devices													Duration (if needed, minutes unless noted)	
			AB-103/14	VN2	VN1	VN3	P-103/132	VN4	VN6	MAP-102/222	P-1120	P-1110	UV-1030	P-1080			
<p><b>OPERATING STATE</b></p> <p>0 - Indicates that the valve/motor is closed/off in Auto.                      1 - Indicates that the valve/motor is open/running in Auto.                      LB - Indicates that the valve/motor will remain the last state it had (non-closed, on/off) to avoid damaging equipment.                      C - Indicates that the valve is alternating between open/close every 10 seconds                      M - Indicates that the valve/motor can be operated manually by the operator at the HMI.</p>																	
<p><b>Legend</b></p> <p>The Operations Sequence Chart (OSC), Control Logic Chart (CLC) and the Control Narrative (CN) should all be read to assist in the understanding of system operations.                      Comments &amp; Sequencing Logic</p>																	
BP Screen	RELAX	Step 1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	5
	soak	Step 2	1	0	1	0	0	0	0	1	0	0	0	0	0	Timer 3	
<p><b>MAINTENANCE CLEAN</b></p>																	
	Valve alignment	Step 1	LB	1	0	0	0	0	0	0	0	0	0	0	0	5	
	Tank Aeration	Step 2	1	0	0	0	0	0	0	0	0	0	0	0	0	Timer 4	
	Valve alignment	Step 3	0	0	0	0	0	0	0	1	1	0	0	0	0	5	
	Initial B.P	Step 4	0	0	0	0	1	1	1	0	1	1	0	0	0	Timer 5	
	soak	Step 5	0	0	0	0	0	1	1	0	0	0	0	0	0	Timer 6	
	Repeated Chemical B.P	Step 6	0	0	0	0	0	1	1	0	1	1	0	0	0	Timer 7	
	Repeated Soak	Step 7	0	0	0	0	0	0	1	1	0	0	0	0	0	Timer 6	
	water B.P	Step 8	0	0	0	0	1	1	1	0	0	0	0	0	0	Timer 5	
	Mem. Tk. Aeration	Step 9	1	0	0	0	0	1	1	0	0	0	0	0	0	Timer 4	
	Valve alignment	Step 10	0	0	0	0	0	0	0	0	0	0	0	0	0	5	
<p><b>RECOVERY CLEAN</b></p>																	
	Valve alignment	Step 1	0	1	0	0	0	0	0	0	0	0	0	0	0	Timer 8	
	Tank Aeration	Step 2	1	0	0	0	0	0	0	0	0	0	0	0	0	Timer 8	
	Valve alignment	Step 3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	
	Valve alignment (Membrane Tank)	Step 4	0	0	0	0	0	0	0	0	1	0	0	0	0	4	
	Valve alignment	Step 5	0	0	1	0	0	1	1	0	0	0	0	0	0	5	
	Repeat B.P with Permeate	Step 6	0	0	0	0	1	1	1	1	0	0	0	0	0	Timer 9	
	Train Soak (Permeate Tank Fil)	Step 7	0	0	1	0	0	1	1	0	0	0	0	0	0	Timer 10	
	Valve alignment	Step 8	0	0	0	0	0	0	0	0	0	0	0	0	0	8	
	Tank Aeration	Step 9	1	0	0	0	0	0	0	0	0	0	0	0	0	Timer 8	
	Valve alignment	Step 10	0	0	0	0	0	0	0	0	0	0	0	0	0	10	
	Valve alignment	Step 11	0	0	0	0	0	0	0	0	0	0	0	0	0	11	

ZMOD 320516 Operations Sequence Chart

**Legend**

0 - Indicates that the valve/motor is closed/off in Auto.  
 1 - Indicates that the valve/motor is closed/off in Manual.  
 - Indicates that the valve/motor will remain the last state it had (open/closed, on/off) to avoid damaging equipment.  
 L.S - Indicates that the valve is alternating between open/closed every 10 seconds.  
 M - Indicates that the valve/motor can be operated manually by the operator at the HMI.

**The Operations Sequence Chart (OSC), Control Logic Chart (CLC) and the Control Narrative (CN) should all be read to assist in the understanding of system operations.**

**Comments & Sequencing Logic**

Waits 6 seconds, for valve alignment, then proceeds to the next step.  
 Starts P1031/32 and controls the flow rate at RCLEAN BP SP.  
 Hold this step for Timer 1 (RCLEAN initial chemical soak), then proceeds to the next step.  
 Hold this step for Timer 12 (RCLEAN chemical soak), then proceeds to the next step.  
 Starts P1031/32 and controls the flow rate at 20-FC1-301.  
 Hold this step for Timer 13 (RCLEAN repeated chemical pulse), then proceeds to the next step.  
 When in this step and the membrane tank level is at or above (90% x 20LY2-201 setpoint) then proceeds to RECOVERY CLEAN step 17.  
 Hold this step for timer 12 ( RCLEAN chemical soak).  
 When in this step and the membrane tank level is at or above (90% x 20LY2-201 setpoint) then proceeds to RECOVERY CLEAN step 18.  
 After the last iteration proceeds to the next step.  
 Backpulses the membrane tank until 20LY2-201 +/- (Clearing level trigger) is active then proceeds to the next step.  
 Holds 6 seconds, for valve alignment, then proceeds to the next step.  
 Aerate the membrane tank.  
 Holds this step for Timer 14 ( RCLEAN membrane tank soak) then proceeds to the next step.  
 Prompts operator to increase membrane tank level until Membrane tank level for fill is active then proceeds to next step.  
 Holds 6 seconds, for valve alignment, then proceeds to the next step.  
 Aerate the membrane tank.  
 Holds this step for Timer 15 ( RCLEAN membrane tank soak) then proceeds to the next step.  
 Holds 6 seconds, for valve alignment, then proceeds to the next step.  
 Train soaks for Timer 16 ( RCLEAN tank soak timer/seconds, then either proceeds to the next step when clean was with sodium hypochlorite or proceed to step 20 when clean was with citric acid.  
 Prompts operator.  
 \*Check the chlorine concentration in the membrane tank.  
 Solution is neutralized if chlorine concentration is below 10 mg/L\*  
 Operator presses CONFIRM NEUTRALIZATION to proceed to next step, or presses RESUME NEUTRALIZATION to return to RECOVERY CLEAN- step 21.  
 Holds 6 seconds, for valve alignment, then proceeds to the next step.  
 Backpulses the membrane tank.  
 Holds this step for Timer 8 ( RCLEAN initial and final permeate pulse) then proceeds to the next step.  
 Holds 6 seconds, for valve alignment, then proceeds to OFF- step 1.

Step #	Tag Numbers	AB-10/31/4	VN2	VN1	VA3	P-1031/32	VN4	VA6	AMP-1021/22	P-1120	VA5	MA-1021/22	P-1110	MA-1030	UV-1080	Duction (if head, minus unless noted)
Step 13	Valve alignment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Step 13	Initial B.P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Timer 11
Step 14	soak	0	0	0	0	1	1	1	0	0	1	0	0	0	0	Timer 12, 14
Step 15	Repeated Chemical B.P	0	0	0	0	1	1	1	0	1	1	0	0	0	0	Timer 13, 15
Step 16	Repeated Soak	0	0	0	0	0	1	1	0	0	0	0	0	0	0	Timer 12, 16
Step 17	Water B.P	0	0	0	0	0	1	1	0	0	0	0	0	0	0	
Step 18	Valve alignment	0	0	0	0	0	1	1	0	0	0	0	0	0	0	Timer 17, 18
Step 19	Mem. Tk. Chemical Soak	1	0	0	0	0	0	0	0	0	0	0	0	0	0	Timer 14, 19
Step 20	Neutralization	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Step 21	Valve Alignment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Timer 20
Step 22	Tank Aeration	1	0	0	0	0	0	0	0	0	0	0	0	0	0	Timer 15, 22
Step 23	Valve Alignment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Step 24	Tk. Soak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Timer 24
Step 25	Operator Prompt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Timer 25
Step 26	Valve Alignment	0	0	0	0	0	0	1	1	0	0	0	0	0	0	Timer 26
Step 27	Flush Piping	0	0	0	0	0	1	1	0	0	0	0	0	0	0	Timer 9, 27
Step 28	RECOVERY CLEAN COMPLETE	0	0	0	0	0	1	1	0	0	0	0	0	0	0	Timer 28

OPERATING STATE: Step Description

DEVIATED DEVICES

1 For operator precision, sodium hypochlorite pumps are interlocked at the PLC with the citric acid pumps to prevent them from running at the same time. Making sodium hypochlorite and citric acid generates chlorine gas. Chlorine gas is toxic at levels many of the operators where a valve actuation, one valve is closing while another is opening. This is done to prevent interlocking of the pumping equipment involved in the given process.

2 When a tank is in STANDBY, the membrane permeate flow cycles first based on duration: Timer2B and frequency: timer 8P filter.

3

**DEVICE SPECIFIC NOTES:**

**GENERAL NOTES:**

ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set/Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revisions	Notes	
<b>Plant Information</b>																		
	Controls Documents		Info															
	Returning a Train to ON		Info								The OSC, CLC and Control Narrative with the P&ID's should be reviewed in their entirety to assist in the understanding of plant operations. Any action to an alarm, which causes a train to shutdown, will require the operator to put the train back on. If the train is on an alarm, the operator must place the train into Manual Stop. If the train is on an alarm, the operator must place the train into Manual Stop. If the train is on an alarm, the operator must place the train into Manual Stop. Changes may be required for field conditions & requirements. The following color scheme is used for device status: GREEN - Indicates a pump is on and a valve is open. RED - Indicates a pump is off and a valve is closed. YELLOW - Indicates a valve is travelling. YELLOW - Indicates a valve is travelling. YELLOW - Indicates a valve is travelling. Green and red color selections are toggled when Device Display Color Green for Running 00-HS-001 is selected to RED. A device in Local will have a "L" symbol displayed over or beside the device on the process graphics. A device placed in MANUAL control will have MAN displayed over or beside the device.							
	Returning a Devices to Auto		Info															
	Setpoints		Info															
	Device Display Colors, Line Display Colors & Status (HMI & SCAADA)		Info	Colors														
	Display Instrumentation Values (HMI & SCAADA)		Info	Plant							The Following items are to be displayed on the HMI: 1) All analog instrumentation signals wired directly to the GE PLC 2) All analog instrumentation signals communicated to the GE PLC by another PLC 3) TMP							
	Trending PID Loops		Info	Plant							AI PID loop parameters are trended							
	Motor & Air Compressor "Auto Start/Stop" Control		Info	Plant							Each motor and Air Compressor has a pop-up screen displaying Auto, Start and Stop buttons. Pressing Auto Places the devices into Auto Mode Start- Places the devices into Manual start Stop- Places the devices into Manual stop							
	Motor & Air Compressor Runtime Info		Info	Plant							Each motor and Air Compressor has a pop-up screen displaying Accumulated Runtime (Hours) and a Runtime Reset Pushbutton. Reset- Resets the accumulated runtime to Zero.							
	Valve "Auto Open/Close" Control		Info	Plant							Each automatic Valve has a pop-up screen displaying Auto, Open and Close Buttons. Auto- Places the device in Auto Mode Open- Places the device into Manual Open Close- Places the device into Manual Close.							
	HMI Security Level - Administrator		Info	Security							The Administrator user type shall have the Supervisor privileges and also the following privileges: - Security configuration, including adding users and changing password - All SCAADA/HMI application and operating system privileges When the user name and password are entered, after one hour of inactivity and/or four hours after logging out, the user must re-enter the password. Default user name: ADMIN Default password: per design guide the Logout button on the HMI. Resets to Guest level.							
	Motor Series		Info					L48										

ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Notes
RESET	Alarm Reset HMI Security Level - Supervisor	00	Info	Buildin Security					When the user name and password are entered. Default user name: SUPER Default password: per design guide CG-07003	Alter one hour of inactivity and/or four hours after logging in. Also reset by selection of the Logout button on the HMI. Resets to Guest level.	Clear all the active alarms. The Security user type shall have the Operator privileges and also the following privileges: - Adjust all presets and setpoints - Place devices such as pumps and valves in Manual (in addition to Auto) - Adjust PID tuning parameters	When the button is pressed the Security user type shall have the Operator privileges and also the following privileges: - Adjust all presets and setpoints - Place devices such as pumps and valves in Manual (in addition to Auto) - Adjust PID tuning parameters - User name and password entry accessible from any process graphic, by selection of Login button. - Current user displayed on user name entry graphic. - Includes Logout button. - Common to all security levels, accessible from all graphics.				
	HMI Security Level - Operator	00	Info	Security					When the user name and password are entered. Default user name: OPER Default password: per design guide CG-07003	Alter one hour of inactivity and/or four hours after logging in. Also reset by selection of the Logout button on the HMI. Resets to Guest level.	The Operator user type shall have the Guest privileges and also the following privileges: - Monitor presets and setpoints, and adjust process control setpoints (not process alarm setpoints) - Access process unit control buttons and reset alarms - Silence the alarm horn and acknowledge alarms - Place devices such as pumps and valves in Auto (but not Manual) - Adjust PID controller output screens, change PID control setpoints, and adjust PID control parameters (except PID tuning parameters)	When the button is pressed the Security user type shall have the Operator privileges and also the following privileges: - Adjust all presets and setpoints - Place devices such as pumps and valves in Manual (in addition to Auto) - Adjust PID tuning parameters - User name and password entry accessible from any process graphic, by selection of Login button. - Current user displayed on user name entry graphic. - Includes Logout button. - Common to all security levels, accessible from all graphics.				
	HMI Security Level - Guest	00	Info	Security					When no user is logged in.	None.	The Guest user type shall have the following privileges: - Navigate through the graphic screens and monitor plant and equipment status	User name and password entry accessible from any process graphic, by selection of Login button. Current user displayed on user name entry graphic. Includes Logout button. Common to all security levels, accessible from all graphics.				
	HMI Screen Saver	00	Info						After 30 minutes of inactivity, HMI system dock.	On any touch or any mouse action.	Activates screen saver.	Message banner "SE Water & Process Technologies" Displayed on all process graphics. Date - dd Mmm YYYY Time - 23:59:29				
	HMI Date and Time	00-K-001	Computed						Set to value of HMI Date and Time when the Time Synchronize button is pressed.			Displayed on any graphic with a suitable separator. Includes Home Mute button for operator selection, accessible from all graphics that display the PLC Time. Date - dd Mmm YYYY Time - 23:59:29				
	PLC Date and Time	00-K-001	Computed													
00-HS-001	Device Display Color Green for Running	00-H-001	Switch						When the Color Green button is pressed. Set, and not available for operator selection, on IPI SCADA design.	When the Color Red button is pressed.	When the Color Red button Available selections: GREEN, RED. Used to select the desired color to be used when a pump is running or a valve is open.	Displayed on system configuration graphic. Includes Color Red and Color Green buttons for operator selection, accessible from system configuration graphic. Buttons only available to the ADMINISTRATOR level of security access.				
00-YA-002	PLC I/O Fault	00-Y-002	Alarm						ALWAYS: - when fault status is detected from any I/O module.	Manual Reset When Alarm Reset pushbutton is pressed.	If any Train is in any step of Production, Backpulse/Relax, or CIP: - Stop all pumps and closes all valves associated with the step. - Inhibits any automatic transition to next step.					
00-YA-004	Alarm Horn	00-Y-004	Switch						When any new alarm is detected.	When the Horn Mute button is pressed.	Energizes PLC discrete output to activate alarm horn.	Announces color of Horn Mute button to red. Includes Horn Mute button for operator selection, accessible from all graphics.				



ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set/Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revision	Notes
<b>FEED SYSTEM</b>																	
08-P-100A-B	Gritzer pump control		Info	pumps	-	-	-	-									
08-P-100A-B	Gritzer pump-Fail to Start	08-P-100A-B	Alarm		-	-	-	-	When the Gritzer pump 08-P-100A-B is requested to run and the running signal is not received for 3 seconds	When the reset button is pressed. The operator has to put the equipment back into Auto.	There are two Gritzer pumps one duty and one stand by. Put the Pump in Manual Stop. Switch the Lag Pump to Lead Pump.	Display of message and the status in control graphic.	A	N	Y		
08-P-100A-B	Gritzer Pump Duty Cycle		Setpoint		-	-	-	Hour			Switch the Lag blower to Lead blower	Display of runtime in the Graphic screen.					
<b>BIOREACTOR SYSTEM</b>																	
10-B-400-A-B	Process Blower Lead/Lag control		Info	Blower	-	-	-	-									
10-YA-401-A	Process Blower-1 Fail to Start	10-B-400-X	Alarm		-	-	-	-	When the process blower 10-B-400-A is requested to run and the running signal is not received for 3 seconds	When the reset button is pressed. The operator has to put the equipment back into Auto.	Put the blower in Manual Stop. Switch the Lag blower to Lead blower.	Display of message and the status in control graphic.	A	N	Y		
10-YA-401-B	Process Blower-2 Fail to Start	10-B-400-X	Alarm		-	-	-	-	When the process blower 10-B-400-B is requested to run and the running signal is not received for 3 seconds	When the reset button is pressed. The operator has to put the equipment back into Auto.	Put the blower in Manual Stop. Switch the Lag blower to Lead blower.	Display of message and the status in control graphic.	A	N	Y		
10-YA-400	No Process Blower Available	10-B-400-X	Alarm		-	-	-	-	IN ALL MODES: -all steps, when there is no blower available to run in auto. Air flow Switch located on the common header. When the blower has been running for 10 seconds and the and the low flow signal is received for 3 seconds.	When any Blower is back in Auto Mode	Callout. Shutdown the train by pulling it to OFF- Step 1.	Display of message and the status in control graphic.	Sn	C	Y		
10-FAL-400	Process Blower air flow low	10-FSL-400	Alarm		-	-	-	-	When the reset button is pressed. The operator has to put the equipment back into Auto.		Put the blower in Manual Stop. Switch the Lag blower to Lead blower.	Display of message and the status in control graphic.	Sn	N	Y		
10-KY-400	Process Blower Duty Cycle		Setpoint		-	-	-	Hour			Put the Lag blower to Lead blower	Display of runtime in the Graphic screen.					
10-YA-401	Aoxic Process Mixer Start	10-M-401	Alarm	Mixer	-	-	-	-	When the Mixer is requested to run and the running signal is not received for 3 seconds	When the Mixer is running	Put the Mixer in Manual stop. Alarm	Display of message and the status in control graphic.	A	N	Y		
10-M-401	Aoxic Process Mixer		Mixer		-	-	-	-									
10-LAL-401	Bioreactor Tank Level Low Low	10-LIT-401	Alarm	Level	FIELD SET	FIELD SET	FIELD SET	mm	When the bioreactor tank level is at or below this setpoint for 10 seconds	When the level is above 10-LCL-401-X	There are 3 mixers located in the Aoxic Tank. When the Mixer is in Auto it runs IN PRODUCTION. RELAX & BACKPULSE: - all steps, proceed to STANDBY - step 1. IN MAINTENANCE CLEAN, RECOVERY CLEAN & NEUTRALIZATION: - all steps, completes mode. Prevents train from entering PRODUCTION, BACKPULSE & RELAX modes. Display the value in Engineering Units	display of status and the total run hours display of tank level and the alarm message	A	N	Y		
10-LIT-401	Bioreactor Tank level		Analog In	Level	0	FIELD SET	mm					display of tank level					
10-LYH-401	Bioreactor tank Level High Trigger	10-LIT-401	Sequencer	Level	0	FIELD SET	mm		When the level is at or above 10-LYH-401 for 3 seconds								
10-LAHH-401	Bioreactor tank Level High Alarm	10-LIT-401	Alarm	Level					When the level is above the setpoint for 3 seconds			Alarm Message	A	N	Y		
20-FC-7520	Plant flow demand										The plant flow demand is calculated using below eq. It is the plant influent flow trimmed to the membrane tank level. The trim is a calculated flow based on changing level. The trim should be proportional control based on a average membrane tank. FC-7520 = 30-FC2-7520						

ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set/Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revision	Notes	
<b>ZEEWEED PROCESS SYSTEM</b>																		
	Mode Selection through OFF		Sequencer	Control								Displayed on process graphic and unit control graphic. Refer the OSC for detail regarding switching from one mode to another from OFF.						
	Mode Selection through ON		Selector	Control								Displayed on process graphic and unit control graphic. Buttons for operator selection, available from unit control graphic.						
	Operation Mode Indicator		Info	Control								Displayed on process graphic and unit control graphic.						
ON-PB-X	ON-Button		Selector	Control					When Button is pressed									
OFF-PB-X	OFF-Button		Selector	Control					When Button is pressed									
ADV-PB-X	Advance Button		Selector	Control					When Button is pressed									
BP-PB-X	Backpulse or Relax Button		Selector	Control					When Button is pressed									
20-KY-2000	Production Duration		Setpoint	Timer	5	20	12	minutes										
20-KY2-3522	Priming Duration		Setpoint	Timer	300	60	30	Seconds	In PRIME - Step 1:									
20-Q-3000	No. of Trains in Production Cycle		Info	Demand	0	1		step		When the timer times out.								
20-HIS13-3300-X	M.CLEAN WITH CITRIC ACID BUTTON		Selector	Control					When Button is pressed									
20-HIS14-3300-X	M.CLEAN WITH SODIUM HYPOCHLORITE BUTTON		Selector	Control					When Button is pressed									
20-HIS15-3300-X	R.CLEAN WITH CITRIC ACID BUTTON		Selector	Control					When Button is pressed									
20-HIS16-3300-X	R.CLEAN WITH SODIUM HYPOCHLORITE BUTTON		Selector	Control					When Button is pressed									

ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set/Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revision	Notes				
<b>Membrane Aeration System</b>																					
20-B-200	Membrane Blower control		Info	Blower																	
20-YA-200	Membrane Blower Fail to Start	20-B-200	Alarm						when the Blower is requested to run and run feedback is not received for 5 seconds	When the reset button is pressed and the operator needs to put back into Auto	Put the Blower in Manual stop.	Alarm message display	A	C	Y						
20-YA1-200	No Membrane Blower Available	20-B-200	Alarm						Callout when the Blower is back in auto mode.	Shutdown trains in the following order until there are sufficient blowers: IN STANDBY: - all steps, continue without blower. Auto-close the train's aeration valve 20-FV-200-X. -delay six seconds and if there is still insufficient number of blowers, proceed to next train. IN MAINTENANCE CLEAN, RECOVERY CLEAN: - all steps, continues steps without blower. Auto-close the train's aeration valve 20-FV-200-X. -delay six seconds and if there is still insufficient number of blowers, proceed to next train. IN PRODUCTION, RELAX, & BACKFILL: - one train goes to OFF step 1. -delay six seconds and if there is still insufficient number of blowers, shutdown the other train.	message - No Aeration Blower Sn C Y available	Sn C	Y								
20-FAL-200	Membrane Blower Air Flow Low	20-FEL-200	Alarm						The Air flow switch is located on the common header. IN PRODUCTION: - all steps, the Blower is requested to run and switch 20-FEL-200 is active for 10 seconds	when the reset button is pressed, and the operator needs to put Back into Auto Mode.	Put the Blower in Manual stop.	Alarm message display	Sn C	Y							
20-KY1-200-X	Membrane Tank Cyclic Valve Cycle Time	20-FV-200-A/B	Setpoint		10	10	10	Seconds			Valves 20-FV-200-A and 20-FV-200-B will alternate between open and close positions every 10 seconds. One valve will be open and another will be closed.										
20-KY4-200	Train in Standby Aeration Frequency	20-FV-200-A/B	Sequencer		10	10	10	minutes	IN STANDBY: Step-3	When a train is not in Standby - step 3	IN STANDBY: - step 2, aerates the membrane tank for 20-KY3-200 seconds every 20-KY4-200 seconds. Starts step with no mixing.										
20-KY3-200	Train in Standby Aeration Duration	20-CV-200-A/B-2/3	Sequencer		0.5	10	5	minutes	IN STANDBY: Step-3	When a train is not in Standby - step 3	IN STANDBY: - step 2, aerates the membrane tank for 20-KY3-200 seconds every 20-KY4-200 seconds. Starts step with no mixing.										
20-ZAC-200-A-2 20-ZAC-200-B	Cyclic Valve Failed to Open	20-FV-200-A/B	Alarm						IN All Modes: When Open Limit switch is not activated for 60 sec when the valve is asked to open	when the reset button is pressed	Callout. Relax IN MAINTENANCE CLEAN & RECOVERY CLEAN: - all steps, continues Maintenance Clean or Recovery Clean without aeration. Once steps are complete, proceeds to OFF - step 1. IN PRODUCTION, BACKFILL & RELAX: - all steps, continues to cycle valve. Train is placed into demand override.	Alarm Message	Sn C	Y							
20-ZAC-200-A 20-ZAC-200-B	Cyclic Valve Failed to Close	20-FV-200-A/B	Alarm						IN All Modes: When Close Limit switch is not activated for 60 sec when the valve is asked to close	When Close Limit Switch is activated	Callout. IN PRODUCTION, BACKFILL & RELAX: - all steps, continues to cycle valve. Train is placed into demand override. IN MAINTENANCE CLEAN: - all steps, proceeds to STANDBY - step 1. IN RECOVERY CLEAN: - all steps, proceeds to PAUSE - step 1. Displays on alarm banner "Recovery Clean Aborted". Maintenance Cleans, Recovery Cleans and Backwashes are prevented on trains which are in demand override.	Displays on alarm banner "Train has a Cyclic Valve Failure - Inappropriate Maintenance Aeration may be Occurring" IN MAINTENANCE CLEAN; Displays on alarm banner "Maintenance Clean Aborted" IN RECOVERY CLEAN; Displays on alarm banner "RECOVERY Clean Aborted"	A	C	Y						

ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revision	Notes
<b>Membrane Tank System</b>																	
20-LUT-200	Membrane Tank Level		Analog In	Level	0	TBD		mm	Displays the Membrane level		Display the value in Engineering Units	Displayed the value and the Setpoint selection in a popup screen					
20-LX1-200	Average Membrane Tank Level		Derived	Level							The average level of all membrane tanks when the trains are in STANDBY, PRODUCTION, RECOVERY CLEAN, MAINTENANCE CLEAN, PRODUCTION, MAINTENANCE CLEAN, RECOVERY CLEAN; - all steps, proceeds to OFF - step 1.	Alarm message	Sn C	Y			
20-LA-200	Tank Level Transmitter Out of Range		Alarm						When the I/O Module detects the transmitter out of range.		IN MAINTENANCE CLEAN; - Displays on alarm banner "Maintenance Clean Aborted." IN RECOVERY CLEAN; - Displays on alarm banner "Recovery Clean Aborted."						
20-LAL-200	Membrane Tank Level Low	20-LIT-200	Alarm				TBD	mm	Callout	When the level is above the setpoint	When the level is above the setpoint	Alarm Message: Membrane Tank Level Low Display					
20-LAH-200	Membrane Tank Level High	20-LIT-200	Alarm				TBD	mm	IN PRODUCTION; -when the level is at or above this setpoint for 10 seconds for either or any any membrane tank.	Manual Reset When the level is at or above this setpoint for 10 seconds for either or any any membrane tank.	IN PRODUCTION: CALLOUT; Close the valve 20-FCV-201	Alarm message	A C	Y			
20-LY1-200	Membrane Tank Level to Enable Membrane Tank Feed	20-LIT-200	Sequencer				TBD	mm	IN ALL MODES: When the level is at or below this level for 8 seconds	Momentary; When the level switch is not active	Resets 20-LAH-200						
20-LY2-200	Membrane Tank Level 3 for Fill	20-LIT-200	Sequencer				TBD	mm	IN RECOVERY CLEAN; Step 20 When the level is at or below this level for 8 seconds		IN RECOVERY CLEAN; -proceeds to the next step. Target setpoint is a level about 300 mm above the 20-LY2-200 setpoint but prevents the membrane tank from overflowing.						
20-LY2-200	Membrane Tank Level above Membranes	20-LIT-200	Sequencer				TBD	mm	IN ALL MODES: When the level is at or above this level for 8 seconds.		Resets 20-LAL-200. IN STANDBY; - when the level is above the setpoint, the train is set to produce water. IN RECOVERY CLEAN; - proceed according to the OSC.						
20-LAL-200	Membrane Tank Level Low	20-LIT-200	Sequencer				TBD	mm	When the Membrane Tank Level is at or below this setpoint for 10 seconds.	When the level is at or above 20-LY2-200.	Callout. Put train to STANDBY - Step 1.	display of alarm message					
20-LAL-200	Membrane Tank Level Low Low	20-LIT-200	Alarm				20-LAL-200	mm	When the Membrane Tank Level is at or below this setpoint for 3000 seconds.	When the level is at or above 20-LY2-200.	IN ALL MODES; -all steps, displays on alarm banner "Membrane Tank X" Possible Membrane Exposure."	display of alarm message	A N	Y			
20-LAL-201-2x	Membrane Tank Level Low Low Possible Exposure	20-LSL-201-2 X	Alarm				0	mm	IN ALL MODES: When the level Alarm low low 20-LAL-201-2 x has been active for more than 3000 seconds. IN RECOVERY CLEAN; - when the level is at or below this setpoint for 2 seconds, the steps as indicated in the OSC.	When the level is at or above 20-LY2-200.	IN ALL MODES; - all steps, displays on alarm banner "Membrane Tank X" Possible Membrane Exposure."	display of alarm message	A N	Y			
20-LY12-200	Membrane Tank Empty Tank	20-LIT-200	Sequencer					mm			IN RECOVERY CLEAN; -steps as indicated in the OSC, proceeds to next step. Level trigger set at the lowest possible level without losing prime on the RAS pump 10-P-402-X.						

ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revision	Notes	
20-FC2-7320	Membrane Tank Level Proportional Controller	20-LIT-300	Controller	proportional					Plant Trim Flow Demand = (Max. Peak Flow x [20-LX0-300 - 20-LCL-300]) / (20-LCH-300 - 20-LCL-300) + 20-LCH-300 This is a calculated flow. Maximum control level is 20-LCH-301 where permeate demand must equal the maximum peak flow for the entire plant. Minimum control level is 20-LCL-300 where trim flow demand is 0 m3/min. This is the plant permeate trim flow used to calculate the net permeate flow for each train in PRODUCTION. 20-FC-301-X.			Setpoint adjustment on popup accessible from process graphic indication of level.						
20-LC-200	Membrane tank Level Setpoint	20-LIT-300	Setpoint				TBD	m3			This is used as SP for the 20-LUC-300 PID							
<b>Permeate System</b>																		
20-FCH-301	Instantaneous Permeate Flow	20-FIT-301	Info	Flow			TBD	M3/HR			This is the Upper limit for 20-FC-301							Y
20-FCL-301	Maximum Flow Setpoint	20-FIT-301	Info	Flow			#	M3/HR			This is the Lower limit for 20-FC-301							Y
20-FPH-7320	Minimum Flow Setpoint										Places 1 train into production step-1							
20-FPL-7320	1 TRAIN TO 0 TRAIN TRIGGER										places ALL train into standby step 1.							
20-FALH-301	Permeate Flow High High	20-FIT-301	Alarm	Alarm			SET	M3/HR	20-FC-7320 IS AT OR ABOVE THIS SETPOINT 20-FC-7320 IS AT OR BELOW THIS SETPOINT IN PRODUCTION: When the permeate flow has been at or above this setpoint for 10 seconds. When the reset button is pressed		Callout	Display of alarm message	Sn C	Y				
20-FALL-301	Permeate Flow Low Low	20-FIT-301	Alarm	Alarm			FIELD SET		IN PRODUCTION: When the Permeate Pump has been running for 5 seconds and the permeate flow has been at or below this setpoint for 20 seconds. When the reset button is pressed		Callout	Display of alarm message	Sn C	Y				
20-FIT-301	Permeate Backpulse Flow		Analog In		0.00	00.00		M3/HR	Displays the value in engineering units			Display of Actual Value and field adjustable setpoint.	Sn C	Y				
20-FA-301	Permeate Backpulse Flow Out of range		Alarm	Alarm					IN ALL MODES: When the transmitter is out of range by 1% of the calibrated range for 2 seconds. (i.e. calibrated range = range max. - range min.) Displays the value in engineering units		IN PRODUCTION, BACKPULSE MAINTENANCE CLEAN, RECOVERY CLEAN. - all steps, proceeds to Off - step 1.	Alarm Message	Sn C	Y				
20-FIT-300	Membrane Header Pressure		Analog In		-15.00	15.00		kg/cm2				Display of Actual Value and field adjustable setpoint.	Sn C	Y				
20-PAH-300	Process Pump Pressure High	20-FIT-300	Alarm	Alarm					IN BACKPULSE MAINTENANCE CLEAN, RECOVERY CLEAN: - all steps, when the backpulse header pressure is at or above this setpoint for 6 seconds. The operator has to put the equipment back into Auto.		IN BACKPULSE MAINTENANCE CLEAN, RECOVERY CLEAN. - all steps, proceeds to SHUTDOWN - step 1.	Alarm Message	Sn C	Y				
20-PA-300	Permeate Backpulse Pressure Transmitter Out of range	20-FIT-300	Alarm	Alarm					This is a common setpoint with multiple Alarms. IN ALL MODES: When the transmitter is out of range by 1% of the calibrated range for 2 seconds. (i.e. calibrated range = range max. - range min.)		IN PRODUCTION, BACKPULSE MAINTENANCE CLEAN, RECOVERY CLEAN. - all steps, proceeds to Off - step 1.	Alarm Message	Sn C	Y				

ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revision	Notes	
20-YA-300	Permeate Backpulsing Pump Fail to start	20-P-300	Alarm						IN ALL MODES: When the MOC is no longer in Auto. When the Pump is requested to run and the running signal is not received for 3 seconds.	When the MOC is returned to Auto. When the reset button is pressed. The operator has to put the equipment back into Auto.	Pump control is removed from the PLC and the pump is placed in the MOC control. When reset, the pump control is returned to the PLC. Callout. IN PRODUCTION, BACKPULSE, RELAX, STANDBY & M-CLEAN: Shutdown the train by pulling it to OFF - Step 1. IN R-CLEAN: Abort R-CLEAN. Put the permeate backpulsing pump in Manual Stop. Put the train into OFF - Step 1.	Displayed of Alarm Message	Sn, C	Y				
20-SC-300	Permeate Backpulsing Pump Speed	20-P-300	Setpoint		25	100	%		When the VFD signal is received for 2 seconds.	When the reset button is pressed. The operator has to put the equipment back into Auto.	WHEN IN MANUAL-START MODE: Pump speed is entered at HMI. IN AUTO MODE: IN PRODUCTION: -all steps, this setpoint is overwritten by the CV value from PID loop flow controller 20-FIC-301-x to control the pump. IN BACKPULSE, MAINTENANCE CLEAN & RECOVERY CLEAN: -all steps, this setpoint is overwritten by the CV value from PID loop flow controller 20-FIC-8820-x to control the pump. Callout.				Y			
20-JA-300	Permeate Backpulsing Pump VFD Fault	20-P-300	Alarm						When the VFD signal is received for 2 seconds.	When the reset button is pressed. The operator has to put the equipment back into Auto.	WHEN IN PRODUCTION, BACKPULSE, RELAX, STANDBY & M-CLEAN: Shutdown the train by pulling it to OFF - Step 1. IN R-CLEAN: Abort R-CLEAN. Put the permeate backpulsing pump in Manual Stop. Put the train into OFF - Step 1.	Displayed of Alarm Message	Sn, C	Y				
20-PDALL-300	TMP Low Low	20-PTI-300	Alarm		-0.562	0	-0.562		IN PRODUCTION: When the TMP has been at or below this setpoint for 6 seconds.	When the reset button is pressed.	Train proceeds to OFF - Step 1.		Sn, C	Y				
20-PDVL-300	TMP Low Low Display	20-PTI-300	Computed		0	-0.432	-0.562		IN ALL MODES: -all steps, when the TMP is above the setpoint, then increases the maximum value for 20-FIC-301-x CV by 0.25% every second until it reaches 100%. IN PRODUCTION: -all steps, captures the initial value for the maximum of the 20-FIC-301-x CV as: Initial value for the maximum CV = (CV value of 20-FIC-301-x) - 0.25 Then reduces the maximum value for 20-FIC-301-x CV by 0.25% every second until it reaches to the its minimum of 25%.				Y					
20-PDOLL-300	TMP Trigger for Extra Air Removal	20-PTI-300	Computed						IN PRODUCTION: -all steps, when maximum value for 20-FIC-301-x CV is below 100%. 20-FIC-301-x CV is below 100%.	-all steps, when the TMP is above the setpoint, then increases the maximum value for 20-FIC-301-x CV by 0.25% every second until it reaches 100%.	IN PRODUCTION: -all steps, the maximum value for 20-FIC-301-x CV is limited to a value below 100%. Displays "TMP at limit" indication on the screen.		Y					

ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revision	Notes	
20-FDI-300	Transmembrane pressure TMP	20-FIT-300	Computed						<p>TMP = Membrane Header Pressure                      - Connection Error                      - Height of the Pressure Transmitter Above the Top of the Membranes + Height from the Bottom of the Tank to the Top of the Membrane Fibers Membrane Tank Level)</p> <p>Control Narrative for Filter Decantation                      PRODUCTION &amp; BACKPULSE:                      20-FDI-300 = 20-FIT-300 + C x [ (A - B) - (20-U-200) ]</p> <p>A = Top of Membranes to Pressure Transmitter                      B = Bottom of Tank to top of the Membranes                      C = 0.0001 bar/m.</p> <p>This calculation is used for at all time.</p>		<p>20-FC-301-X = 20-FC-7320-20-Q-3000-X</p> <p>PV is the flowmeter, 20-FIT-301                      SP is 20-FC-301 in PRODUCTION                      CV is the permeate backpulsing pump 20-P-300 output %                      The maximum CV is 20% and the maximum CV is defined by 20-PRALL-300 Alarm IN                      E-SP-PV</p> <p>PV is the flowmeter, 20-FIT-301                      SP is 20-FC1-301 in BACKPULSE                      SP is 20-FC2-301 in MC CIP                      SP is 20-FC3-301 in RC CIP                      CV is the permeate backpulsing pump 20-P-300 output %                      The maximum CV is 20% and the maximum CV is defined by 20-PRALL-300 Alarm IN                      E-SP-PV</p>	<p>Display the computed value.                      Alarm use high, low and the setpoint.</p>						
20-FIC-301	Permeate Flow PID Controller	20-FIT-301	Controller	Flow	20-FOL-301	20-FCH-301	CALCULATED	L/M										
20-FIC-301	Permeate Flow PID Controller	20-FIT-301	Controller	PID			Kp-FIEL D SET R-FIELD Update-1 sec. Deadband d=0											
20-FIC-8820-X	Backpulsing CIP Flow PID Controller	20-FIT-301	Controller	PID			Kp-FIEL D SET R-FIELD SET Update-1 sec. Deadband d=0											
20-AAH-300	Permeate Turbidity High	20-AIT-300	Alarm		0	5	1	rtu	In Production: -when the Turbidity has been at or above the setpoint for 30 seconds. In Production: -when the Turbidity has been at or above the setpoint for 60 seconds.	When the turbidity is below the setpoint	Display of alarm message	A	N					
20-AAH-300	Permeate Turbidity High	20-AIT-300	Alarm		0	5	1	rtu	In Production: -when the Turbidity has been at or above the setpoint for 60 seconds.	When the turbidity is below the setpoint	Display of alarm message	A	N					
20-AIT-300	Permeate Turbidity		Analog In		0	10		rtu										
20-FIQ-3022	Today's Permeate Volume		Computed				2	KLD	Actual Instrument is 20-AE/AIT-300 Calculate the Train's Production Volume for Today = Permeate volume during PRODUCTION minus backpulsing volume from BACKPULSE displays value on the screen.	At midnight after current value is put into 20-FIQ-3022-X								
20-FIQ-3022-X	Yesterday's Permeate Volume		Computed				2	KLD	At midnight this value is stored at 20-FIQ-3022	At midnight this value is stored at 20-FIQ-3022-X								
20-FIQ-3022-X	Accumulated Cycle's Permeate Volume		Computed				2	KLD	At midnight Value is displayed on the screen until the next midnight. Totalize the net permeate flow during the production cycle.	Reset at 1x10 <sup>9</sup>								

ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revision	Notes	
<b>Recirculation System</b>																		
16-P-402-X	RAS Pump control		Motor															
16-HA-402-x	RAS Pump fail to Start	16-P-402-x	Alarm						IN ALL MODES: -all steps, when the MCC is no longer in Auto.	When the MCC is returned to Auto.	The pumps will operate in lead and lag pumps. The Pump control is removed from the PLC and the pump is placed in the MCC control.		A	N	Y			
16-YA1-402	No Recirculation Pump Available	16-P-402	Alarm						IN ALL MODES: -all steps, when there are no recirculation pumps available to run in auto or manual-start.	When any recirculation pump is placed into auto or manual-start.	Callout -all steps, proceeds to FAULT - step 1.		SO	C	Y			
16-YA-402	RAS Pump 16-P-402-x fail	16-P-402-X	Alarm						IN ALL MODES: When the pump is requested to run and the pump is not received for 3 seconds.	When the recirculation pump is placed into auto or manual-start.	IN MAINTENANCE CLEAN & RECOVERY CLEAN: -all steps, continues steps until mode is completed and then the train proceeds to SHUTDOWN - step 1.		A	C	Y			
16-NY1-402-x	RAS Pump Load Alternating Time	16-P-402-X	Info		72	24	12		IN ALL MODES: -all steps, when the pump is running.	When load is switched.	This is the actual accumulated run time of the equipment.				Y			
	RAS Pump Alternating Lead	16-P-402-X	Info						IN ALL MODES: -all steps, when the accumulated run time is equal to or greater than 16-FIT-402 and the lead pump is not running. OR -all steps, when the lead pump is not available. (Pump is available if in Auto at HMI).	When lead is switched.	IN ALL MODES: -all steps, changes the lead of the pumps. Lead is not switched if the other pump is not available.			Y				
16-FAHH-400	Recirculation Flow High	16-FIT-400	Alarm			200	M3/HR		When the recirculation flow has been at or above the setpoint for 10 seconds.	When the flow is below this setpoint.	Callout.	Alarm Message	A	C	Y			
16-FALL-400	Recirculation Flow Low	16-FIT-400	Alarm			135	M3/HR		When the recirculation pump has been running for 10 seconds and the flow is at or below this setpoint for 10 seconds.	When the reset button is pressed. The operator has to put the equipment back into Auto.	Callout. Put the recirculation pump 16-P-402-x in Manual Stop.	Alarm Message	A	C	Y			
16-FIT-400	RAS Flow To Bioreactor	16-FIT-400	Analog In		0	300	M3/HR				Displays value with engineering units on screen.				Y			
16-FA-400	RAS Flow Transmitter Out of Range	16-FIT-400	Alarm						IN ALL MODES: When the transmitter is out of range by 1% of the calibrated range for 2 (i.e. calibrated range = range max. - range min.)	When the transmitter is in range.	IN MAINTENANCE CLEAN & RECOVERY CLEAN: -steps continue		A	C	Y			
16-FOI-400	Today's Total Plant RAS Volume	16-FIT-400	Computed		0	10000	mg/l			At midnight, totalizer is reset to zero.	Totalized flow through all 16-FIT-400				Y			
16-FOI2-400	Yesterday's Total Plant RAS Volume	16-FIT-400	Computed		0	10000	mg/l			At midnight, totalizer is reset to zero.	At midnight the value is stored at 16-FOI2-400				Y			



ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revision	Notes	
<b>BACKPULSE SYSTEM</b>																		
20-KY-8800	Backpulse or Relax Duration		Setpoint		20	120	30	Seconds	IN BACKPULSE: -step 3. IN RELAX: -step 3.	When timer times out.	IN RELAX & BACKPULSE: -starts timer. Proceeds as per OISC when timer times out.	Setpoint adjustment on popup accessible from process graphic indication for train setpoints.						
20-FAHH-8820	Backpulse Flow High High	20-FTT-301	Alarm				TBD	M3HR	IN PRODUCTION: When the Permeate Backpulse Pump has requested to run and the flow has been at or above the setpoint for 3 sec. IN BACKPULSE: When the operator has to put the equipment back into Auto.	When the reset button is pressed, the operator has to put the equipment back into Auto.	IN BACKPULSE: -all steps, proceeds to SHUTDOWN - step 1.	Alarm Message	Sn	C	Y			
20-FALL-8820	Backpulse Flow Low Low	20-FTT-301	Alarm				TBD	M3HR	IN PRODUCTION: When the Permeate Backpulse Pump has requested to run and the flow has been at or below the setpoint for 3 sec. IN BACKPULSE: When the operator has to put the equipment back into Auto.	When the reset button is pressed, the operator has to put the equipment back into Auto.	IN BACKPULSE: -all steps, proceeds to SHUTDOWN - step 1.	Alarm Message	Sn	C	Y			
20-LAL-001	Backpulse Tank Level Low	20-LSL-001	Alarm						IN PRODUCTION: When 20-LSL-001 is active for 3 sec.	When 20-LSL-001 is not active.	Callout: IN BACKPULSE: De-energizes the output to the pump and continues the BACKPULSE sequence without pump. -all steps, proceeds to the next step. IN M-CLEAN OR R-CLEAN: Put the permeate backpulse pump in Auto Stop. -all steps, proceeds to the next step. When the alarm is cleared, the PLC continues to the step after the permeate backpulse and chemical pumps start.	Callout: IN BACKPULSE: De-energizes the output to the pump and continues the BACKPULSE sequence without pump. -all steps, proceeds to the next step. IN M-CLEAN OR R-CLEAN: Put the permeate backpulse pump in Auto Stop. -all steps, proceeds to the next step. When the alarm is cleared, the PLC continues to the step after the permeate backpulse and chemical pumps start.	A	N	Y			
20-LAH-001	Backpulse Level High High	20-LSH-001	Alarm						IN PRODUCTION: When 20-LSH-001 is active for 3 sec.	When the reset button has been pressed.	IN BACKPULSE: Callout: The Train Process to FAILT-step-1	Display of alarm message	A	N	Y			
20-PDAH-000	Backpulse TMP High High	20-PIT-300	Alarm	TMP	0	0.502	0.502		IN BACKPULSE: When the TMP is at or above this setpoint for 8 sec during Backpulse	When the reset button has been pressed.	IN BACKPULSE: Callout: The Train Process to FAILT-step-1							
20-PDVH-000	TMP High Trigger	20-PIT-300	Info	TMP	0.14	0.482	0.482		IN BACKPULSE: MAINTENANCE CLEAN & RECOVERY CLEAN: When the TMP is at or above this setpoint, the TMP is at or above this setpoint.	IN ALL MODES: When the TMP is at or below this setpoint, the TMP is at or above this setpoint. IN BACKPULSE: MAINTENANCE CLEAN & RECOVERY CLEAN: When the TMP is at or above this setpoint, the TMP is at or above this setpoint.	IN BACKPULSE: MAINTENANCE CLEAN & RECOVERY CLEAN: -all steps, captures the initial value for the maximum of the 20-FIC-8120 x CV as: FIC-8120 x CV as: Initial value for the maximum CV = (CV value of 20-FIC-8820 x 0.25) Then reduces the maximum value for 20-FIC-8820 x CV by 0.25% every second until it reaches to the its minimum of 25%.							
20-PDVH-000	TMP High Display	20-PIT-300	Info	TMP					IN BACKPULSE: MAINTENANCE CLEAN & RECOVERY CLEAN: -steps as per the OISC.	IN PRODUCTION: When the maximum value for 20-FIC-8820 x CV is limited to 8820 x CV is at 100%. IN M-CLEAN: Automatically reset in the next step. IN R-CLEAN: Put the reset button is pressed. IN R-CLEAN: Display banner "Maintenance Clean Aborted"	IN BACKPULSE: MAINTENANCE CLEAN & RECOVERY CLEAN: -all steps, the maximum value for 20-FIC-8820 x CV is limited to a value below 100%. Displays "TMP at limit" indication on the screen. Callout: IN M-CLEAN: De-energizes the output to the chemical pumps and the backpulse pump. Put the train into OFF - Step 1. IN R-CLEAN: Display banner "Maintenance Clean Aborted"							
20-PDAH-001B-X	CIP TMP High High	20-PIT-300	Alarm	Alarm					IN M-CLEAN OR R-CLEAN: When the TMP is at or above this setpoint for 8 seconds during BACKPULSE: The actual instrument is 20-PEPIT-301%.	IN M-CLEAN: Automatically reset in the next step. IN R-CLEAN: Put the reset button is pressed. IN R-CLEAN: The operator has to put the equipment back into Auto.	IN M-CLEAN: Automatically reset in the next step. IN R-CLEAN: Put the reset button is pressed. IN R-CLEAN: Display banner "Maintenance Clean Aborted"							
20-FCI-301	Backpulse Flow setpoint	20-FTT-301	Computed					M3HR			Operator enter "Recovery Clean Aborted," Common to both Trains.							

ZM0D 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set/Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revision	Notes	
<b>CLEAN IN PLACE (CIP) SYSTEM</b>																		
20-FAHH-8120	CIP Flow High High	20-FTT-301	Alarm				TBD	M3HR	In M-clean or R-clean: When the permeate backpulsing pump has been requested to run and the flow has been at or above this setpoint for 10 seconds. The actual instrument is 20-FE-FTT-301.	When the flow is below the setpoint	IN MAINTENANCE CLEAN & RECOVERY CLEAN: - all steps, proceeds to SHUTDOWN - step 1. - energizes the output to the chemical pumps and permeate backpulsing pump - cabout	Display of alarm message	Sn	N	Y			
20-FAUL-8120-X	CIP Flow Low Low	20-FTT-301	Alarm				TBD	M3HR	In M-clean or R-clean: When the permeate backpulsing pump has been requested to run for 10 sec and the flow has been at or below this setpoint for 10 sec. The actual instrument is 20-FE-FTT-301.	When the flow is above the setpoint	IN MAINTENANCE CLEAN & RECOVERY CLEAN: NEUTRALIZATION: - all steps, proceeds to SHUTDOWN - step 1. - energizes the output to the chemical pumps and permeate backpulsing pump - cabout	Display of alarm message	Sn	N	Y			
20-FC5-301	Maintenance Clean CIP Flow Setpoint	20-FTT-301	Computed		TBD	TBD	TBD	M3HR										
20-FC3-301	Recovery Clean CIP Flow Setpoint	20-FTT-301	Computed		TBD	TBD	TBD	M3HR										
<b>CIP-Citric Acid Chemical System</b>																		
Prevent Stalling of Citric Acid Pumps																		
23-LAL-201	Citric Acid Tank Level Low	23-LSL-201	Alarm						When a Sodium Hypochlorite Pump is ON. OR When any train is in Maintenance Clean Chlorine Clean or Recovery Clean Chlorine Clean.	Blocks stalling of any Citric Acid Pump. In auto or manual modes.								
23-P-200	Citric Acid Pump Control		Info						IN MAINTENANCE CLEAN & RECOVERY CLEAN: - all steps, when switch is active for 5 seconds.	When the 23-LSL-201 is not active	IN MAINTENANCE CLEAN & RECOVERY CLEAN: - all steps, stop the citric acid dosing pump	option to enter setpoint from HMI common for both the trains.	A	N				
<b>CIP-Sodium Hypochlorite Chemical System</b>																		
Prevent Stalling of NaOCl Pumps																		
23-LAL-201	NaOCl Tank Level Low	23-LSL-201	Alarm						When a Citric Acid Pump is ON. OR When any train is in Maintenance Clean Acid Clean or Recovery Clean Acid Clean.	When the level is above the setpoint	IN MAINTENANCE CLEAN & RECOVERY CLEAN: - all steps, stop the dosing pump.							
23-P-210/23-P-220	NaOCl Control		Info						IN MAINTENANCE CLEAN & RECOVERY CLEAN: - all steps, when switch is active for 5 seconds.		IN MAINTENANCE CLEAN & RECOVERY CLEAN: - all steps, stop the dosing pump.							
<b>CIP-Maintenance Clean</b>																		
20-KY1-8101	Initial and Final M-clean Pulse duration		Setpoint	M-Clean	10	120	60	seconds	The Duration of Initial and Final M-clean Pulse									
20-KY1-8102	Soak Duration Between M-clean Permittal Pulse		Setpoint	M-Clean	10	300	270	seconds	Soak duration between M-clean Permittal Pulse									
20-KY1-8103	M-clean Chemical Pulse Duration		Setpoint	M-Clean	10	120	20	seconds	M-clean Chemical Pulse Duration									
20-KY1-8104	Number of M-clean Chemical Pulse Iteration		Setpoint	M-Clean	8	10	8	N/A	Number of M-clean Chemical Pulse Iteration									
20-KY3-8100	Maintenance Clean to Occur on Given Day Enable Button		Info	M-Clean							Operator can select to have a Maintenance Clean on specific days of the week for a specific train.							
20-KY3-8100	Maintenance Clean CIP Aeration Step Timer		Info	Blower	0	000	300	seconds	IN MAINTENANCE CLEAN: - In aeration steps, as detailed in OSC.		IN MAINTENANCE CLEAN: - all steps, as detailed in OSC.							

ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revision	Notes	
<b>CIP-Recovery Clean</b>																		
20-KY14-8100	Recovery Clean CIP Aeration Step Timer		Setpoint	Blower	0	600	300	seconds	IN RECOVERY CLEAN: - In aeration steps, as detailed in OSC.		IN RECOVERY CLEAN: - In aeration steps, as detailed in OSC.							
20-KY29-8100	Recovery Clean Pulse Duration		Sequencer	R-Clean	30	7000	120	seconds	IN RECOVERY CLEAN: - steps as noted in the OSC.		IN RECOVERY CLEAN: - steps as noted in the OSC, this is the steps duration. Consult the OSC, Recovery Clean steps, for details.							
20-KY25-8100	Recovery Clean Flush Soak Duration		Sequencer	R-Clean	30	3600	3600	Seconds	IN RECOVERY CLEAN: - steps as noted in the OSC.		IN RECOVERY CLEAN: - steps as noted in the OSC, this is the steps duration. Consult the OSC, Recovery Clean steps, for details.							
20-KY19-8100	Recovery Clean Flush Aeration Step Timer		Setpoint	Blower	0	600	300	seconds	IN RECOVERY CLEAN: - In aeration steps, as detailed in OSC.		IN RECOVERY CLEAN: - In aeration steps, as detailed in OSC.							
20-KY2-8101	Initial and Final R-clean Pulse Duration		Sequencer	R-Clean	10	120	60	seconds	The duration of Initial and Final R-clean Pulse									
20-KY2-8102	Soak Duration Between R-clean Chemical Pulse		Sequencer	R-Clean	10	300	270	seconds	Soak duration between R-clean chemical Pulse									
20-KY2-8103	R-clean Chemical Pulse Duration		Sequencer	R-Clean	10	120	30	Seconds	R-Clean Chemical Pulse Duration									
20-KY27-8101	R-Clean Extended Soak Duration		Sequencer	R-Clean	5	12	5	hours	R-clean Extended Soak Duration									
20-KY28-8100	R-Clean Soak Extended Soak - Mixing Duration		Sequencer	R-Clean	0.30	300	60	seconds	IN RECOVERY CLEAN: - In extended soak step, and every time 20-KY28-8100 times out.		IN RECOVERY CLEAN: - setpoint is mixing duration with air in extended soak step. - setpoint is 10 minutes for 20-KY28-8100 seconds every 20-KY28-8100 seconds. Soak step - setpoint of 0 indicates no during the soak step.							
20-KY28-8100	R-Clean Soak Extended Soak - Mixing Frequency		Sequencer	R-Clean	600	7200	1200	seconds	IN RECOVERY CLEAN: - as per OSC.		IN RECOVERY CLEAN: - setpoint is mixing frequency. Timer retains when it times out. - aerrates the membrane tank for 20-KY28-8100 seconds every 20-KY28-8100 seconds. Starts step with no mixing.							
20-KY19-8101	Neutralization Aeration Step Timer		Sequencer	R-Clean	5	900	60	seconds	IN RECOVERY CLEAN: - as per OSC.		IN RECOVERY CLEAN: - steps as noted in the OSC, this is the steps duration. Consult the OSC, Recovery Clean steps, for details.							
20-KY20-8100	Neutralization Soak Duration		Sequencer	R-Clean	5	1200	900	seconds	IN RECOVERY CLEAN: - as per OSC.		IN RECOVERY CLEAN: - steps as noted in the OSC, this is the steps duration. Consult the OSC, Recovery Clean steps, for details.							
20-HIS30-3000-x	Rinse Button		Sequencer	R-Clean					IN RECOVERY CLEAN: When The button is pressed	When the train is in the selected step.	Consult the OSC, Recovery Clean steps, for details.							
20-HIS31-3000-x	Resume Neutralization Button		Sequencer	R-Clean					IN RECOVERY CLEAN: When The button is pressed	When the train is in the selected step.	Consult Interlocks in CLSIC and OSC for more information. - steps as per OSC, proceeds according to the OSC.							
20-HIS32-3000-x	Confirm Neutralization Button		Sequencer	R-Clean					IN RECOVERY CLEAN: When The button is pressed	When the train is in the selected step.	Consult Interlocks in CLSIC and OSC for more information. - steps as per OSC, proceeds according to the OSC.							
<b>Priming System</b>																		
20-PDYL-4623	TMP Trigger for Extra Air Removal		Controller		0	-0.422	-1.004	kg/cm2	IN PRODUCTION: - all steps, if the TMP is at or below the setpoint for 30 seconds.	IN PRODUCTION: ONCE IN STEP-2	IN PRODUCTION: - step 1, Ejector Compressed Air Valve 20-FV-801-1 and 20-FV-802-2 opens.							
90-PAL-100	Air compressor pressure Low	90-PSL-100	Alarm							When the reset button is pressed	IN ALL MODES: - when the air compressor low pressure switch is active Displays on alarm banner "Low Air pressure"		Sn, N					

ZMOD 320516 Control Logic Chart

Tag	Description	Loop Tag	Type	Sub Type	Range Min	Range Max	Setpoint	Units	Set/Derivation	Reset	Action	Operator Interface	Alarm Type	Severity	Log	Revision	Notes
<b>Power System</b>																	
00-LA-0000	General Calcut		Alarm	Control					When any condition requiring a calcut is activated	When the conditions requiring the calcut are cleared	Energize the auto dialer output relay and the alarm light on the panel door						
00-LAL-0001	Plant Power Lost		Alarm	Plant					When the system detects that power is lost	When the trip condition is cleared	Turn off all the equipment Go to Startup Step 1.  The system blocks all fail safe inputs that are normally closed (to avoid nuisance alarms)  This startup sequence shows the order in which the devices in the plant are re-enabled after a power interruption or after an emergency stop has been reset.  ZerWeedB trains that were in STANDBY, PRODUCTION, BACKPULSE/RELAX, or MAINTENANCE CLEAN prior to the power failure, will proceed to STANDBY - step 1.  ZerWeedB trains that were in RECOVERY CLEAN, prior to the power failure, will proceed to OFF - step 1. Displays on alarm banner: "Maintenance Clean Aborted" or "Recovery Clean Aborted."						
	Plant Power Restored		Info	Plant													
00-LAL-0002	AC Power Out of Phase		Alarm	Plant					When the AC monitor detects power out of phase	When the trip condition is cleared	Turn off all the equipment. Go to Startup Step 1.  The system blocks all fail safe inputs that are normally closed (to avoid nuisance alarms)  When the trip condition is cleared and reset buttons is pressed	Alarm message	Sn	C	Y		
00-LAL-0003	System Stop Button/Emergency Plant Button		Alarm						When System Stop Button is pressed								
00-LAL-0004	PLC Battery Low		Alarm						When PLC Battery is low	When trip condition is cleared		Alarm message	Sn	C	Y		
	Startup Step 1		Info						When the system detects that power is restored	When the conditions requiring the calcut are cleared	This startup sequence shows the order in which the devices in the plant are re-enabled after a power interruption or after an emergency stop has been reset.  All trains proceed to POWER OFF until power is resumed and the train is enabled.  ZerWeedB trains that were in STANDBY, PRODUCTION, BACKPULSE/RELAX, or MAINTENANCE CLEAN prior to the power failure, will proceed to STANDBY - step 1 as per the start-up sequence.  ZerWeedB trains that were in RECOVERY CLEAN prior to the power failure, will proceed to OFF - step 1 as per the start-up sequence. Displays on alarm banner: "Recovery Clean Aborted." A delay is provided in each step to allow for devices to start before advancing to the next step. Steps are skipped for those devices which are not ready.  Always utility air compressors to run if required.  Always start-up sequence to complete a self diagnostic.  Displays "Power-up Delay" on the screen.						
	Startup Step 2		Info						60 seconds after start of step 1		Re-enables all common, non-sequenced valves. Enable all the Transmitters.						
	Startup Step 3		Info						15 seconds after start of previous step		Allows Process Blowers to run if required.						
	Startup Step 4		Info						30 seconds after the start of the previous step. There is no delay if the device in the previous step is not required.		Allows screens and mixers to run if required.						
	Startup Step 5		Info						30 seconds after the start of the previous step. There is no delay if the device in the previous step is not required.								
	Startup Step 6		Info						30 seconds after the start of the previous step. There is no delay if the device in the previous step is not required.		Always train 1 & 2 to come out of POWER OFF mode.  Train proceeds to either STANDBY - step 1 or OFF - step 1. See start-up sequence step 1 for more details.						

#1 to be decided based on the selected pump model

## ZMOD 320386 Control Logic Chart

<b>Tag</b>	Tag name for the element. An "X" in the tag's suffix may be used to represent identical elements, if usage of that "X" is consistent with the P&ID tagging convention.
<b>Description</b>	Description for the element.
<b>Type</b>	Purpose for the element. Predefined types will prompt the use of defined and standardized programming practices. The following predefined types are available:
<b>Alarm</b>	Notifies an operator with an alarm message at the operator interface.
<b>Analog In</b>	A reading from a field instrument.
<b>Comm</b>	A variable or a set of variables that are communicated to or from the PLC via a networked communications architecture.
<b>Computed</b>	Calculates a numeric value for use in a PLC program and/or display at an operator interface.
<b>Controller</b>	Calculates a continuous or binary output for regulating a process variable.
<b>Info</b>	General information for a programmer or any user of the CLC.
<b>Motor</b>	Sets a command from the PLC to run a motor, or other similar device.
<b>Selector</b>	An operator or automatic selection, usually with three or more possible values. The output variable is usually an integer word or boolean array in a PLC, with one and only one bit on at a time.
<b>Sequence</b>	Directs the automatic operation of pumps, valves, and other control devices through a series of operations.
<b>Setpoint</b>	A numeric value for use in a PLC program that can be adjusted by a user at an operator interface.
<b>Switch</b>	A discrete value for use in a PLC program and/or display at an operator interface.
<b>Totalizer</b>	Calculates a totaled value.
<b>Valve</b>	Sets a command from the PLC to open a valve.
<b>Sub Type</b>	Further breakdown of the type category.
<b>Loop Tag</b>	A grouping of elements with a common purpose. If W&PT standard tagging has been applied on the P&ID, the element tags are derived from the loop tags. For example, transmitter 34-FIT-211 contributes to flow loop 34-F-211, and motor pushbutton 34-HS-101 contributes to motor loop 34-M-101. If custom tagging has been applied on the P&ID, abbreviated text or an extrapolation of the custom tagging convention may be used for a grouping of elements.
<b>Range</b>	The range of the numerical value of the produced data, or the entry limits for the setpoint that is used to trigger the produced data.
<b>Min &amp; Max</b>	The number of decimal places shown indicates the resolution at the operator interface. For example, 0.0 to 10.0 psig.
<b>Setpoint</b>	The default value for a given setpoint.
<b>Units</b>	The engineering units of the produced data or setpoint.
<b>Set Derivation</b>	The conditions for setting or calculating the produced data. Used by the programmer to create the produced data.
<b>Reset</b>	The conditions for reset of the produced data.
<b>Action</b>	The action that occurs when the produced data is set. Also used to explain the intent or usage of the produced data.
<b>Operator Interface</b>	A description of programming on the operator interface for monitoring and/or control of the produced data.
<b>Alarm Type</b>	A classification of the alarm generated by the PLC program when the element is true. A = Advisory S = Shutdown Sn = Normal Shutdown Si = Immediate Shutdown blank = no alarm
<b>Severity</b>	To differentiate the urgency for an operator to respond to particular alarms. C = Critical Alarm N = Noncritical Alarm
<b>Log</b>	Flags the element as a data point to be logged by data acquisition software.
<b>Revision</b>	Flags the element as changed since an earlier revision of the document, with reference to the revision identifier associated with the change.
<b>Notes</b>	Generally used for notes or comments that are not required for programming, including explanation of a recent revision or explanation of a unique customization.

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### **SERV-0001 ZeeWeed Membrane Care, Handling and Storage 500 a/b, 500c, 500d, ZW1000**

#### **1.0 Purpose**

The purpose of this document is to outline the requirements associated with the receipt, unloading and storage of ZeeWeed® membranes and associated cassette assemblies. Information is also included on storing wetted membranes. If, after reading this document, questions exist on proper membrane handling, please contact your GE Water representative.

Although the ZeeWeed® membranes are designed for maximum durability in water filtering applications, membranes are susceptible to irreversible damage if mishandled. Any concerns regarding membrane handling and potential damage should be addressed with GE Water staff directly before any activities are undertaken at site that may cause an increased potential for membrane damage to occur. It should also be confirmed in advance that suitable Builders All Risk Insurance coverage is in place or other insurance coverages as deemed necessary by the project contract.



**The installer in charge of the site is responsible for taking all reasonable precaution to prevent damage during installation and to prevent debris and foreign objects from falling in the membrane tanks after the cassettes are installed.**

#### **2.0 Applicability and Revisions**

This document covers the ZeeWeed® product line, including all ZeeWeed 500 and 1000 series modules/elements and cassettes. Three important documents to accompany this procedure include:

- I. **Equipment Acceptance Certificate and Checklist** - a document used to confirm the receipt of the goods to the satisfaction of the receiver (for membrane shipments, typically the Installer).
- II. **Membrane Pre-Installation Checklist** - a checklist to be completed by the Installer prior to membrane uncrating and installation.
- III. **ZeeWeed® Cassette Installation Procedure** - a procedure specific to each membrane type that details the steps involved in uncrating and installing new membrane cassettes (either ZeeWeed® 500c, ZeeWeed® 500d or ZeeWeed® 1000).

Contact your GE Water Lifecycle Services for clarification as necessary.  
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### SERV-0001 ZeeWeed Membrane Care, Handling and Storage 500 a/b, 500c, 500d, ZW1000

#### 3.0 Definitions

- **Installer** - Organization that is contractually responsible for the project site.
- **ZeeWeed®** - An ultrafiltration membrane in which the membrane surface is cast onto the outside of long thin hollow fibres. A large number of fibres are bound together in a top (sometimes also a bottom) collection header.
- **Module/Element** - An assembly to house and contain the membrane fibre. One ZeeWeed® membrane, containing numerous individual fibres grouped together, is called a module or an element. See pictures to the right.



500c



500d



ZW1000



ZW1000 V3

#### 4. Membrane Shipment

During shipping of the ZeeWeed® membranes from the GE Water manufacturing facility to the intended site, the following conditions must be met:

- Shipment temperatures are to be controlled in the range of 2 - 35°C (35° - 95°F) (Setpoint 20° C or 68°F)
- The shipping crates housing the membrane cassettes should never be exposed to excessive vibration or large bumps. When shipping membrane cassettes by rail or truck, care is to be taken to ensure that air suspension cars or trailers are utilized.

In most cases membranes will be shipped in populated cassette form (modules are already installed) in cassettes.

Contact your GE Water Lifecycle Services for clarification as necessary.  
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## **SERV-0001 ZeeWeed Membrane Care, Handling and Storage 500 a/b, 500c, 500d, ZW1000**

### **5. Handling of Factory Shipped GE Water Membranes**

#### **5.1 General Information**

##### **Cassettes**

- Membrane cassettes are shipped in a plywood packing crate.
- The cassette itself is sealed in a plastic bag to retain moisture and prevent damage to the membranes due to drying.

##### **Modules/Elements**

- Individual membrane modules/elements are shipped in a cardboard box within a crate.
- The module or element itself is sealed in a plastic bag to retain moisture.
- Modules or elements in cardboard boxes should not be stacked more than six high.

#### **5.2 Unloading Membranes**

The Installer is responsible for the prompt and proper unloading of all membrane equipment and materials received into his custody.

- Dock level, off-loading facilities are recommended.
- The wooden shipping crates have been designed to be lifted from the bottom using a forklift.

**Note that extended forks and an appropriately sized lift are required for the 500d product.**

- Damage incurred or observed during equipment off-loading needs to be immediately reported to your GE Water representative.



- It is recommended that an experienced/qualified forklift truck driver unloads the membranes from the carrier.
- 500d and ZW1000 cassettes are shipped on their sides and will require uprighting - follow all procedures carefully to prevent injury
- Shipping crates are not to be stacked!

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**5.3 Confirmation of Equipment and Materials**

- A cross-check should be performed on the shipment using the packing slip to confirm the delivery of membrane equipment.

**Note: membrane crates are not to be opened! Verification should be limited to external examination of crates.**

- The equipment delivery will be checked for content and any damage that may have occurred during shipping or the unloading process.
- Any non-conformance shall be immediately reported to your GE Water representative (in writing). Digital pictures of damage should be provided.
- Refer to section 5.4 for "Confirmation of Handling Indicators"
- Once the equipment shipment has been checked, the document provided by GE Water (ref. "Equipment Acceptance Certificate and Checklist") is completed and signed by the Site Organization's representatives.
- The Installer shall expeditiously replace all materials and equipment that are lost or damaged while in the custody of the Installer.
- Replacement materials and equipment of a type and quality equal to the original materials and equipment shall be acceptable to GE Water and to the Owner.

**5.4 Confirmation of Handling Indicators**

GE Water includes a series of Shipping Indicators to protect the integrity of the membrane cassettes while they are being shipped. Indicators may include Freeze and/or Heat.

- The Installer's representative should document the indicator condition on the indicator check label located on the membrane crate.
- At the time of discovery the Installer must inform the ZENON representative of any triggered indicators. (A triggered indicator indicates ideal shipping conditions were not maintained. The ZENON FSR will evaluate membranes prior to installation).
- During membrane installation, the GE Water Representative onsite will also inspect and record the status of all indicators.

	Freeze Indicator	Heat Indicator
<b>Indicator Location:</b>	External	External
<b>When to Check:</b>	At time of receipt	At time of receipt



Indicators are located next to instruction labels.



Note: Duplicate indicators are inside crate. These indicators are for ZENON FSR use.

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### **SERV-0001 ZeeWeed Membrane Care, Handling and Storage 500 a/b, 500c, 500d, ZW1000**

#### **6.0 Storage of Membranes**

The Installer shall provide all facilities and services required for the storage, maintenance, protection and security of the equipment and materials delivered by ZENON.

The following conditions should be followed:

- Equipment and materials shall be stored in assigned lay-down areas.
- Stored equipment and materials shall be adequately supported and protected to prevent damage.
- Equipment shall be moved into the permanent building or onto its permanent foundation as soon as construction will permit.
- Stored materials and equipment shall not be allowed to contact the ground. In warehouses that do not have dry concrete or suspended floors, materials and equipment shall be stored on platforms or shoring.
- Indoor storage furnished by the Installer shall consist of suitable construction trailers or portable enclosures and shall be weather-tight, well ventilated, and secure against theft and vandalism.
- Access doors shall be adequate to accommodate the movement and handling of materials and equipment to be stored and shall be equipped with secure locks.
- Membrane cassettes will be stored upright on a level surface.
- The membrane cassette crates must remain closed until the Installer begins membrane installation to prevent permanent membrane damage due to drying out.



**Membranes should be stored in a dark dry area with a storage temperature between 5° - 35° C (40° - 95° F)!**

#### **6.1 Storage Conditions - Crated Cassettes**

The following conditions should be ensured when storing crated cassettes:

- Stored in a sheltered area protected from freezing, direct sunlight or extreme heat.
- Vacuum sealed bag should remain sealed until membrane installation is being performed.

It is recommended that the cassettes be stored no longer than necessary prior to installation. Coordinate with GE Water for appropriate shipment times. Maximum storage duration of a cassette is 12 months from the date of shipment.

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### **SERV-0001 ZeeWeed Membrane Care, Handling and Storage 500 a/b, 500c, 500d, ZW1000**

#### **6.2 Storage Conditions – Bagged Modules / Elements:**

New modules / elements preserved with glycerin solution, bagged and factory sealed, may be stored for up to 12 months. The following conditions should be ensured when storing bagged modules / elements:

- Stored in a sheltered area protected from freezing, direct sunlight, extreme heat and winds that could accelerate drying.
- The module / element should be kept bagged and sealed at all times.

Disassembly of cassettes to replace modules/elements requires attention and care. Contact GE Water for re-assembly procedures, which include step-by-step instructions, bolt torques, and identification of non-reusable hardware.

#### **6.3 Storage Conditions – Wetted Membranes**

It is important to note that ZeeWeed® membranes should not be allowed to dry out as membrane properties will be adversely affected. **Drying may result in irreversible damage to the membranes.**

If the preservative is flushed out or if the module has been in contact with water, the membrane must not be allowed to dry out under any circumstances. The membranes may be left in air for a maximum of forty-five minutes out of direct sunlight and wind. After forty-five minutes, membranes should be immersed in water. Spraying the membranes after this period is not sufficient to prevent drying-out and will not allow a longer period of contact with air. If membranes are **frequently lightly misted** (not sprayed with fire hoses or pressure washers) from the time they have been taken out of the water, they may be left in air for a maximum of 6 hours (5° - 35°C (40° - 95°F)). Since the membranes are maintained wet, there is no need for specific re-wetting procedures. However, if necessary for other reasons (e.g., drinking water compliance, residual of preservatives) the standard procedures for rinsing and disinfection may be used before starting the operation. If it is impractical to immerse or repeatedly spray the membrane, the membrane should be cleaned, preserved in glycerin solution and re-bagged according to membrane preservation procedures. Please refer to the Operations and Maintenance manual supplied with the system for further information.

Longer storage durations are to be discussed with GE Water on a case by case basis.

Every effort has been made by GE Water and Process Technologies Canada (GE) to provide current information while preparing this procedure. GE maintains that depictions of methods and/or techniques and use of specific tools and/or apparatus shown within the situations portrayed are accurate at the time of printing. GE accepts no liability for any reliance placed on the information contained herein.

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### **SERV-0001 ZeeWeed Membrane Care, Handling and Storage 500 a/b, 500c, 500d, ZW1000**

#### **6.4 Storage Durations – Wetted Cassettes**

When membranes have been installed in a tank, they need to be kept wet at all times. When the protective glycerin solution is removed, the membranes become susceptible to drying.

For storage periods of up to approximately 15 days, simple immersion of the cassettes in water containing sodium hypochlorite (NaOCl) with a maximum residual concentration of 3 mg/L is suitable. Residual should be monitored every week and re-dosing will be required if the residual drops to less than 0.2 mg/L. Recovery cleaning of the membrane prior to storage is strongly recommended. If the membranes have been in service in a MBR application, inspection and debris removal (if necessary) of the membrane prior to storage is also required. Periodic aeration may also be necessary to prevent anoxic or anaerobic conditions from developing in the tank. Daily testing of the water to ensure that the residual chlorine concentration is within acceptable limits is required; a simple swimming pool chlorine test kit is acceptable. A log is to be maintained recording daily NaOCl concentration and water temperature. Longer storage durations are to be discussed with GE Water on a case-by-case basis.

#### **6.5 Wetted Membranes – Long term removal from water**

If membrane cassettes are to be re-configured or rebuilt for any reason, GE Water Field Service Representatives are required to maintain warranty. If short-term storage (<15 days) refer to section 6.4 in this document. If the module is to be out of service for a longer period, the module/cassette must be preserved and stored.

- Perform a recovery cleaning on membrane modules (refer to the appropriate process manual).
- Ensure that no sludge or solids are present on the membranes.

Please contact GE Water Customer Service for proper preservation instructions.



**In the case that the membranes have spent time in storage, carefully check for any signs of mold on the fibres. Should any mold be present, immediately rebag and follow through with the steps outlined in SERV-0056 Disinfection of Moldy Cassettes/Modules.**

**Contact your GE Water Representative for advice on returning a sample for analysis.**

Contact your GE Water Lifecycle Services for clarification as necessary.  
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**DO'S & DON'TS****DO'S**

1. Clean the air filter on Air Blowers regularly. Change the Air Filters Periodically.
2. Maintain the MLSS level in Bio reactor as specified during actual commissioning of the plant, drain out the excess sludge from tank through drain.
3. Run the blower continuously.
4. Changeover from one blower to another after every Shift.
5. Ensure the min. dissolved oxygen level in FAB reactor tank is 2 mg/l.
6. Regularly follow the lubrication and maintenance schedule for all mechanical moving items.
7. Take composite samples from the locations specified. Analyze them and maintain logbook regularly.
8. Remove sludge from sludge holding tank regularly.

**DON'TS**

1. Don't let acidic pH < 6 or alkaline pH > 8.5 or hot (temp. > 38 Deg. °C) effluent reaches the FAB reactors in any case.

## SAMPLING AND ANALYSIS

Sampling and analysis of the effluent should be done to check the quality of waste and performance of each unit.

### Samples should be taken and analyzed at the following points –

1. At the inlet of FAB reactor – I (After Equalization tank)
2. At the outlet of Anoxic Tank
3. At the outlet of Aerobic Tank
4. At the outlet of MBR

### METHODS OF SAMPLING

Samples collected must be representative in nature otherwise laboratory analysis will be misleading. Careless collection of samples would lead to wrong conclusions. Sampling point should be selected where wastewater is homogenous in nature. Care should be taken to avoid entry of extraneous material such as scum and floating matter into sampling bottles.

### COMPOSITE SAMPLES

Composite samples are required to see performance of the units. For this the samples shall be collected every 4 hours. The samples thus collected shall be then mixed together for making a Composite Sample. e.g. For making a Composite Sample at FAB Reactor Inlet, take the samples at FAB inlet every 4 hours & the samples thus collected shall be mixed together to have a composite sample of the day.

### SAMPLE VOLUME

About one to two liters of sample are adequate for the parameters required for process control. Samples should be immediately transported to laboratory for analysis. In case there is some delay, proper preservation like keeping the samples in ice should be done

### ANALYSIS

The samples shall be analyzed for various parameters as listed in daily Sampling & analysis Schedule. The Samples can be analyzed from nearest laboratory or in the inhouse laboratory if available.

### DAILY SAMPLING & ANALYSIS SCHEDULE

S · N O ·	SAMPLE POINT	SAMPLIN G TYPE	PARAMETERS TO BE ANALYSED				
			pH	SS	O&G	BOD	COD
1.	Effluent at the inlet of FAB	Composite	•	•	•	•	•
2.	At the outlet of Anoxic Tank	Composite		•	•	•	•
3.	At the outlet of Aerobic	Composite		•	•	•	•
4.	At the outlet of MBR	Composite		•	•	•	•

**ROUTINE & EMERGENCY INSPECTION**

Remove accumulation of debris from inlet channel and outlet V-notch if provided Chamber. All the tanks, baffles and weirs should be inspected and cleaned daily. · All the vertical walls and channels should be cleaned by squeeze. · All the mechanical equipment should be inspected for normal trouble free operation.

- If the colour of the wastewater is changed in any unit, samples should be taken immediately to investigate the cause of the problem.
- Inspect sludge collection and other equipment annually for the indication of corrosion.

**EMERGENCY INSPECTION**

· In case of any serious problem with any unit, feeding should be stopped immediately to that unit. Drain all the wastewater from the unit and inspect carefully the structure, unusual deposition, each and every part of mechanical equipment, etc. All the mechanical equipment should be made in good working condition. Unit should be cleaned properly before making the same operational again.

**PLANT SHUT DOWN**

In case plant needs to be shut down for a considerable period of time, following should be observed

- Close inlet valve to plant and open bye-pass valve if any.
- Thus effluent will not be received in the plant.
- Pump out effluent from intermediate sump. Open drain valves of tank and drain out the contents.
- The equipment then should be flushed with clear water.

**Biochemical Oxygen demand (BOD)****Outline of the Method**

Bio chemical oxygen demand (BOD) is the quantity of oxygen required by a definite volume of the liquid effluent for oxidizing the organic matter contained in it by microorganisms under specified conditions. For its determination, the dissolved oxygen content of the sample, with or without dilution, is measured before and after incubation at 20 Deg.C. For 5 days.

**Apparatus Required**

Glass stopper bottles, narrow neck bottles of about 300 ml capacity, with suitable water sealing.

**Reagents Required**

- Sodium Hydroxide Solution - approximately 1 N.
- Hydrochloric acid - approximately 1 N.
- Sodium sulphite solution - Dissolve 5 g of anhydrous sodium sulphite in 1 liter of water. Prepare fresh solution daily for use.
- Dilution water - Distilled water of good quality, free from metals, particularly copper, and aerated.
- Phosphate buffer solution - Dissolve 5g of potassium dihydrogen phosphate ( $KH_2PO_4$ ), 2.75g of dipotassium hydrogen phosphate ( $K_2HPO_4$ ), 3.4 g of disodium hydrogen phosphate ( $Na_2HPO_4 \cdot 7H_2O$ ) and 7 g of ammonium chloride in about 500 ml of water and dilute to 1 liter.
- Magnesium Sulphate Solution - Dissolve 22.5 g of magnesium sulphate in water and dilute to 1 liter.
- Calcium chloride solution - Dissolve 27.5 g of anhydrous calcium chloride in water and dilute to 1 liter.
- Ferric Chloride Solution - Dissolve 0.25 g of ferric chloride ( $FeCl_3 \cdot 6H_2O$ ) in water and dilute to 1 liter.
- Seeding Material - Supernatant liquor of domestic sewage stored for 24 to 36 hours at 20 Deg.C. In the case of industrial effluent containing organic compounds, which are not easily oxidized by sewage seed, the receiving water collected about 3.5 km below the discharge point may be used.

**Test Procedure**

- Samples containing acidity or caustic alkalinity should be neutralized to pH about 7.0 with sodium hydroxide solution or hydrochloric acid respectively by adding a predetermined quantity.
- Samples containing residual chlorine or chloramines should be dechlorinated if chlorine is not dissipated on standing for 2 hours. To dechlorinate, first determine the quantity of sodium sulphite solution required for a known aliquot of the sample by titration to starch-iodide end point. After acidifying the sample with acetic acid (1:1) or sulphuric acid (1:50) followed by 10ml of 10 percent potassium iodide solution. Then add to the requisite volume of the sample the predetermined quantity of sodium sulphite, avoiding any excess, and check for the absence of chlorine after 20 minutes.
- Samples containing toxic substances in large amounts would require special treatment. However, the effect of small amount may be overcome by using the proper dilution so that toxicity is removed and the maximum BOD value is obtained. If increasing dilution's show increasing BOD, the dilution should be increased to a level where BOD levels off at a maximum.



- To check the quality of the dilution water and the effectiveness of the seed, determine the BOD of a standard solution of 300 mg/l either glucose or glutamic acid in the dilution water. Standard glucose solution should show a BOD of  $224 \pm 10$  mg/l and glutamic acid  $217 \pm 10$  mg/l.
- Store the dilution water at 20 Deg.C. and use when near that temperature. Take the desired volume of dilution water required for the test sample and add, for every 1 liter of water, 1 ml each of phosphate buffer solution, magnesium sulphate solution, calcium chloride solution and ferric chloride solution. Seed the dilution with seeding material. The quantity of seeding material (0.1 to 1 percent of settled sewage or 1 to 5 percent receiving water) added should be such that oxygen depletion in the dilution water control is between 0.2 and 0.8 mg/l after incubation at 20 Deg 'C. for 5 days.
- Prepare as follows several dilution's of the sample (usually 0.1 to -0 percent for strong industrial effluents and 5 to 25 percent for treated effluent) so as to obtain a depletion of at least 2 mg/l of dissolved oxygen after incubation for 5 days. In the case of dilution's greater than 1:100 prepare a 10 percent primary dilutions in a volumetric flask and from this make the final dilutions.
- Siphon carefully the prepared seeded dilution water into a graduated 1000 ml measuring cylinder and fill to the 500 ml mark. Add the requisite quantity of the carefully well mixed sample to make the particular dilution and fill with dilution water to 1 liter. Mix thoroughly but gently with a plunger type of rod without entraining air. Siphon the dilution into two glass-stopper bottles, fill completely and stopper. Prepare succeeding dilutions of lower concentrations in the same manner.
- Determine the initial dissolved oxygen concentration in one of the two bottles of each dilution. Water seal the other bottles and incubate at 20 Deg.C. for 5 days. At the same time, siphon the dilution water alone into two glass-stopper bottles and determine the blank in one and incubate the other at 20 Deg.C, for 5 days. After incubation for 5 days, determine the dissolved oxygen in the dilutions and the blank in the same manner as the initial dissolved oxygen content.

### Calculation

Biochemical oxygen demand (5 days at 20 Deg'C.), mg/l =  $\{(D1 - D2) - (C1 - C2) F\} / P$

Where

D1 = Initial dissolved oxygen content of the diluted sample,

D2 = Dissolved oxygen content of the diluted sample after incubation.

C1 = Initial dissolved oxygen content of the seeded dilution water,

C2 = Dissolved oxygen content of the seeded dilution water after incubation,

F = ratio of the seed in the sample to that in the control, that is, percent seed in D1 divided by percent seed in C1, and

P = Decimal fraction of the sample used.

### Chemical Oxygen Demand (COD)

#### Outline of the Method

This is determined by refluxing the sample with an excess of potassium dichromate in acid conditions and estimating by titration the amount of dichromate consumed.

#### Interference

Unstable samples should be tested without delay and samples containing settleable solids should be homogenized by suitable means for ease of representative sampling. Initial dilutions in volumetric flasks should be made on those samples having a high COD, in order to reduce the error which is inherent in measuring small sample volumes. Chlorides are quantitatively oxidized by this procedure when silver sulphate is not used as a catalyst. In this case, a correction should be applied by determining chlorides on a separate sample and subtracting the calculated oxygen demand of the chlorides from the result. Since 1 mg/l of chloride will consume 0.23 mg/l of oxygen, the correction is mg/l of chloride x 0.23

**Reagents Required**

Standard Potassium Dichromate Solution - 0.25 N. Concentrated Sulphuric Acid.

Standard Ferrous Ammonium Sulphate Solution - 0.25 N. The solution shall be standardized daily against standard potassium dichromate solution.

Ferriin Indicator Solution - Dissolve 0.485 g of 1, 10 phenanthroline

(monohydrate), together with 0.695g of ferrous sulphate ( $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ ) in distilled water and dilute to 100 ml.

Silver Sulphate

Mercuric Sulphate

**Test procedure**

Place a 50ml sample, or an aliquot diluted to 50 ml with distilled water, in a 300 - ml round-bottom flask fitted with ground-glass joint for attaching a condenser, and add 25 ml of standard potassium dichromate solution. Carefully add 75 ml of concentrated sulphuric acid, mixing after each addition.

**Caution**

The mixture shall be thoroughly mixed before heat is applied. If this is not done, local heating occurs in the bottom of the flask and the mixture may be blown out. Attach the flask to the condenser and reflux the mixture for 2 hours. Pumice granules or glass beads should be added to the reflux mixture to prevent bumping. Cool and then wash down the condenser with about 25ml of distilled water. In many cases, the 2 hour reflux period is not necessary. Therefore, with particular samples, the reflux period of refluxing may be permissible. Transfer the contents to a 500 ml conical flask, washing out the reflux flask 4 to 5 times with distilled water. Dilute the mixture to about 350 ml and titrate the excess potassium dichromate with standard ferrous ammonium sulphate solution, using Ferriin indicator. Generally 2 to 3 drops of the indicator are used. The colour change is sharp, changing from the blue-green to a reddish-blue. The end point, however, will not be as sharp as in the standardization of the reagents because of the lower acid concentration. For this reason, it is necessary that the sample be diluted to at least 350 ml before the titration is carried out. A blank consisting of 50 ml of distilled water instead of the sample, together with the reagents, is refluxed in the same manner

**Calculation**

Chemical oxygen demand, mg/l =  $((A - B) N \times 8000)/V$

Where,

A = volume in ml of ferrous ammonium sulphate solution used in the Titration in the blank.

B = volume in ml of ferrous ammonium sulphate solution used in the titration with the sample,

N = normality of standard ferrous ammonium sulphate solution and,

V = Volume in ml of the sample taken for the test.

**Total Suspended Solids (TSS)****Outline of the method**

Suspended matter is determined by filtering the sample through an asbestos pad in a Gooch crucible.

**Reagent Asbestos cream**

Make a cream of acid-washed medium-fiber Gooch asbestos with water. Add one liter of water for every 15 g of asbestos. If the asbestos contains too much fine powder, remove the latter by repeated decantation.

**Procedure**

Make carefully asbestos mat in the Gooch crucible by adding sufficient asbestos cream to produce a mat about 3mm thick. In preparing the mat, first fill the crucible with well-mixed asbestos cream, let stand for about two minutes to allow the heavier particles to settle and then apply suction to the same extent as will be used for filtering the sample. Wash the mat with water with the suction on by filling and drawing through. Dry the crucible with the asbestos mat in an oven at 103 Deg °C. to 105 Deg °C. For one hour, cool in desiccators and weigh. Filter the sample through the weighed Gooch crucible after moistening with a few drops of water. Add successive increments of 10 ml of the well-shaken sample for filtration using suction. Add each increment of sample before the mat becomes dry. The use of a pipette with an orifice wide enough to prevent clogging with suspended matter is recommended. Continue successive 10ml additions of the sample until the filtration becomes inconveniently slow or until about 10 to 20 mg of suspended matter has been filtered. Carefully wash the mat with 10ml of water to remove soluble salts. Continue suction until draining is complete. Dry the crucible in an oven at 103 Deg's. To 105 Deg's. For one hour, cool to room temperature in desiccators and weigh.

**Calculation**

Total suspended solids, mg/l = 1000 w/V

**Total Dissolved Solids (TDS)**

A well-mixed filtered sample is evaporated in a weighed dish and dried to constant weight in an oven at 103 to 105 Deg. C. The increase in weight over that of the empty dish represents the total residue.

**Apparatus**

1. Silica or porcelain dish of 100 ml capacity
2. Desiccators
3. Oven

**Procedure**

Ignite the clean evaporating dish at 550 + 50 Deg. C for 1 hour. Cool, desiccate and weight. Transfer the measured sample to the pre weighed dish and evaporate to dryness on a steam bath. Choose a sample volume that will yield a minimum residue of 25 mg to 250 mg. If necessary, add successive portions of sample to the same dish. Dry the evaporated sample for at least 1 hour at 103 to 105 Deg. C. Cool the dish in desiccators and weigh. Repeat the cycle of drying, cooling and weighing until a constant weight is obtained.

**Calculations**

Total dissolved solids, mg/liter = wt of residue x 1000 ml. Of sample taken

**Fecal Coliforms**

Fecal coliform bacteria are found in the feces of humans and other warm-blooded animals. These bacteria can enter rivers directly or from agricultural and storm runoff carrying wastes from birds and mammals and from human sewage discharged into the water.

Fecal coliform by themselves are not dangerous (pathogenic).

**Pathogenic organisms**

include bacteria, viruses and parasites that cause diseases and illnesses. Fecal coliform bacteria naturally occur in the human digestive tract, and aid in the digestion of food. In infected individuals, pathogenic organisms are found along with fecal coli form bacteria. If fecal coli form counts are high (over 200 colonies/100 ml of water sample) in the river, there is a greater chance that pathogenic organisms are also present. A person swimming in such waters has a greater

chance of getting sick from swallowing disease-causing organisms, or from pathogens entering the body through cuts in the skin, the nose, mouth, or the ears. Diseases and illness such as typhoid fever, hepatitis, and gastroenteritis, dysentery, and ear infections can be contracted in waters with high fecal coli form counts. Pathogens are relatively scarce in water, making them difficult and time-consuming to monitor directly. Instead, fecal coli form levels are monitored, because of the correlation between fecal coli form counts and the probability of contracting a disease from the water.

### Sampling Procedures

1. Remove the stopper or cap just before sampling and avoid touching the inside of the cap.
2. If sampling by hand, use gloves and hold the bottle near its base. Plunge it (opening downward) below the water surface, then turn the bottle underwater into the current and away from you.
3. Avoid sampling the water surface because the surface film often contains greater numbers of fecal coli form bacteria than is representative.
4. Also, avoid sampling the sediments for the same reason, unless this is intended. The same general sampling procedures apply when using the extended rod sampler.
5. When collecting samples, leave some space in the sample container (an inch or so) to allow mixing of the sample before pipetting. It is a good idea to collect several samples from any single location to minimize the variability that comes with sampling for bacteria. If possible, sterilization should occur between sampling sites. *Ideally, all samples should be tested within one hour of collection. If this is not possible, the sample bottles should be placed in ice and tested within six hours.*

Two general types of analyses are possible to enumerate fecal coli forms:

1. MPN - Most Probable Number
2. Membrane Filter - MF

The MPN method attempts, by serial dilution, to introduce one, and only one, bacteria into a fermentation tube containing media for the bacteria to thrive on. By observing gas production or the lack of gas production, it is possible to determine the probable number of bacteria originally present in the sample. In performing the analysis, it is necessary to have five tubes each of at least three decimal dilutions. The goal of the dilution scheme is to have some tubes positive with gas production and some tubes negative or no gas production. The purity of the water under study with experience will determine the decimal dilutions to be used. Dilution of 1, 0.1, and 0.01 ml can be used successfully for a wastewater treatment plant effluent which is within the 200 coli form/100 ml discharge limit for chlorinated effluents.

### Most Probable Number (MPN) Index

By examining different volumes of sample, one-tenth multiples of 1 ml, it is possible to make an approximate estimate of the number of coli form bacteria present in the sample through consideration of the relative numbers of tubes in the various dilutions which yield positive and negative results. The estimation is in the form of a "most probable number index" which essentially is a concentration of coli form bacteria in the sample (expressed as the number of bacteria per 100 ml of sample) which would most probably yield the same combination of positive and negative tubes as obtained in the examination of the sample. For convenience in calculating, the most probable number index table has been prepared. When more than 3 dilutions in a decimal series are examined, the results from only 3 of them are significant. The highest dilution giving positive results in all 5 portions tested and the next 2 succeeding higher dilutions are selected. The results of these 3 dilutions are then used in computing the MPN index. The calculated index will equal the tabular index multiplied by a factor equal to the denominator of the highest dilution giving positive results in all 5 tubes. For example, if all tubes in all dilutions are positive until the 1/1000 dilution is reached, we consider only the 1/1000 and 1/10,000

dilutions as significant. Suppose the results of analysis indicate that the positive tubes for these 3 dilutions are as follows:

1/100 5+ 0-

1/1000 4+ 1-

1/10,000 3+ 2-

The MPN index then equals  $280 \times 1000 = 280,000$  coli form bacteria in 100 ml of the original.

### **Membrane Filter**

The membrane filter technique (MF) is the second method used for the enumeration of fecal coliforms. The membrane filter technique involves passing a portion of sample through a membrane filter. The filter process is designed in such a way as to retain coli form bacteria present in the sample. The entire filter with the retained bacteria is placed on a specially prepared media contained in a petri dish. The petri dish and its content are next incubated for 24 hours at 44.5°C. At the end of the incubation period, the filter is examined with a 10 - 15X stereoscopic or some other optical device. All blue colored colonies on the filter are counted. Each blue colored colony is assumed to be the result of one fecal coli form originally in the sample. From the colony counting procedure and knowing the sample volume filtered, it is possible to calculate the number of fecal coli form/ 100 ml present in the original sample. In comparing the MPN and the Membrane Filter technique it must be remembered that:

1. The MPN is an estimate of the number of fecal coli forms originally presenting the sample while the MF technique results in an exact count.
2. Most of the equipment and supplies needed for the MF technique are available sterile and ready for use from a number of commercial companies.
3. The techniques used in the MF procedure are considered more easily mastered than those used in the MPN.
4. The MF technique has been found to yield low and variable recoveries on samples of chlorinated wastewater when compared to the MPN technique.

Either the MPN or the MF technique can be used for self-monitoring of a wastewater treatment plant effluent; however, the EPA, in promulgating the methods to be used notes "...the MPN will be required to resolve any controversies." In the majority of cases the MF technique will more than satisfy the self-monitoring requirements now in existence with the MPN method being the required method only in unusual circumstances. Samples used for fecal and total coli form analysis should be grab samples collected in sterile containers. The sample must be chilled and the analysis begun within one hour of collection time. The sample must also be dechlorinated at the time of collection.

**Guidelines to fill up the Log Sheet**

1. The Log sheet should be filled up once in every hours
2. Inlet Flow to be measured by bucket method at the outlet of Equalization tank and pressure to be set at Feed Pump discharge
3. Air Blower changeover to be done once in Shift, Oil level of Blower to be checked and changed if required.
4. Air blower suction filter to be cleaned once in a week.
5. Under the columns Air to Eq Tank, Air to Bio Reactor mention 'OK' or 'NOT OK' by seeing visually the air distribution in the respective zones and measuring air to reactors.

**Annexure-V****Inventory**

<b>Inventory of Sewerage Treatment Plant</b>
Given in attached O&M manual
<b>Inventory of Inlet tank, pump room, outgoing tank for residential complex</b>
1. Johnson make 3HP Self-priming non clog pump with D.O.L. starter – 02 nos.
2. Inlet tank & outlet tank
<b>Inventory of water softening system</b>
1. Water softening system comprising M.S. fabricated vertical softener 1800 mm dia. (approx.) and 1800 mm HOS with 8 mm, and 10 mm thickness at dished ends and shell, internal rubberized lining with M.S. rubber lined brine tank of suitable for two regeneration liter capacity with motorized agitator, 65 mm dia. face piping, CI butterfly valves, pressure gauge, hydraulic brine injector, accessories, painting inside with epoxy paint and outside with two coat of red oxide primer and two or more coat of synthetic enamel paint, testing and commissioning complete with resins. Capacity 75000 lph.
2. Providing and fixing rubber lined M.S. tank for salt mixing and brine saturation capacity of 2regeneration as per manufacture's design for main softener.
<b>Inventory of Effluent Treatment Tanks</b>
1. Effluent Treatment Tanks 02 nos. as per drawing attached.

**Annexure-VI  
(FINANCIAL BID)**

**Name of work: Comprehensive Maintenance & operation of 850kLD MBR based Sewerage Treatment Plant including effluent treatment, water softening plant, collecting pit etc. installed at AIIMS, Jodhpur.**

S. No.	Details of items	Qty.	Rate in Rs. per month		Amount (Rs.)
			In figure	In words	
1.	Comprehensive Maintenance & operation of 850kLD MBR based Sewerage Treatment Plant including effluent treatment, water softening plant, collecting pit etc.	12 months			
<b>Total Amount In Figure</b> (Inclusive of all Taxes and Other Charges)					

1. I/We have gone through the terms & conditions and special conditions of contract as stipulated in the tender enquiry document and confirm to accept and abide the same.
2. The service provider shall take into account all the costs involved in compliance of all the conditions as stated above while quoting his rates in tender.
3. No other/extra charge would be payable by the Institute other than quoted in the rate.
4. The relevant Indian Standards / pollution control board guidelines related to the work must be followed

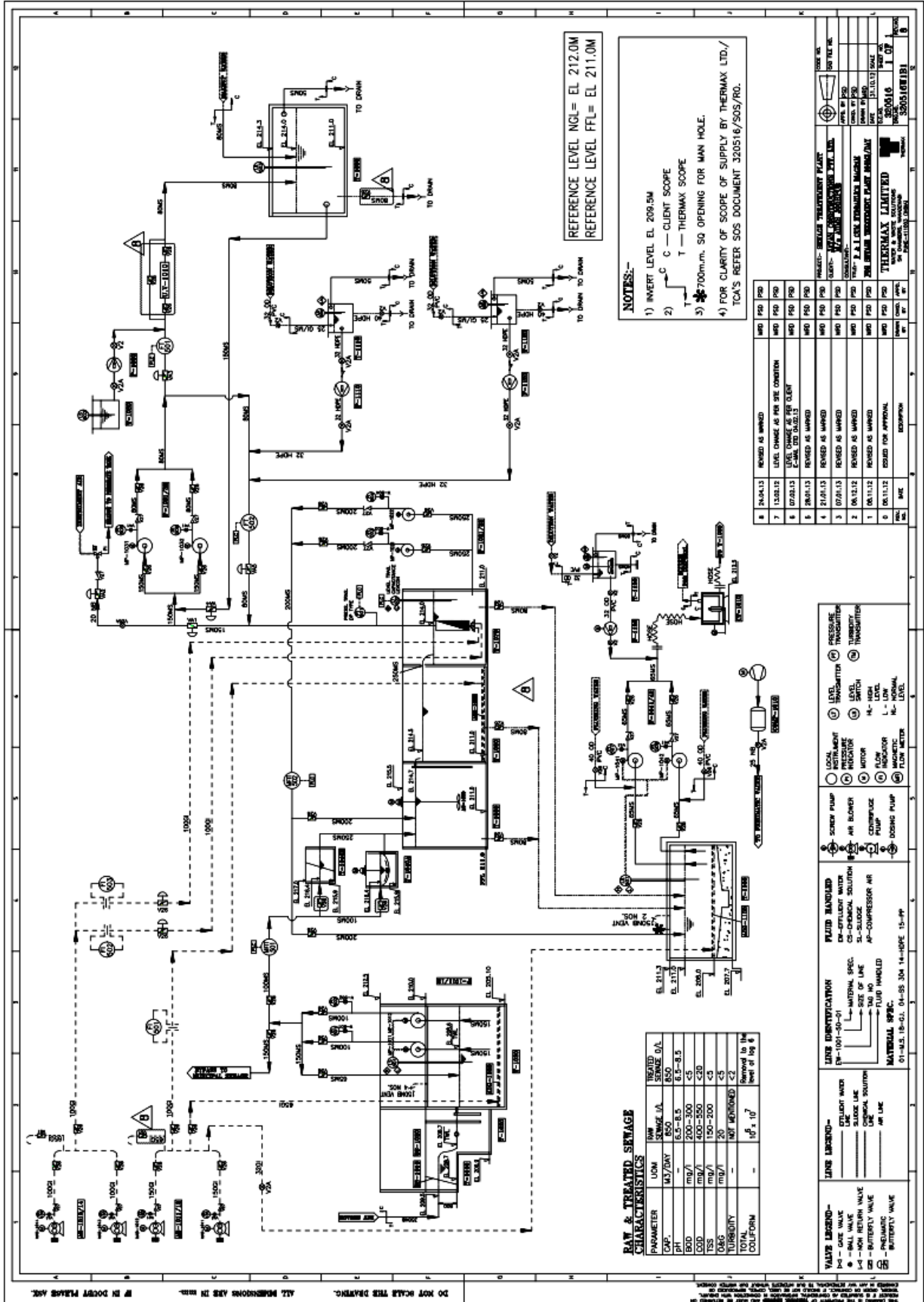
Date:  
Place:

Name :  
Business Address :  
Signature of Bidder :  
Seal of the Bidder :



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**RAW & TREATED SEWAGE CHARACTERISTICS**

PARAMETER	UNIT	RAW SEWAGE	TREATED SEWAGE
CAP.	M <sup>3</sup> /DAY	850	850
BOD	mg/l	6.5-8.5	6.5-8.5
COD	mg/l	200-300	<5
TSS	mg/l	400-500	<20
URBILITY	mg/l	150-200	<5
TOTAL COLIFORM	10 <sup>6</sup> x 10 <sup>7</sup>	NOT REQUIRED	NOT REQUIRED

**NOTES:-**

- 1) INVERT LEVEL EL 209.5M
- 2) C - CLIENT SCOPE
- 3) T - THERMAX SCOPE
- 4) FOR CLARITY OF SCOPE OF SUPPLY BY THERMAX LTD./ TCA'S REFER SOS DOCUMENT 320516/SOS/RO.

REFERENCE LEVEL NGL= EL 212.0M  
REFERENCE LEVEL FFL= EL 211.0M

NO.	DATE	DESCRIPTION	BY	CHKD.
1	08.11.12	ISSUED FOR APPROVAL		
2	08.11.12	REVISED AS MARKED		
3	07.01.13	REVISED AS MARKED		
4	21.07.13	REVISED AS MARKED		
5	07.02.13	LEVEL CHANGE AS PER CLIENT		
6	07.02.13	LEVEL CHANGE AS PER CLIENT		
7	15.02.13	LEVEL CHANGE AS PER SITE CONDITION		
8	08.04.13	REVISED AS MARKED		

**VALVE LEGEND:-**

- BALL VALVE
- HIGH RETURN VALVE
- BUTTERFLY VALVE
- ◇ PNEUMATIC BUTTERFLY VALVE

**LINE LEGEND:-**

- EFFLUENT WATER
- SLOPE LINE
- ORIGINAL SOLUTION
- NEW LINE

**LINE IDENTIFICATION**

DN-101-01-01

MATERIAL SPEC. SIZE OF LINE TM IN Ø

FLUID HANDLED

01-02, 18-01, 04-05, 304 14-002 15-04

**FLUID HANDLED**

- LOCAL INSTALLMENT
- FLOW METER
- MAGNETIC FLOW METER
- MOTOR
- HIGH
- LOW
- NORMAL
- TRANSDUCER
- PRESSURE TRANSDUCER
- TRANSDUCER

**SCREW PUMP**

- AIR BLOWER
- COMPRESSOR PUMP
- DOSEING PUMP

**LOCAL INSTALLMENT**

- FLOW METER
- MAGNETIC FLOW METER
- MOTOR
- HIGH
- LOW
- NORMAL
- TRANSDUCER
- PRESSURE TRANSDUCER
- TRANSDUCER

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LIST OF CIVIL UNITS

TAG. NO.	DESCRIPTION	SIZE/CAP.	QTY.
T-1010	COARSE BAR SCREEN	0.8 x 1.8 x 0.8M SWD	1NO.
T-1020	OIL & GREASE TRAP	5.45x 1.8 x 1.8M SWD	1NO.
T-1030	EQUALIZATION TANK	9.4 x 6.5 x 3.5M SWD	1NO.
T-1040A	FINE BAR SCREEN-AUTO	1.0 x 1.0 x 0.5M SWD	1NO.
T-1040B	FINE BAR SCREEN-MANUAL	1.0 x 1.0 x 0.5M SWD	1NO.
T-1050	ANOXIC TANK	4.4 x 4.4 x 3.7M SWD	1NO.
T-1060	BIO REACTOR	8.1 x10.0 x 3.5M SWD	1NO.
T-1070	MEMBRANE TANK (GE MEM)	3.1 x 4.4 x 3.0M SWD	1NO.
T-1090	PERMEATE TANK	4.4 x 4.4 x 3.0M SWD	1NO.
T-1100	SLUDGE HOLDING TANK	2.95x 2.6 x 3.0M SWD	1NO.
-	SPACE FOR CENTRIFUGE	SUITABLE	1NO.

MECHANICAL UNIT DETAIL FOR 850M3/DAY (MBR)

Sr. NO.	DESCRIPTION	MARK	SIZE / CAPACITY	NOS. OFF.
1	BAR SCREEN 6MM	BS-1010	TL STD.	1 NO
2	SLOTTED PIPE OIL SKIMMER	OS-1020	TL STD.	1 NO
3	AIR GRID - EQUALISATION TANK	AG-1030	TL STD	1 LOT
4	DIFFUSER	-	TL STD	1 LOT
5	BIO REACTOR FEED PUMPS	P-1011/12	35.5M3/HR@12MWC	2 NOS
6	FINE SCREEN (AUTO) 2MM	BS-1040A	TL STD	1 NO
7	FINE SCREEN (MANUAL) 2MM	BS-1040B	TL STD	1 NO
8	AIR BLOWER FOR EDT, SHT & BIO REACT.	AB-1011/12	650M3/HR@5400MMWC	2 NOS
9	AIR BLOWER FOR MEMBRANE	AB-1013/14	450M3/HR@4000MMWC	2 NOS
10	AGITATOR FOR ANOXIC TANK	AG-1050	SUITABLE	1 NO
11	AIR GRID FOR - BIOREACTOR	AG-1060	TL STD.	1 LOT
12	DIFFUSER	-	TL STD	1 LOT
13	MEMBRANE	MEM-1070	SUITABLE	1 LOT
14	MEMBRANE SKID	-	SUITABLE	1 NO
15	SLUDGE RECIRCULATION PUMPS	P-1021/22	142M3/HR@10MWC	2 NOS
15	PERMEATE PUMPS (WITH VFD)	P-1031/32	38-45M3/HR@10MWC	2 NOS
16	HYPD DOSING TANK	T-1080	150 LITS	1 NO
17	HYPD DOSING PUMP	P-1080	6 LPH	1 NO
18	UV SYSTEMS	UV-1010	SUITABLE FOR 36M3/HR	1 NO
19	AIR GRID SLUDGE HOLDING TANK	AG-1100	TL STD.	1 LOT
20	DIFFUSER	-	TL STD	1 LOT
21	CENTRIFUGE FEED PUMPS	P-1041/42	5.0M3/HR@14 MWC	2 NOS
22	CENTRIFUGE (BATCH TYPE)	CF-1010	45KG PER BATCH SOLID HANDLING CAPA.	1 NO
23	DWPE DOSING TANK	T-1130	300 LITS	1 NO
24	DWPE DOSING PUMP	P-1130	0-50 LPH	1 NO
25	AGITATOR FOR DWPE DOSING TANK	AG-1130	SUITABLE	1 NO
26	AIR COMPRESSOR WITH DRYER	COMP-1010	2 CFM/70MWC	1 NO
27	HYPD DOSING TANK FOR MAINTENANCE	T-1110	300 LITS	1 NO
28	HYPD DOSING PUMP FOR MAINTENANCE	P-1110	150 LPH@2BAR	1 NO
29	CITRIC DOSING TANK FOR MAINTENANCE	T-1120	300 LITS	1 NO
30	CITRIC DOSING PUMP FOR MAINTENANCE	P-1120	150 LPH@2BAR	1 NO

NO.	DATE	REVISION	BY	CHKD BY	APPD BY
1	11/11/12	ISSUED FOR APPROVAL			
2	04/11/12	REVISED AS MARKED			
3	07/01/13	REVISED AS MARKED			
4	21/01/13	REVISED AS MARKED			
5	28/01/13	REVISED AS MARKED			
6	07/02/13	LEVEL CHANGE AS PER CLIENT E-MAIL DTD 04/02/13			
7	13/02/13	LEVEL CHANGE AS PER SITE CONDITION			
8	04/04/13	REVISED AS MARKED			

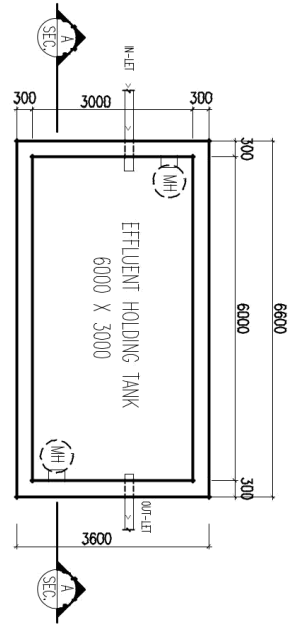
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 CLIENT: **INDIAN THERMOFLUENT PLANT**  
 CONTRACT NO.: **INDIAN THERMOFLUENT PLANT**  
 DRAWING NO.: **INDIAN THERMOFLUENT PLANT**  
 DATE: **11/11/12**  
 SCALE: **AS SHOWN**  
 THERMAX LIMITED  
 1000, 10th Floor, 10th Cross, 10th Main, 10th Stage, 10th Block, 10th Sector, 10th Phase, 10th City, 10th State, 10th Country.

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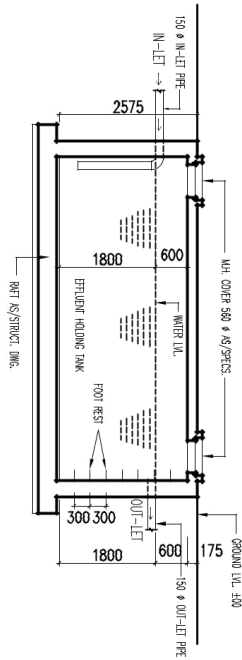
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DO NOT SCALE THIS DRAWING. ALL DIMENSIONS ARE IN MM. IN DOUBT PLEASE ASK.

ARCHITECTURAL DETAILS



EFFLUENT HOLDING TANK PLAN  
(SCALE 1:100)



EFFLUENT HOLDING TANK SECTION-AA

NOTE :-  
REFER SEWERAGE LAYOUT Dwg. NO. SW-001, PART-1, 2, & 3.  
FOR LOCATION OF EFFLUENT HOLDING TANK (E.H.T.)

AIMS AT JODHPUR

NOTES :-

NO.	DATE	REVISION

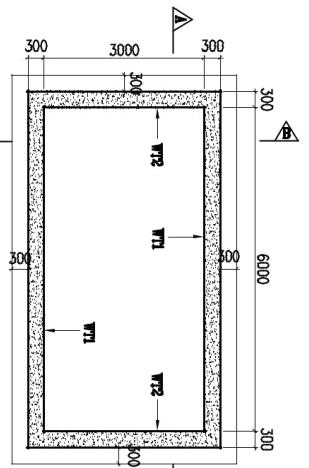
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DATE	1/25	PROJECT NO.	3W-015
DATE	1/25	PROJECT NO.	3W-015

CONSULTANT  
Ministry of Health & Family Welfare

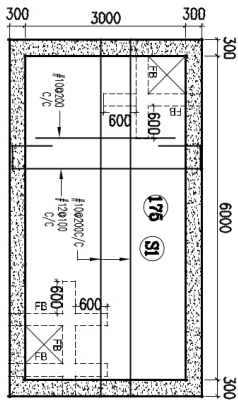
PROJECT  
AIMS AT JODHPUR  
EFFLUENT HOLDING TANK  
PLAN AND SECTION

DATE	1/25	PROJECT NO.	3W-015
DATE	1/25	PROJECT NO.	3W-015
DATE	1/25	PROJECT NO.	3W-015

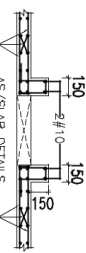
STRUCTURAL DETAILS



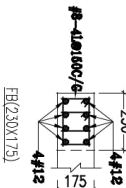
EFFLUENT HOLDING TANK BOTTOM PLAN



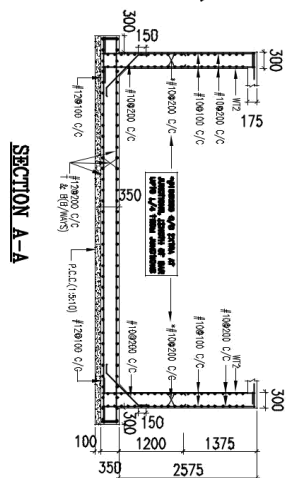
EFFLUENT HOLDING TANK TOP PLAN



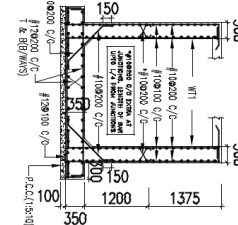
TYPICAL MANHOLE DETAILS



AS/SLAB DETAILS



SECTION A-A



SECTION B-B

- NOTES FOR WATER TANK
1. THIS DRAWING IS NOT TO BE SCALED.
  2. DIMENSIONS SHOWN IN MM EXCEPT OTHERWISE SPECIFIED.
  3. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH RELEVANT ARCH. DRAWINGS & SPECIFICATION.
  4. ALL DIMENSIONS SHALL BE TO FACE UNLESS OTHERWISE SPECIFIED.
  5. ONLY A/AS GRADE CONCRETE OF APPROVED QUALITY SHALL BE USED.
  6. F & S REINFORCEMENT SHALL BE PROVIDED TO IS: 1786-1986.
  7. WATER TANK SHOULD BE PROVIDED WITH WATER TIGHTNESS TEST.
  8. WATER TIGHTNESS TEST SHALL NOT BE ALLOWED TO EXCEED 0.50 CM OF WATER PER SQ. M OF AREA.
  9. (REPAIR) PASTORER OF A REPAIR COMPANY SHALL BE - 3706/CMJ.
  10. CONCRETE SHALL BE - M-35 (MIN. CEMENT CONTENT SHALL BE - 3706/CMJ).
  11. SLAB COVER TO THE MAIN REINFORCEMENT SHALL BE - 25MM.
  12. SLAB BOTTOM COVER SHALL BE - 50 MM.
  13. ALL CONSTRUCTION JOINTS SHALL BE PROVIDED IN ALL CONSTRUCTION JOINTS.