



TAMIL NADU POLLUTION CONTROL BOARD



Circular Memo No. T5/TNPCB/F.6758/2025 dated: 02.01.2025

Sub: TNPC Board –Industrial sector units having Zero Liquid Discharge (ZLD) system
– Revised Guidelines to be followed for checking the adequacy of RO and RMS
in the ZLD system - Issued – Reg.

Ref:

1. Board Memo No.T2/TNPCB/6758/Textile/2010 dated 12.03.2010.
2. Board Memo No.T2/TNPCB/6758/Textile/2020 dated 31.12.2020.
3. Technical presentation held on 30.12.2024 via VC meeting with all the JCEE-(M)s /DEEs/HODs of the Board.

The Board in its memo under reference first cited has issued certain instructions including criteria suggested to verify the adequacy of Reverse Osmosis (RO) and Reject Management System (RMS) in order to have uniformity in enforcing and monitoring of textile processing industries having ZLD system.

Industrial units including Textile Processing and other Industrial sector units treat their trade effluents in a sequence of Primary, Secondary, Biological Treatment system followed by Tertiary treatment system components viz.RO Plant, Multiple Effect Evaporator and Agitated Thin Film Dryer (ATFD) so as to achieve zero discharge of effluent.

Now-a-days, Best Available Technology (BAT) treatment options are emerging, necessitating the Board to provide detailed information on the efficiency and checking the adequacy of Reverse Osmosis and Reject Management System in ZLD at various stages by issuing suitable guidelines to ensure uniformity in enforcement and monitoring of the ZLD units across the State.

In this regard, a technical presentation held on 30.12.2024 via VC meeting with all the JCEE(M)s/ DEEs/HODs of the Board, during which it has been decided by the Board to issue the guidelines to be followed for checking the adequacy of RO and RMS which are enclosed herewith vide Annexure –I & II.

These guidelines are basic and indicative only to aid the inspecting officials to act according to the advanced/latest technologies available in the field from time to time.

This circular memo shall be communicated to all the Engineers working under their control for monitoring and to furnish the ZLD adequacy check slips for the ZLD systems along with inspection reports to the Board regularly for the ZLD units of all sectors.

The guidelines prescribed in the annexure are subject to modification due to the advancement or latest technologies available in the filed from time to time for revision periodically whenever necessity arises.

The receipt of this circular memo shall be acknowledged.

Encl. Annexure- I & II

J. S. Kumar
2/11/2025

For Chairperson

To

All the District Environmental Engineers of the Board

All the Joint Chief Environmental Engineer-(M)s of the Board

All the Environmental Engineers and Environmental Engineer (FS) of the Board

Copy to the HODs of the Board for information.

Om
02-01-2025

Copy to PS to Chairperson

Copy to PA to MS

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Annexure-I

I. Guidelines to be followed for checking the adequacy of Ultra Filtration(UF)/ Micro Filtration(MF), Nano Filtration(NF) and Reverse Osmosis (RO) System in the ZLD System.

1. Adequate pre-treatment membrane filtration systems using spiral wound membranes (SW) to remove finer particles, Total Suspended Solids (TSS) and other colloidal particles in the inlet water entering RO system so as to reduce the fouling on the membranes and increase life of the membranes of the RO system.
2. The pre treatment membrane filtration systems of either UF or MF shall be provided for the removal of TSS and other colloidal particles as pre treatment system prior to the inlet of RO the ZLD system.
3. The indicative Inlet parameters to be maintained for the **UF/MF system** are as follows:-
 - i. pH – 6.5 to 7.5
 - ii. TSS < 50 mg/L
 - iii. COD < 200 mg/L
 - iv. Total Hardness < 150 mg/L
 - v. Silica < 5 mg/L
 - vi. Iron < 0.1 mg/L and
 - vii. Oil & Grease < 0.1 mg/L.

4. Specific data of **Permeate production capacity** of UF/MF system.

Pre treatment system	Membrane Size (")	Permeate Recovery capacity (Litres/hr)	Recovered Permeate Quantity (%)	Reject Quantity (%)	Back wash quantity (%)
Ultra Filtration	8" Dia x 60" L	2000	85% To RO I-feed	10% To ETP collection Tank	5% To ETP collection Tank
	8" Dia x 80" L	3500			
Micro Filtration	6.5"Dia x 87.2" L	1700	85% To RO I-feed	10% To MF feed	5% To ETP collection Tank

5. The indicative inlet parameters to be maintained for **RO system** is as follows.

- i. pH – 6 to 7
- ii. TSS < 1 mg/L
- iii. COD < 150 mg/L
- iv. Total Hardness < 150 mg/L
- v. Silica < 5 mg/L
- vi. Iron < 0.1 mg/L
- vii. Oil & Grease < 0.1 mg/L

6. Specific data of **feed processing capacity** of in RO / NF system.

RO (SW) membranes (")	Feed capacity in RO – Stage – I (Litres/Hour)	Feed Capacity in RO– Stage- II (Lit/Hour)	Feed capacity in RO–Stage –III (Litres/Hour)	Feed capacity in RO – Stage – IV (Litres/Hour)
8" Dia x 40" L	1000	750	600	500
4" Dia x 40" L	250	200	150	100
NF (SW) membranes	Feed capacity (Litres/Hour)			
8" Dia x 40" L	1000			

7. Specific data of RO/ NF permeate and reject quantity.

Stage of RO	Permeate Quantity (%)	Reject Quantity (%)
RO – Stage - I	65% (Reuse)	35% to RO II- feed
RO – Stage - II	45% (Reuse)	55% to RO III- feed
RO – Stage - III	35% (Reuse)	65% to RO IV- feed
RO – Stage - IV	25% (Reuse)	75% to RMS
Nano Filtration	60 %	40 %

Note: In some cases, RO system membranes are designed using software that considers the characteristics of primary treated effluent, membrane type, flow and recovery rate. This approach is followed for proposing advanced technological membranes in secondary effluent treatment. In that case, output data from the membrane software must be furnished to the Board for approval and maintained in log books for the RO system.

8. EMFMs shall be provided in the following locations.

- i) ETP Inlet
- ii) ETP Outlet
- iii) UF/MF Inlet
- iv) UF/MF Permeate
- v) UF/MF Reject
- vi) UF/MF Backwash
- vii) RO Inlet (every stage)
- viii) RO Permeate (every stage)
- ix) RO Reject (every stage)
- x) NF Inlet
- xi) NF Permeate
- xii) NF Reject
- xiii) Combined Permeate for process reuse and
- xiv) Brine for process reuse.

9. The EMFMs should not have an on/off switch attached to it and the whenever the motor is switched on, the EMFMs must start functioning without any interruption.

10. Separate Energy meter shall be provided for the following systems.

- i) UF/MF ii) NF and ii) RO.

11. All the EMFM/EM shall be interfaced with online continuous effluent monitoring system so that the readings are recorded continuously

12. The maximum hours of operation of RO system can be taken as 20 hours per day.

13. The TDS levels and the mass balance of the membrane systems shall be checked using the following formula.

$$\text{Feed Qty X Feed TDS} = (\text{Permeate Qty X Permeate TDS}) + (\text{Reject Qty X Reject TDS})$$

(Lit/Day) (mg/L) (Lit/Day) (mg/L) (Lit/Day) (mg/L)

14. The quantity of total dissolved Salts present in the system per day shall be calculated using the following formula.

$$\text{Total Salt in Kg/Day} = \text{Feed TDS level (mg/L)} \times \frac{\text{Total flow (Lit/Day)}}{10^6}$$

Annexure-II

II. Guidelines to be followed for checking the adequacy of Reject Management System (RMS) - Evaporator and ATFD in the ZLD System.

1. Total reject quantity shall be taken as twice that of the actual quantity of RO rejects generated or from the other sources as its capacity for RMS design purpose.
2. Specific data on the Condensate quantity, Reject Quantity and the indicative inlet parameters of the Evaporators and ATFD.

Evaporator types/ ATFD	Condensate Quantity	Reject Quantity	Inlet parameters
Falling Film Evaporator (FFE) only	80% Condensate (Reuse)	20% Reject to ATFD	TDS < 1,50,000 mg/L Hardness < 600 mg/L Silica < 50 mg/L pH- 7 to 8
Forced Circulation Evaporator (FCE)	80% Condensate (Reuse)	20% Reject to ATFD	TDS - No limitations Hardness- No limitations Silica- No limitations pH - 7 to 8
Combined Falling Film and Forced Circulation Evaporator(CFF and FC)			
Agitated Thin Film Drier (ATFD)	66.66% Condensate (Reuse)	33.33% Solids-Mixed Salt Storage	TDS- Min.2,00,000 mg/L pH - Above 7

3. Based on the total reject quantity of RMS, following indicative adequate capacity of Evaporator systems with stages and ATFD shall be provided for optimum efficiency and use.

TOTAL REJECT QUANTITY	EVAPORATOR SYSTEM			ATFD	
	No of stages	Inlet TDS Range	Reject TDS Range	Inlet TDS Range	Outlet Salt Range
< 5 KLD	Min 1	Min 10,000 mg/L	Min 2,00,000 mg/L	Min 2,00,000 mg/L	Mixed Salt with 5 – 10 % moisture
5 KLD to 15 KLD	Min 2	Min 10,000 mg/L	Min 2,50,000 mg/L	Min 2,50,000 mg/L	
15 KLD to 75 KLD	Min 3	Min 10,000 mg/L	Min 2,75,000 mg/L	Min 2,75,000 mg/L	
75 KLD to 150 KLD	Min 4	Min 10,000 mg/L	Min 3,00,000 mg/L	Min 3,00,000 mg/L	
150 KLD & Above	Min 5	Min 10,000 mg/L	Min 3,50,000 mg/L	Min 3,50,000 mg/L	

4. Based on the total reject quantity of RMS, the following indicative adequate Evaporator systems with ATFD & corresponding capacity of Boiler or Thermic Fluid heater shall be provided for optimum energy efficiency and use.

<u>TOTAL REJECT QUANTITY</u>	<u>EVAPORATOR SYSTEM WITH ATFD</u>	<u>Maximum Steam Energy requirement from steam Boiler</u>	<u>Thermic Fluid heat Energy requirement from Thermic Fluid heater</u>
< 5 KLD	Single stage Evaporator with ATFD	250 Kg/Hour	1.5 Lakhs Kcal/Hr
5 KLD to 15 KLD	Minimum Double Stage Evaporator with ATFD	150-375 Kg/Hour	1 - 2 Lakhs Kcal/Hr
15 KLD to 75 KLD	Minimum Triple stage Evaporator with ATFD	250-1250 Kg/Hour	1.5 - 7 Lakhs Kcal/Hr
75 KLD to 150 KLD	Minimum Four stage Evaporator with ATFD	940-1850 Kg/Hour	5 - 10 Lakhs Kcal/Hr
150 KLD & Above	Minimum Five stage Evaporator with ATFD	1500 Kg/Hour & above	8.5 Lakhs Kcal/Hr & above

Note: Fuels (Fire wood/Briquettes/Coal/LPG/NG/ Diesel/Furnace Oil) having lower operating cost shall be utilised for the operation of either Steam Boiler or Thermic Fluid Heater.

5. Electro Magnetic Flow Meter (EMFM) shall be provided in the following locations. i) MEE Feed, ii) MEE Condensate, iii) MEE Reject, iv) ATFD Feed and v) ATFD Condensate.
6. Separate Energy meter (EM) shall be provided for the following systems. i) Steam Boiler/Thermic Fluid Heater, ii) Evaporator and ii) ATFD.
7. Vortex Steam Flow meter (SFM) shall be provided at the inlet of Evaporator and ATFD to measure the steam energy utilised for RMS.
8. Adequate capacity of Oil pump shall be provided in the Thermic Fluid Heater as per the requirement so as to achieve the desired efficiency of Thermic Fluid heat Energy to utilise in the Evaporator and ATFD.
9. All the EMFM /EM/ SFM shall be interfaced with online continuous effluent monitoring system so that the readings are recorded continuously.
10. The maximum hours of operation of RO and RMS system can be taken as 20 hours per day.
11. The quantity of total Salt which can be recovered as mixed salt from ATFD for disposal shall be calculated using the following formula.

$$\text{Total Salt in Kg/Day} = \frac{\text{Feed TDS level into ATFD (mg/L)} \times \text{Total flow (L/Day)}}{10^6}$$

For Chairperson