ELBE EUT — ENGINEERING GUIDE

ZLD System Design Guide

Module Selection & Sizing for Zero Liquid Discharge

Technical White Paper · 2026 Edition

1. Zero Liquid Discharge Objectives

Zero Liquid Discharge (ZLD) eliminates liquid effluent from an industrial site by recovering nearly all feed water as reuse-grade permeate and converting the residual concentrate into solid salt. Coal-to-chemicals, pulp & paper, and thermal power operators increasingly mandate ZLD under environmental permits.

2. ELBE EUT ZLD Architecture

A typical ELBE EUT ZLD train integrates: (1) pre-treatment — PP tubular membrane or chemical softening; (2) high-recovery concentration — DTRO/DTNF up to 90 bar; (3) brine crystallisation — mechanical vapour compression (MVC) or spray drying. Overall water recovery exceeds 98 %, with the balance leaving as dry solids.

3. Module Selection Matrix

Stream characteristic	Recommended module
High suspended solids / oil	PP tubular membrane (MF/UF)
High salinity, moderate COD	DTNF (nanofiltration)
High salinity + high COD	DTRO (reverse osmosis)
Saturated brine / concentrate	DTRO @ 90 bar + MVC

4. Sizing Workflow

Step 1 — Characterise feed: TDS, COD, SS, hardness, oil & grease, temperature.

Step 2 — Set target recovery and permeate quality from the discharge/reuse spec.

Step 3 — Select pre-treatment and membrane stages using the matrix above.

Step 4 — Size concentrate handling (evaporator / crystalliser) for the residual 2 – 10 %.

Step 5 — Validate with pilot trial; ELBE EUT offers containerised pilot DTRO units.

Engineering support: https://x.com/huihuapp