ADVANCED MEMBRANE FILTRATION
A MAJOR ADVANTAGE FOR RELIABLE WASTEWATER TREATMENT OR PROCESS FILTRATION

SYSTEMS THAT GIVE YOU GREATER FLEXIBILITY AND BETTER PERFORMANCE

E-Series Membrane Filtration Systems
Evoqua Water Technologies offers the Memtek® E-Series systems incorporating proprietary crossflow tubular membranes which remove precipitated contaminants and produce a high quality filtrate suitable for discharge or further treatment. The modular components can stand alone, work together or work with existing equipment. The stand alone units are ideally suited for integrating with existing reaction tanks or settlers for effluent polishing. Membrane filtrate from an E-Series system can be discharged from the plant or reused directly in non-critical rinses. The filtrate is also suitable as a feed to reverse osmosis where from 75-90% of the water can be recycled and reused within the plant. Standard E-Series systems accommodate flow rates up to 400 gpm while custom designed systems are available to handle larger flow capacities. These Memtek systems are easy to operate and provide for continuous solid/liquid separation with minimal operator attention.

EF Advanced Membrane Filtration Systems
The basic EF system is a skid-mounted package consisting of membrane modules, recirculation pump, in-place cleaning loop, backpulse mechanism, instrumentation and controls. The skid-mounted design is compact and requires minimal floor space.

EFC Advanced Membrane Filtration Systems
The EFC system includes the EF system equipment plus a recirculation tank with level controls, anti-swirl baffles and slurry transfer pump.

RX and RXP Reaction Systems
These systems are rugged, corrosion resistant tanks equipped with heavy duty mixers; metering pumps; chemical reaction monitors and controllers; level controls and alarms; inlet, overflow and drain ports; control panel; access platform and covers.

Materials of Construction
The rugged fluorocarbon membranes are non-plugging, abrasion and chlorine resistant. The process tanks are fabricated from heavy duty fiberglass reinforced epoxy resins or high density polyethylene. All components in contact with wastewater are PVC, polypropylene, nylon, stainless steel or other corrosion resistant material.
MARKET | APPLICATION
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Metal Finishing | Removal of heavy metals to less than 0.1 ppm
Printed Circuit Board | Removal of heavy metals to less than 0.1 ppm
Semiconductor | Arsenic removal to less than 0.1 ppm
 | Fluoride removal to below 5 ppm
 | Cutting fluid recycle from silica grinding and slicing operations
 | Deionized water recycle from wet blast and back grinding processes
 | Heavy metals removal from tin/lead plating onto lead frames
Groundwater Remediation | Removal of heavy metals to less than 0.1 ppm
Battery Manufacturing | Removal of lead and cadmium from wastewater
Automotive | Removal of zinc and phosphate from phosphatizing operations
General Industry | Removal of heavy metals from incinerator scrubber water
 | Pretreatment for reverse osmosis water recycling
 | Lime softening of cooling tower blowdown for water recycling
 | General heavy metals removal to less than 0.1 ppm
 | Replacement of clarifier or a clarifier followed by a sand filter

E-SERIES SYSTEM CAPABILITY*

<table>
<thead>
<tr>
<th>CONTAINMENT</th>
<th>WASTEWATER CONC. (mg/l)</th>
<th>MEMTEK® EFFLUENT (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>10 - 1000</td>
<td>0.5</td>
</tr>
<tr>
<td>Arsenic</td>
<td>1 - 50</td>
<td>0.005</td>
</tr>
<tr>
<td>Cadmium</td>
<td>25 - 115</td>
<td>0.05</td>
</tr>
<tr>
<td>Chromium</td>
<td>3 - 275</td>
<td>0.1</td>
</tr>
<tr>
<td>Copper</td>
<td>1 - 1500</td>
<td>0.1</td>
</tr>
<tr>
<td>Cyanide</td>
<td>5 - 300</td>
<td>0.1</td>
</tr>
<tr>
<td>Gallium</td>
<td>4 - 20</td>
<td>0.5</td>
</tr>
<tr>
<td>Germanium</td>
<td>20 - 110</td>
<td>0.5</td>
</tr>
<tr>
<td>Gold</td>
<td>1 - 12</td>
<td>0.15</td>
</tr>
<tr>
<td>Iron</td>
<td>2 - 1500</td>
<td>0.02</td>
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<tr>
<td>Lead</td>
<td>2 - 100</td>
<td>0.05</td>
</tr>
<tr>
<td>Manganese</td>
<td>1 - 10</td>
<td>0.02</td>
</tr>
<tr>
<td>Mercury</td>
<td>3 - 30</td>
<td>0.005</td>
</tr>
<tr>
<td>Nickel</td>
<td>4 - 300</td>
<td>0.1</td>
</tr>
<tr>
<td>Rhodium</td>
<td>20 - 500</td>
<td>0.1</td>
</tr>
<tr>
<td>Silver</td>
<td>10 - 200</td>
<td>0.1</td>
</tr>
<tr>
<td>Tin</td>
<td>20 - 75</td>
<td>0.1</td>
</tr>
<tr>
<td>Uranium</td>
<td>1 - 15</td>
<td>0.01</td>
</tr>
<tr>
<td>Zinc</td>
<td>2 - 400</td>
<td>0.1</td>
</tr>
</tbody>
</table>

*Typical values achieved in practice may vary depending on equipment configuration and pretreatment chemistry.
MICROFILTER KEY FEATURES
1. CONCENTRATION TANK
The concentration tank is used to ensure that a constant concentration of solids is being pumped to and from the microfiltration membranes. The tank is equipped with level probes to allow the microfilter feed pump to cycle on and off.

2. SLUDGE WITHDRAWAL PUMP
In order to maintain the right solids concentration (typically 3-5% solids) in the microfiltration recirculation loop for proper system operation, an automatic sludge withdrawal pump is supplied with timers. The sludge or solids removed from the concentration are either pumped to a sludge storage tank or directly to a filter press.

3. FEED PUMP
A reliable pump is used to provide the adequate crossflow through the membrane tube.

4. BACKPULSE
The microfilter is equipped with an automatic backpulse mechanism. The permeate flow rate is periodically reversed through the membrane. This results in maintaining higher flow rate and extends the time between cleaning cycles.

5. PERMEATE
The microfilter permeate (membrane filtrate) usually contains heavy metal that is less than 0.1 ppm. After final neutralization, the permeate can be discharged to drain, reused for non-critical rinses or further processed by reverse osmosis (RO) for water recycle.

6. MEMBRANE/MODULES
The membrane is a rugged polyvinylidene difluoride (PVDF) material attached to a porous one inch substrate. The membrane tubes are bundled together either in a 4 or 10 tube arrangement and placed inside a PVC or CPVC housing.

7. CLEAN-IN-PLACE
The on-board clean-in-place system consists of two cleaning tanks. One tank is used to make up the cleaning solution; while the other tank contains fresh water to flush the membranes after cleaning. The membranes can be cleaned with acids, caustic, bleach and other various cleaning agents. Automatic cleaning is also available as an option.

8. MODULAR DESIGN
The system is fully skid-mounted and includes the membrane modules, backpulse mechanism, recirculation pump, clean-in-place system, air diaphragm pump, concentrate recirculation tank, electrical power controls, instrumentation and PLC controller. The system is fully piped, wired and equipped for operation.
E-SERIES SYSTEM OPERATION

Pretreatment in RX and RXP Systems

The process begins with the transfer of wastewater to one or more reaction tanks (1). Pretreatment chemistry (2) is selected considering the nature of the wastewater and is controlled automatically and continuously.

Filtration in EF and EFC Systems

The chemically pretreated wastewater then flows to the concentration tank (3). From there, the water is pumped continuously through the tubular membrane filtration modules (4) at a high fluid velocity. At the
normal operating pressure (20 - 40 psi), clean water is forced through the pores of the membrane while the particulate contaminants remain suspended in the recirculated stream. The filtration piping also includes a backpulse mechanism which reverses the flow of filtrate to maintain higher flow rates and extend the time between cleaning cycles. The clean water (membrane filtrate) flows by gravity from the membrane modules to drain (5), storage tank (6) or the final neutralization tank (7). The concentration of the wastewater slurry recirculated in the membrane modules is typically maintained between 2-5% solids. Under normal operating conditions, a portion of the slurry is periodically removed from the system, usually to a filter press (8). Every E-Series filtration system includes a convenient integral cleaning loop (9) consisting of a pump, two tanks and the necessary piping and valving to permit in-place cleaning of the membrane modules.

**E-SERIES SYSTEMS ARE KEY ELEMENTS OF TREATMENT UPGRADES**

**Wire and Cable Manufacturer, Jacksonville, FL**

A manufacturer of high carbon steel wire products is using the E-Series system to treat rinsewaters from the acid cleaning and descaling of wire rod and processed wire. The E-Series system consistently produces effluent at less than half the discharge limits for all metals. The management staff wanted assurance that the waste treatment system would operate in compliance. Memtek® products demonstrated detailed knowledge of the company’s wastewater and confirmed their design concept with treatability testing on actual samples of the wastewater. Memtek products provided turnkey installation, startup and operator training. The system provides the customer with the confidence that the effluent is consistently well below discharge limits.

**Parts Manufacturer, New Haven, IN**

A leading manufacturer of industrial, automotive, aerospace defense fluid connectors, as well as automotive and commercial custom engineered molded extruded plastic products is using the Memtek E-Series microfiltration system to treat metal bearing wastewaters. Since startup, the treatment system has consistently met the required effluent limitations at operating costs that are lower than conventional technologies.

**Printed Circuit Board Manufacturer, Raleigh, NC**

A major manufacturer of printed circuit boards, recently upgraded their wet processing operations with new, state-of-the-art equipment. The customer also replaced their wastewater treatment system, which was based on ion exchange, with a Memtek E-Series microfiltration system. The customer needed a reliable waste treatment system to meet very low compliance limits. The E-Series microfiltration system has reduced operating costs and generated sludge with high copper content. As a result, sludge disposal costs are significantly lower than expected.