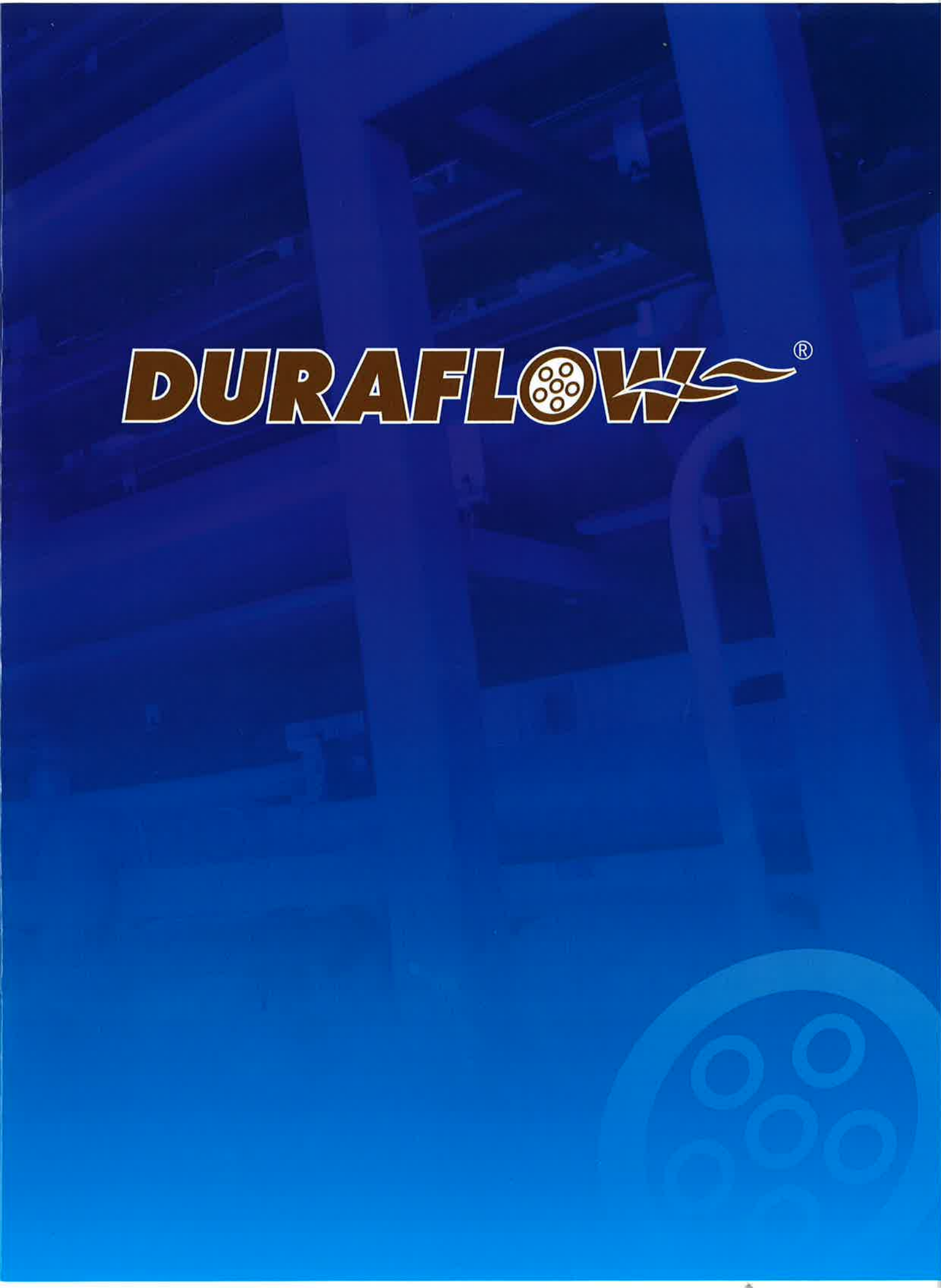
DURAFLOW®

DURAFLOW®

The Company

Duraflow, LLC is a global leader in the design, engineering, manufacture and supply of high–quality tubular membrane filters backed by unmatched support and service. The Duraflow membrane filtration (DMF) products have been successfully applied in many industries for water recycle and reuse, wastewater compliance treatment, process water purification, brine water desalination, and selected chemical material recovery. Due to its high quality, filtrate produced from the DMF process with a SDI below 3.0 is an excellent feed to a reverse osmosis for desalination in a water recycling process.

Duraflow delivers the DMF products to end–users through our OEM distributors, a worldwide network of technical and business professionals experienced in solving complex water/wastewater problems encountered in different industrial sectors. The Duraflow team works closely with the clients to provide consultation and support in analyzing the project objectives, exploring the viable alternatives, validating the feasibility, assessing the potential, and presenting the most practical cost–effective solution to meet the clients? overall requirements.

New England Water Environmetal Assocition

American Membrane Technology Association, AMTA

Water Environmental Federation

National Association of Surafce Finishing

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DMF Products

Duraflow membranes are manufactured in a tubular configuration capable of handling high solid concentration. The membranes, made of PVDF, are cast on the surface of 1" diameter porous polymeric tubes to produce a nominal pore size of 0.1 micron. The extraordinary chemical resistant property of PVDF allows the use of a wide range of chemicals – acids, bases and oxidizers for cleaning of the persistent fouling substances.

DF Standard Module	1-Tube	4-Tube	10-Tube	19-Tube
Membrane Surface Area	1.5 ft^2 (0.14 m^2)	6 ft^2 (0.56 m^2)	15 ft^2 (1.40 m^2)	28.5 ft^2 (2.65 m^2)
Module Diameter	1.5" (3.81 cm)	4" (10.16 cm)	6" (15.24 cm)	8" (20.32 cm)
Module Length	72" (1.83 m)	72" (1.83 m)	72" (1.83 m)	72" (1.83 m)
Shell Material	SCH 40 PVC	SCH 40 PVC	SCH 40 PVC	SCH 40 PVC
End Sealing Material	Epoxy Resin	Epoxy Resin	Epoxy Resin	Epoxy Resin
Weight	9 lb (4.1 kg)	25 lb (11.35 kg)	40 lb (18.2)	72 lb (32.7 kg)
Flow Capacity / Module @ 500 GFD	0.5 GPM (1.9 LPM)	2 GPM (7.6 LPM)	5 GPM (19 LPM)	9.5 GPM (36 LPM)

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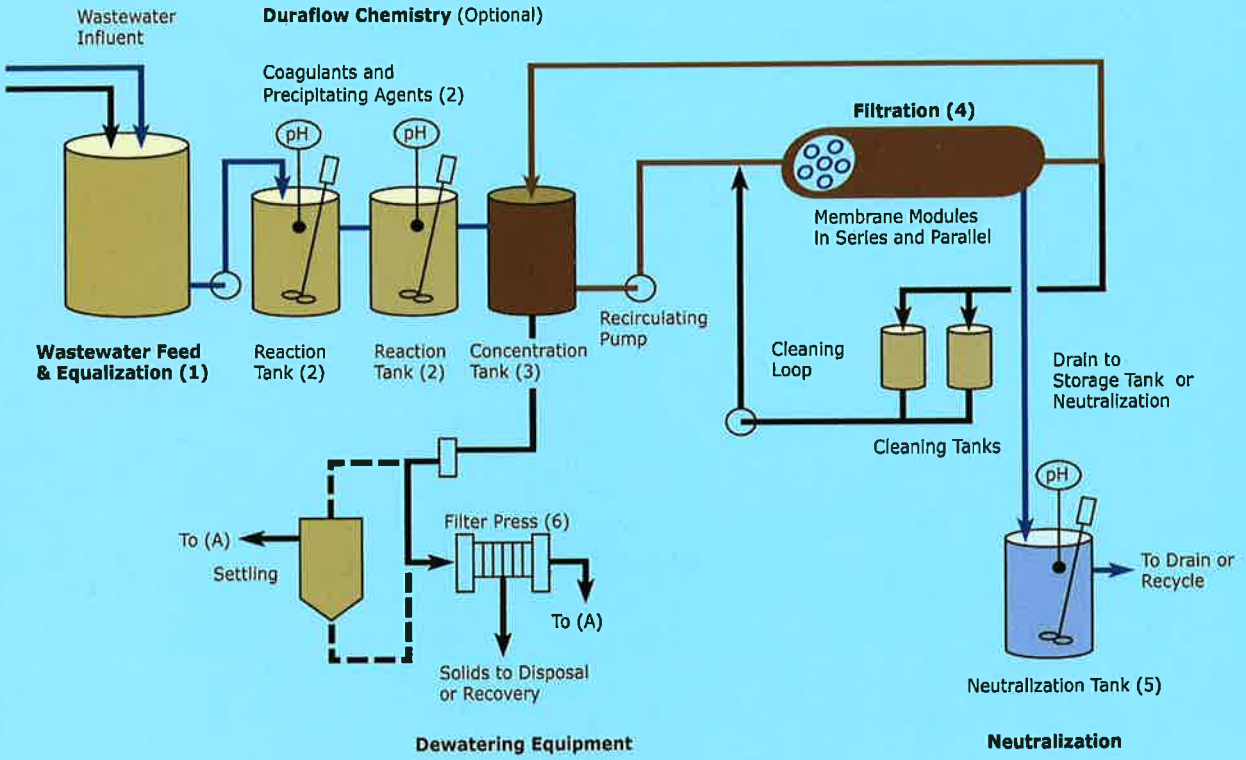
DMF Process

Duraflow Process Schematic



Chemical Pre-treatment

- Convert dissolved contaminants to insoluble particles
- Coagulate particles to optimize membrane filtration and contaminant removal efficiency
- Mitigate incompatible membrane fouling substances

Duraflow Membrane Filtration

From the EQ tank (1), the chemically pre-treated wastewater (2) flows to the concentration tank (3) and processed through the Duraflow membrane filters (4) for separation of the precipitated suspended solids. The waste solution is pumped at a high velocity through the membrane modules connected in series. The turbulent flow produces a high-shear scrubbing action which minimizes deposition of solids on the membrane surface. During operation, clear filtrate permeates through the membrane, while the suspended solids retained in the re-circulation loop are periodically purged for de-watering (6). The filtrate, after pH adjustment (5) is directed to the POTW for discharge or to the RO system for recycle.

Operation Parameters

- Flow configuration: Cross-flow
- Modules per train: Up to 18
- Operating pressure: Up to 60 PSI
- Operating temperature: Up to 110° F
- Feed flow velocity: 12-15 ft/sec
- Feed flow per tube: 35 GPM
- Back-pulse: 10 sec every 20 min

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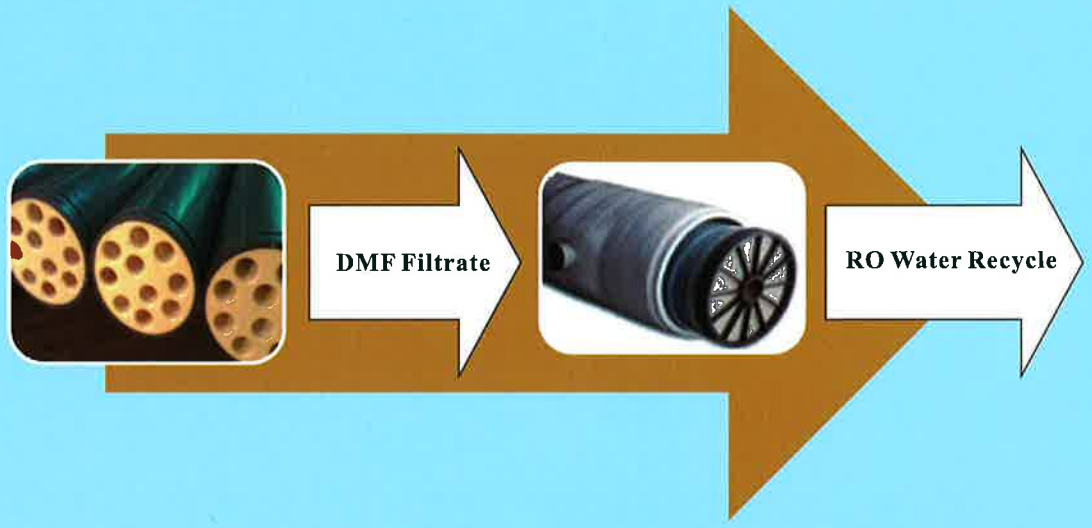
DMF Applications

The DMF plays a key role in a total water management system that meets today's dual priorities of full effluent compliance and cost-effective water reuse/recycle. Many of our customers take a stepwise approach by installing a DMF system for removal of all regulated contaminants to address the immediate compliance requirements. Depending on the dissolved solid concentration, the high-quality filtrate from the DMF can be recycled to non-critical areas in some cases or processed through a reverse osmosis for desalination prior to recycling to production processes.



Contaminant	Achievable DMF Filtrate Quality (mg/L)
Arsenic	<0.005
Cadmium	<0.005
Chromium	<0.05
Copper	<0.005
Fluoride	<10.0
Hardness (Tot.)	<60 (CaCO3)
Lead	<0.05
Manganese	<0.02
Mercury	<0.005

Contaminant	Achievable DMF Filtrate Quality (mg/L)
Nickel	<0.05
RO Fouling	<3.0 SDI
Silica	<15
Silver	<0.01
Sulfate	<100
Tin	<0.1
TSS	<1.0
Turbidity	<1.0 NTU
Zinc	<0.05

Values are practical and may vary depending on treatment protocol and background chemistry.

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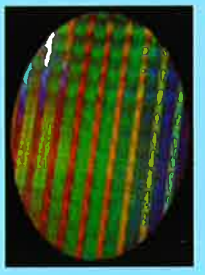
DMF Systems

Our certified OEMs are capable of engineering and building DMF treatment and water recycle systems on a turnkey basis. Each system is custom designed to meet the customers' specifications and expectations. In addition, foot print minimization, component accessibility and operational safety are key engineering and fabrication considerations. Special features:

- Skid–mounted, pre–piped and pre–wired to minimize installation & start–up cost
- Automatic back–pulse mechanism to optimize membrane flux performance
- Industrial PLC with operator interface for complete process control & monitor
- Built–in clean–in–place (CIP) equipment for user–friendly cleaning operations

Iron/Steel ***Chemical*** ***Power*** ***Plating/PCB*** ***Semiconductor*** ***Mining***



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DMF Advantages

Product Innovation

Duraflow builds a membrane with its porosity spanning both Ultrafiltration (UF) and Microfiltration (MF). This feature allows the DMF products to achieve the high flux of a Microfilter, while providing the complete solids rejection or fine filtration of an Ultrafilter. The new generation DMF products offer the following key features and benefits.

- High porosity yields high filtrate flow rate (output)
- Uniform pore size produces consistent high filtrate quality
- Strong membrane–to–substrate composition extends filter service life
- Low–fouling tubular configuration allows high solid concentrations (2–3 wt % TSS)
- Chemical–resistant PVDF membrane is compatible with aggressive cleaning chemicals (bleach, peroxide, H_2SO_4, HCl, caustic, etc.) that could destroy other types of membranes used for UF, NF and RO

Energy & Space Saving

With the new improved module materials, a DMF module train assembly can be built to accommodate up to 18 filters. The extended train configuration results in substantial cost savings and operating benefits relative to the conventional design of less than 12 filters.

– Energy saving (25% less)
– Capital cost reduction
– System foot print reduction
– Cost–competitive for high flow applications
– Installation simplification
– O&M cost reduction

Unparalleled Service

The Duraflow technical team consisting of professional engineers, process application designers, equipment builders and chemists, works side–by–side with its local OEMs to provide all the needed service from conceptual process design through equipment fabrication to system commissioning. We listen to the customers and learn about their needs as their long–term water management partner. Key consulting services provided:

– Application Assessment
– Pilot Testing
– Process Engineering
– Equipment Specs
– System Design
– Equipment Fabrication
– System Installation
– Commissioning
– O&M Cost Reduction

120 Lumber Lane, Building 3, Unit 15, Tewksbury, MA. 01876 USA
Tel:978 851 0447 Fax:978 851 7459
http:www.duraflow.biz