

# Esmil Membrane Systems

Effective and robust effluent treatment systems based on membrane separation processes.



## Esmil Membrane Systems

- For water and wastewater treatment, industrial effluent treatment, product recovery, ultrapure water applications.
- High recovery rates and application of best available technologies to ensure high reliability, ease of maintenance, low operating costs.
- Membrane systems carefully designed for your complex wastewater applications.
- Fine tuning and custom design of the membrane plants.
- Sustainable systems that recover water and products achieving your Zero-discharge process.
- Pre-assembled and containerised skids for different applications, suitable for different standards and requirements (ASME, DNV, Hazardous Areas Class I / Zone I, Class II / Zone II).



Esmil designs and fabricates effluent treatment systems based on a membrane separation processes which can be effectively introduced into the whole treatment process.

## Discover Next-Level Effluent Treatment Systems with Esmil

Effluent treatment solutions have evolved to address a wide array of separation, concentration, and recovery needs in different sectors and applications. However, maximising efficiency while minimising costs remains paramount. At Esmil, we specialise in developing unique membrane systems that not only meet but exceed these demands.



### Experience and Expertise

With 40+ years of industry experience and unparalleled knowledge, we leverage our expertise to craft customised membrane solutions tailored to your specific requirements.

### Precision Engineering

Our individualised approach ensures that each system is meticulously designed to be both effective and efficient, eliminating overdesign and providing user friendly systems and process reliability for our customers.

### Fabrication Facilities

With our own fabrication facilities, we have the flexibility to design, produce and adjust membrane skids and their components in-house. This also allows us to maintain strict quality control standards and provide timely servicing and support to our customers.

### Market Monitoring and Improvement

We are constantly monitoring the market for suppliers of unique membrane solutions, including vibratory systems and membranes made of specific materials, and test them. This allows us to stay at the forefront of innovation, constantly improving and developing our systems to maintain our competitive edge in the industry.

### Smart Automation

Our advanced control systems intelligently manage membrane plant operation and cleaning regimes, optimising performance, reducing operating expenses and prolonging membrane lifespan.

### Innovation and Sustainability

Through continuous research and development of solutions in laboratory or on-sites, we are dedicated to enhancing value for businesses by promoting by-products recycling, achieving zero discharge and fostering sustainability.

### Cutting-Edge Technology

By combining conventional methods with state-of-the-art membranes, and partnering with leading suppliers of ultrafiltration (UF), nanofiltration (NF) and reverse osmosis (RO) membranes, we deliver unparalleled performance even for the most challenging effluents.



Experience the Difference: Partner with Esmil for innovative, cost-effective, and sustainable effluent treatment solutions that redefine industry standards. Contact us today to unlock the full potential of your wastewater treatment needs.

## Range of applications

- Anaerobic digestate treatment.
- Oil&Gas Industry effluents.
- Power plants and mining applications.
- Landfill leachate treatment.
- MDF wastewater treatment and product recovery systems.
- Food processing Industry applications.
- Clean and ultrapure water systems.
- Metal processing Industry applications.
- Product recovery for chemical and pharmaceutical Industry effluents.

## Key features

- High process and system reliability.
- Customised design.
- Fine-tuned software.
- High recovery rate.
- Zero discharge process.
- Long lifespan of membranes with right pretreatment & cleaning regime.
- Compliance with Various Industry Regulations (ASME, ATEX/Ex, DNV, etc.)
- Modular design.

## Esmil Membrane Plant and main parts

### Valves

- Ball / Butterfly / Globe
- Connections - Flanged / Wafer / Threated / Butt welded
- Actuators - Pneumatic / electrical

### Housings

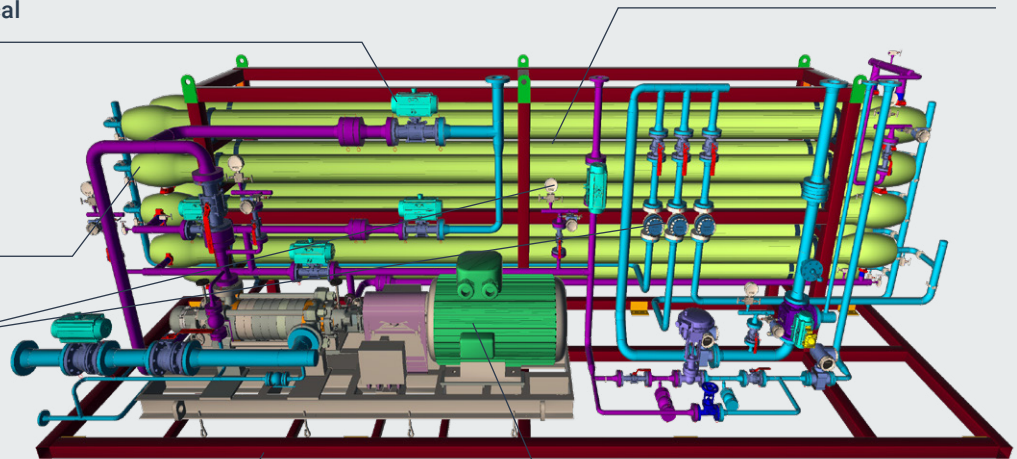
Material - FRP; SS / Rating - upto 1200 psi / Ports - End or Side / Size 2540; 4040; 8040 / Length - upto 8 elements

### Instruments

- pH, Conductivity, ORP analysers / Pressure & Level transmitters / Flow Meters
- Makes - E&H / Yokogawa / WIKA / ABB
- Duty - ATEX / IP55 / IP65

### Membranes

UF; NF; RO / Make - All major makes to suit the process specific requirements. Typically selected based on the pilot study results for waste water applications



### Skids

Customised /pre-assembled & pre-wired / Hydrottested / Software - Preloaded & Tested with Simens or Allan Bradley PLC /Material - CS Epoxy Coated / SS

### High Pressure Pump

Multistage / Pressure upto 70 barg / Material-SS to DSS / Std - Centrifugal / ISO / API

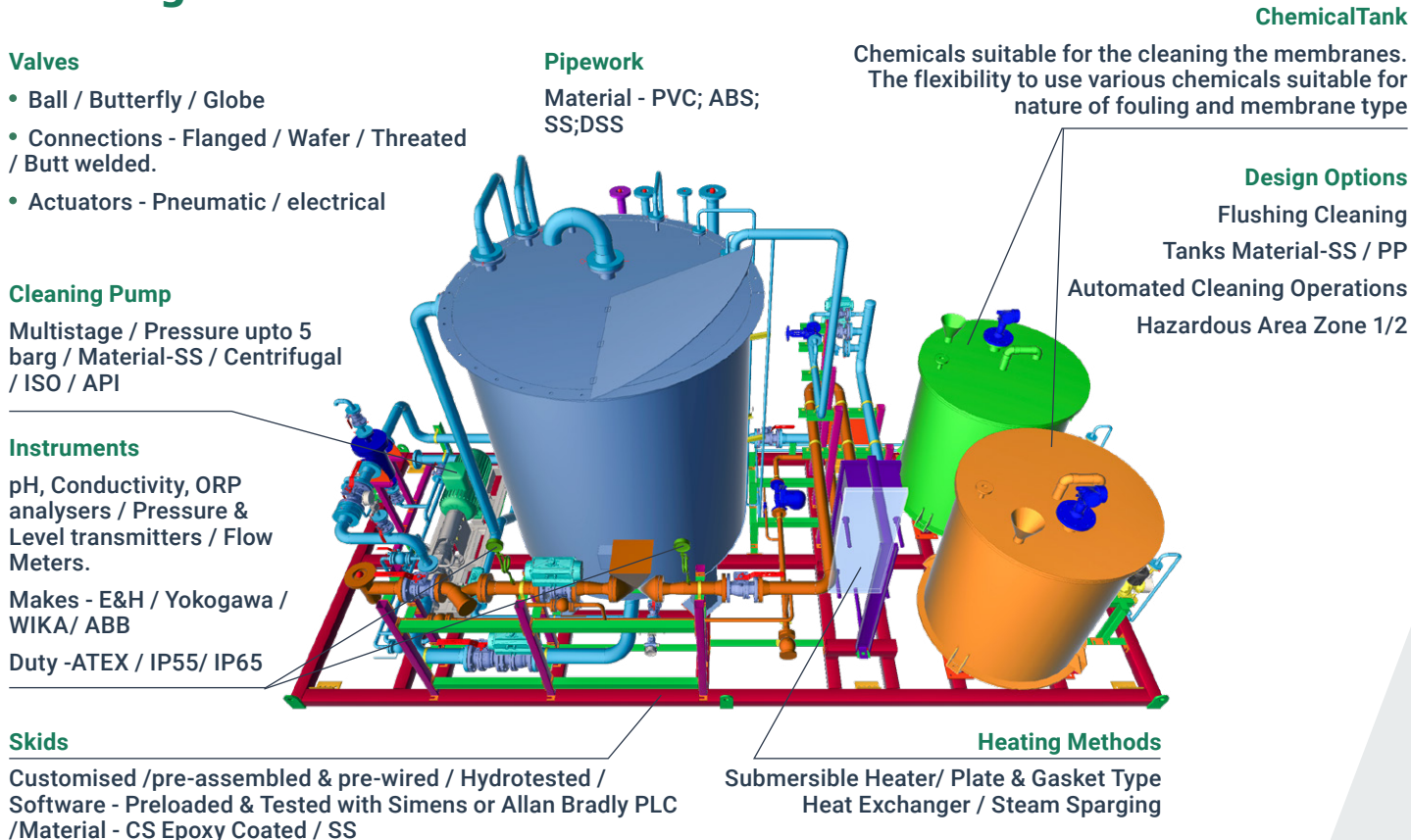
### Pipework

Material - PVC; ABS; SS; DSS

### Design Options

- Christmas Tree/ Feed & Bleed
- High Recovery
- Constant Pressure
- Constant Flow
- Multistage: up to 4 stagesv
- Automated Service & Cleaning Operations
- Hazardous Area Zone 1/2
- Modular Design for Future Expansion

## Esmil CIP membrane cleaning system to ensure reliable operation and long membrane lifetime



## Esmil Membrane Skids



At Esmil, we utilise a range of membrane technologies for membrane skids. Our solutions include classic **Reverse Osmosis (RO), Ultrafiltration (UF), Nanofiltration (NF) membranes as well as special membrane systems such as Vibratory Shear Enhanced Processing (VSEP), zwitterionic (ZI)**, stainless steel, ceramic and special ultrafiltration membranes. RO membranes are applied when

dissolved solids need to be separated or concentrated, while UF membranes can effectively remove almost all suspended solids and pathogens. NF membranes offer selective removal of divalent ions, organic compounds and contaminants, while VSEP membranes employ vibratory shear to enhance separation efficiency on the feed with presence of solids thus giving more flexibility for the process design.

**Reverse Osmosis (RO)** technology, utilised in our Esmil Membrane Systems for Wastewater Treatment, is a highly efficient separation process that uses a semi-permeable membrane to separate water molecules from dissolved solids and contaminants. **By applying high pressure, RO membranes effectively remove a wide range of impurities, including salts, heavy metals, bacteria, and organic compounds, resulting in high quality water.** With its ability to achieve high contaminant removal rates and consistent quality permeate, RO technology is an essential component in ensuring the success of treatment processes.

**Zwitterion Reverse Osmosis (ZIRO) membranes**, utilised by Esmil for high organics feed applications, provides high degree of fouling resistance towards organics inhibiting formation of biolayer by microorganisms and organic materials on membrane surface. Thus membrane elements can provide stable performance even for high-fouling organics streams. The membrane cleaning could be done just with hot water. The chemical cleaning requirements is 10 times lesser than the standard membranes and using inexpensive standard cleaners, which means lower chemical consumption and longer membrane life.

**ULTRAFILTRATION (UF)** technology, utilised in Esmil Membrane Systems, is a versatile filtration method that effectively **removes suspended solids and high molecular weight organics (> 1000 Daltons) from wastewater**. UF selectively allows water and dissolved solids to pass through while retaining particles and macromolecules. This results in high water clarity free of pathogens, making UF an essential step in achieving high-quality treated water or to concentrate the solids for a further product recovery stage.

**NANOFILTRATION (NF)** technology utilised in Esmil Membrane Systems for Wastewater and Industrial Effluents Treatment, is a specialised separation **process that offers selective removal of specific larger ions and other molecules (mainly organic compounds)**. **With a pore size between that of reverse osmosis and ultrafiltration, NF membranes effectively separate dissolved substances based on size and charge**. This results in improved water quality by reducing hardness, color, and certain contaminants, while still allowing smaller ions to pass through. NF technology is particularly beneficial in applications where targeted removal of specific contaminants or adjustment of water chemistry is required for optimal water quality.

**VIBRATORY SHEAR ENHANCED PROCESSING (VSEP)** membranes, utilised in our Esmil Membrane Systems for Wastewater Treatment, offer a unique approach to separation and filtration. VSEP technology employs vibratory shear forces to enhance the efficiency and effectiveness of the membrane separation process. By applying controlled vibrations, VSEP membranes can achieve higher separation rates, reduced fouling, and improved overall performance working with different membrane types (e.g. UF, NF or RO). This innovative technology is particularly effective in treating challenging wastewater streams with high solids content, oil and grease, and difficult-to-separate substances, providing superior results in terms of separation efficiency and system reliability.

**SPECIAL MEMBRANES** can be individually selected for challenging effluents which pose risk of fouling due to presence of similar charge ions as the membrane surface or membrane material compatibility issue. These solutions include:

- **use of steel membranes,**
- **zwitterionic membranes,**
- **range of modified UF membranes,**
- **ceramic membranes.**

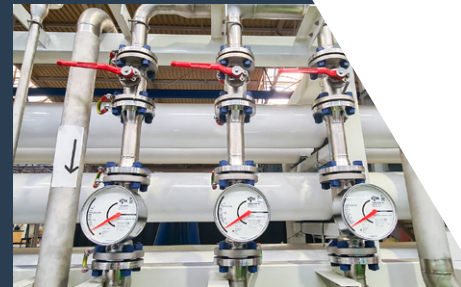
For example, Esmil utilises **ZWITTERION ULTRAFILTRATION (ZIUF)** membranes for effluents with higher viscosity or suspended solids content as well as for highly contaminated leachates and even slurries to maintain high recovery rate and fouling resistance. **STEEL AND CERAMIC MEMBRANES** can be used on a wide variety of tough process streams with a broad range of chemicals, pressures and temperatures. They offer reliable operation as they are mechanically strong and can be used in applications with high level of oil and suspended solids in the feed. They are also abrasion resistant (this is case only for SS elements). Ceramic membranes have a high resistance to ozone and chlorine, which allows oxidising agents' use for the cleaning of stubborn foulants.





## Production

The Esmil industrial base consists of 3 large manufacturing plants, which are equipped with modern machinery. This allows us to manufacture both mass-produced equipment, as well as most of the required non-standard equipment.



Esmil Company is certified according to the ISO standards for the Quality Management and Environmental Protection System, and has the following certifications:

- International Quality Standards Certification ISO 9001:2015
- Environmental Management System ISO 14001:2015

We support our customers during the sales process, as well as by providing startup and commissioning services and support through the warranty and post-warranty periods.

## Components and materials from the world's leading manufacturers

The careful selection of **high-quality materials and components** from the world's leading manufacturers ensures the high quality, durability and efficiency of our equipment. In the production of Esmil equipment, we use components of the best brands in the industry. Stainless steel from European and American manufacturers with special anti-corrosion coating, the best drives and pumps on the market, electronics and components for the control cabinets construction, reliable flow meters, and many other high-quality components guarantee excellent quality and durability of Esmil equipment.

The use of the best components available is a matter of honour for us and **a guarantee of quality and efficiency** for our equipment. We pay special attention to our manufacturing processes because each component of the equipment is critical to its durability and high performance.

High-quality components and materials together with our thorough internal **quality control** which includes non-destructive test methods (NDT) including radiographic testing (RT), positive material identification (PMI) and numerous other tests including even checking the quality and thickness of the paint, ensure that Esmil equipment is reliable and exceptional. This is what makes the Esmil Group one of the best equipment manufacturers, trusted by customers all over the world.

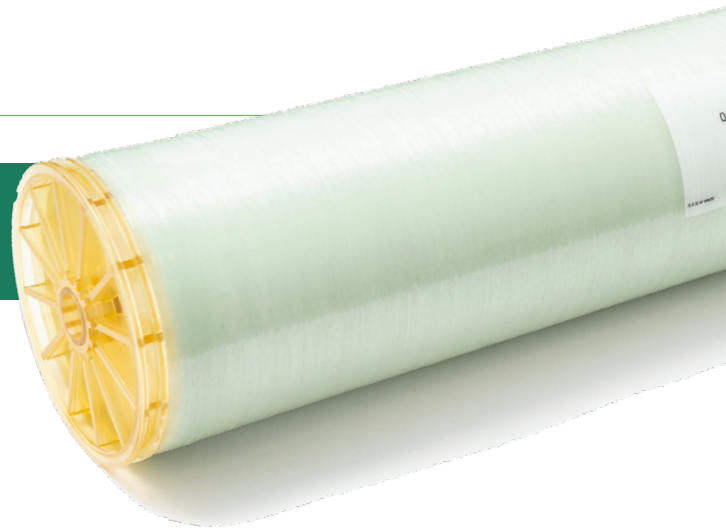
## The success formula of the Esmil equipment consists of the following three components:

- **Innovative engineering ideas.** We combine the experience in the machine industry and wastewater treatment world to bring you a market-leading solution.
- **Top-class machinery.** This allows us to carry out all preparation, mechanical processing, welding and assembly accurately, quickly and with high precision. We use equipment from Japanese, Swiss and German manufacturers in our production.
- **Production culture.** We have a proud manufacturing culture that includes, among others, the philosophy of working with stainless steel and aluminium.

Today we make extensive use of robotic machinery in our manufacturing shops, achieving very high quality, production rates and repeatability on the production line. Providing a resistant, tight and aesthetically pleasing welding seam is a great challenge – this is met by our qualified and professional welders, as well as our industrial robots.

These industrial robots are essential for welding mass-produced units, as they are able to operate according to a specified program around the clock, while constantly delivering a high-quality welding seam.

# Esmil Membrane Systems: State-of-the-Art Technology



- **Reliable design and process**

At Esmil, reliability is at the core of everything we do. Our membrane systems are meticulously designed and engineered to ensure consistent and dependable performance, meeting the highest standards of reliability in effluent treatment processes.

- **High quality of materials**

We spare no expense in sourcing the highest quality materials for our membrane systems. From durable membranes to robust structural components, our commitment to using top-notch materials ensures longevity and efficiency in every solution we provide.

- **Best components from reliable suppliers**

Partnering with trusted suppliers, we integrate the best components into our membrane systems. By selecting only the most reliable and proven components, we guarantee the highest level of performance and durability for our customers.

- **Max sustainability and zero discharge**

Our membrane systems are designed with sustainability in mind, aiming for zero discharge wherever possible. By incorporating advanced technologies and innovative processes, we help our customers minimize their environmental footprint and achieve sustainable effluent treatment solutions.

- **Custom design and software**

Every effluent treatment challenge is unique, which is why we offer custom design and software solutions tailored to your specific needs. Our team of experts works closely with you to develop customised membrane systems that optimise efficiency and effectiveness for your application.

- **Contaminated and problematic effluents**

No effluent is too contaminated or problematic for our membrane systems to handle. With advanced filtration and separation capabilities, we excel in treating even the most challenging effluents, delivering clean and compliant discharge solutions.

- **Industrial Regulations**

Our membrane systems comply with all relevant industrial regulations, including ATEX, NVI, and other standards. We ensure that our solutions meet the strictest safety and quality requirements, providing our customers with peace of mind and regulatory compliance.

- **Modular and compact design**

Versatility and space efficiency are key features of our membrane systems. With modular and compact designs, our solutions can be easily integrated into existing facilities or deployed in space-constrained environments, maximising flexibility and utility.

- **Pre-assembled skids and containerised solutions**

To streamline installation and deployment, we offer pre-assembled skids and containerised solutions. These ready-to-install units minimise on-site construction and setup time, accelerating project timelines and reducing overall costs.

- **Ease of maintenance**

We understand the importance of hassle-free maintenance. That's why our membrane systems are designed for easy access and maintenance, with user-friendly features and intuitive interfaces to minimise downtime and optimise system performance.

- **Quality control at Esmil's**

Quality is paramount at Esmil. Our rigorous quality control processes ensure that every membrane system meets our stringent standards of performance and reliability, providing our customers with consistent and superior solutions.

- **Esmil service team**

Our dedicated service team is here to support you every step of the way. From initial installation to ongoing maintenance and support, our experienced technicians are committed to ensuring the continued success of your effluent treatment system.

- **High recovery rates to add the highest value**

We maximise the value of your effluent treatment process by achieving high recovery rates. Through advanced filtration and separation techniques, we help you recover valuable resources and minimise waste, adding value to your operations and bottom line.

- **Long lifespan**

Built to last, our membrane systems boast a long lifespan and require less replacement or refurbishment. With proper care and maintenance, our solutions provide reliable performance and cost savings for years to come.

- **Proper Cleaning Regime and CIP system**

Maintaining optimal performance requires proper cleaning and maintenance. Our membrane systems feature sophisticated cleaning regimes and CIP (Clean-in-Place) systems, ensuring thorough and efficient cleaning to prolong system lifespan and maximise uptime.

- **Sophisticated automation and fine-tuned software**

Automation is key to optimising efficiency and reliability. Our membrane systems feature sophisticated automation and fine-tuned software, enabling precise control and monitoring of system parameters for optimal performance and cost savings.

- **Low operating costs**

Efficiency is at the heart of our membrane systems, resulting in low operating costs and reduced energy consumption. By maximising efficiency and minimising waste, we help our customers achieve significant cost savings and improved profitability.





## A few references:

### Purified Terephthalic Acid (PTA) Plant

PTA plant generates significant amount of byproduct high in acetic acid (AA) upto 2%. Esmil supplied the membrane system to PTA plant in Turkiye which separate and concentrate AA for reuse and produce high quality treated water meeting ATEX Zone 2 requirements.

Flow Capacity – 65 m<sup>3</sup>/h.

### Shell Oil, Ireland

- The site receives the gas from offshore wells which comes along with the produced water. Esmil plant treat the produced water for removal of oil, hydrocarbons, and heavy metals to get treated water suitable for on sea discharge.

Capacity – 10 m<sup>3</sup>/h.

- The site also generates the runoff water which is treated with separate membrane system for the removal of oil and suspended solids.

Capacity – 35 m<sup>3</sup>/h.

### Kronospan Unilin, France

The site makes MDF sheets. The wastewater, high is organics and solids, from various points inside the plant is collected and treated by Esmil membrane system to get the solids and organics separated and concentrated to burn in the energy plant while the treated water is used for the process and boiler feed.

Capacity – 2 x 25 m<sup>3</sup>/h.

### JG Pears, UK

The site makes pet food ingredients from waste collected from the farmers, abattoirs, meat processing plants and the catering industry. The wastewater, high is organics and solids, from various points in the plant is collected and treated by MBR system followed by RO membranes to get the water suitable for the cooling tower make-up.

Capacity – 35 m<sup>3</sup>/h.

### Poppy Seeds Plant

The food grain site in UK generates waste, high is organics and solids, treated by Esmil UF and RO membrane to get the treated water suitable for water course discharge.

Capacity – 2 m<sup>3</sup>/h.

### Distillery Waste Water, UK

The site collects the waste from various distilleries. The wastewater, high is organics and solids, treated by Esmil UF and RO system to separate and concentrate the solids to use to mix with animal food and the treated water, low in COD goes to the wetland.

Capacity – 4 m<sup>3</sup>/h.

### A Distillery Site 1, UK

The waste from distillery is treated in Anaerobic Digester to produce biogas and the digested sludge. The digestate, high is organics and solids, treated by Esmil membrane system to separate and concentrate the sludge to use as organic fertilizer / solid conditioner, while the treated water goes to the water course.

Capacity – 3 m<sup>3</sup>/h.

### A Distillery Site 2, UK

The waste from distillery. A containerised mobile skid.

Capacity – 0.75 m<sup>3</sup>/h.

### A Distillery Site, US

The waste from distillery. A containerised mobile skid for testing and study the treatment process at different customer sites.

Capacity – 0.75 m<sup>3</sup>/h.

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