

TurboClean® Membranes: Water Purification for Beverages



The Specialty
Membrane Company

October 1, 2012

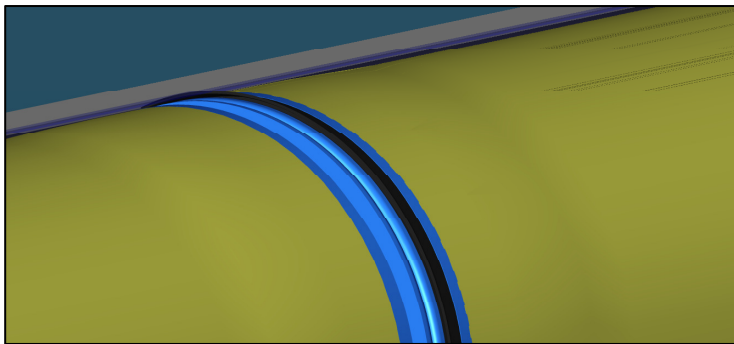
What Are TurboClean® Elements?

- Sanitary-style element design for membranes
- Patented hard-shell design
- No stagnant areas prone to bacteria growth
- Rugged and durable design
- Extremely consistent diameter
- Available for RO, UF and NF membranes

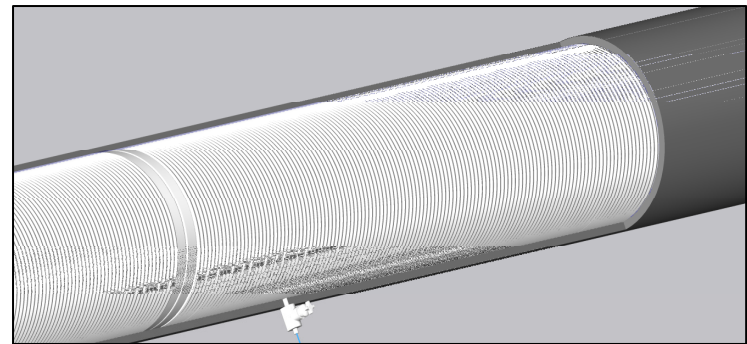


Comparing Element Types

FRP / Taped Elements



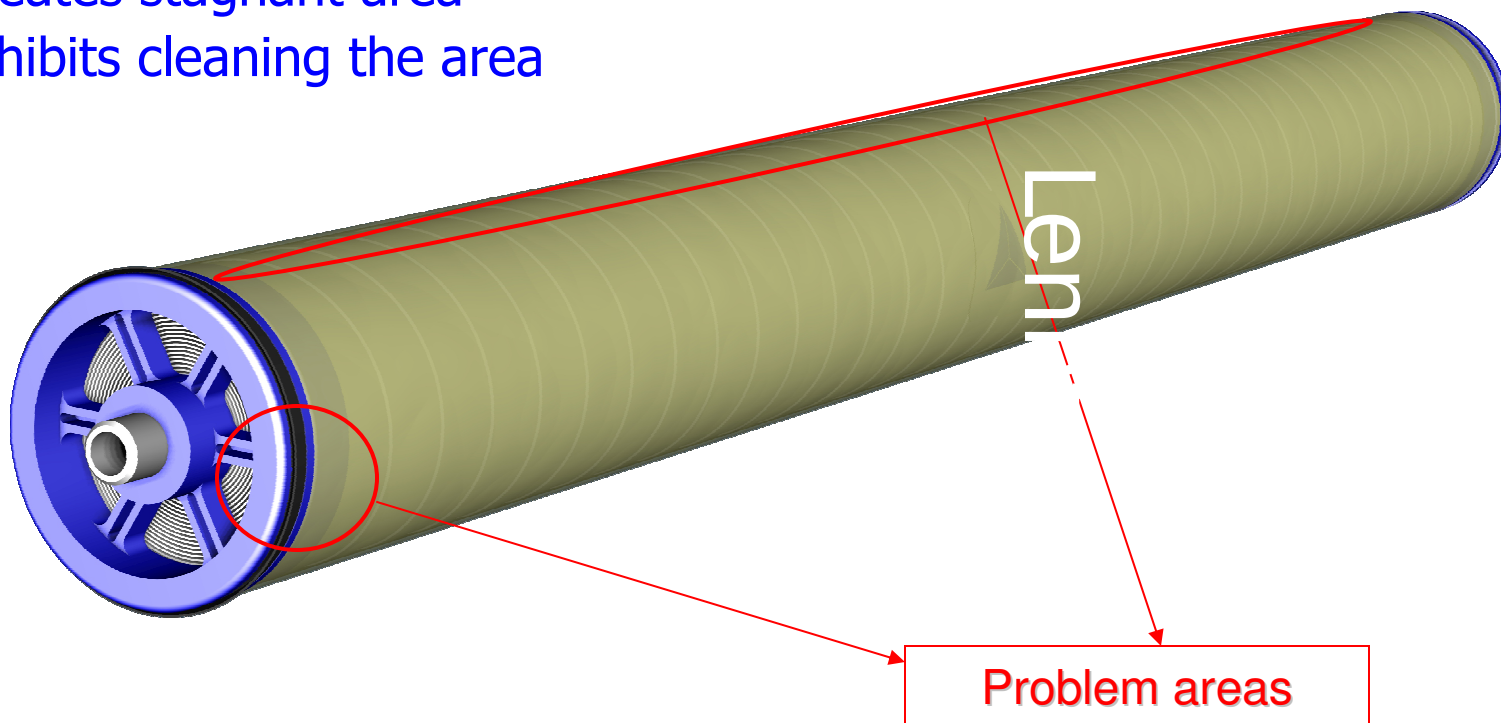
TurboClean® Elements



- U-Cup / Brine Seal
 - Creates stagnant area between the element and the pressure vessel
 - Provides bio-growth friendly environment and inhibits cleaning and sanitization.

Elements With Brine Seals

- Seal required to prevent bypass flow
- Creates stagnant area
- Inhibits cleaning the area

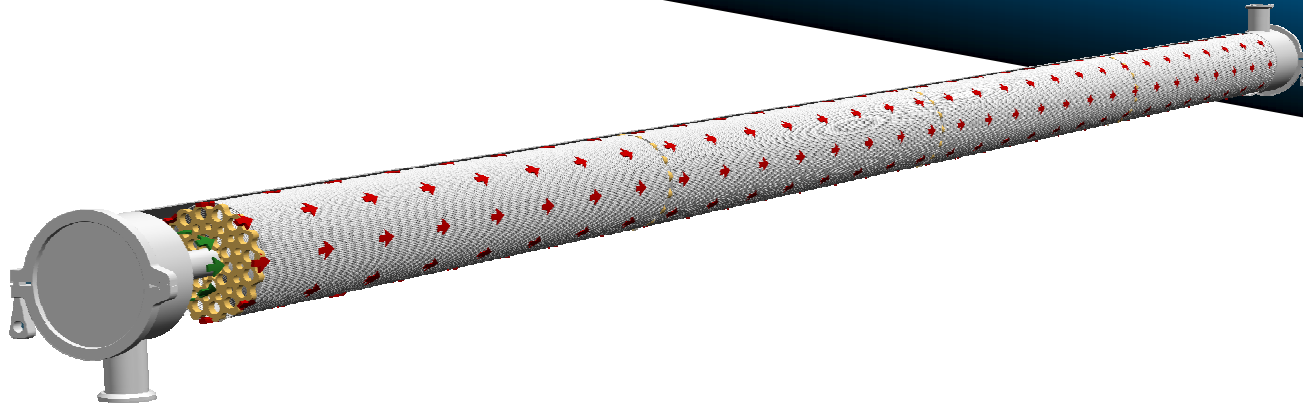


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TurboClean® Elements

LENNTECH



- Used when stagnant flow regions in the process are prohibited or detrimental
- Continuous annular bypass flow through full vessel length
- Eliminates stagnant volume
- Fully cleaned in CIP

⇒ Reduced risk of microbiological contamination



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Comparing Sanitary Elements

TurboClean outerwrap



Full – Fit outerwrap

- TurboClean® elements offer 60-65% less bypass
 - Machined shell = Most consistent element diameter
 - Higher cross-flow across membrane surface
 - Better cleaning
 - Hard TurboClean shell yields a stronger, more durable element



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Comparing Bypass Flows (Theoretical) *LENNTECH*

- ◆ 8" Codeline® vessel ID: 7.950" (nominal)
- ◆ Full-fit element OD: 7.850" (typical)
- ◆ TurboClean® element OD: 7.915" (nominal)

- ◆ Area of Codeline vessel = 49.639 sq in
- ◆ Area of full-fit element = 48.398 sq in
- ◆ Area of TurboClean element = 49.203 sq in

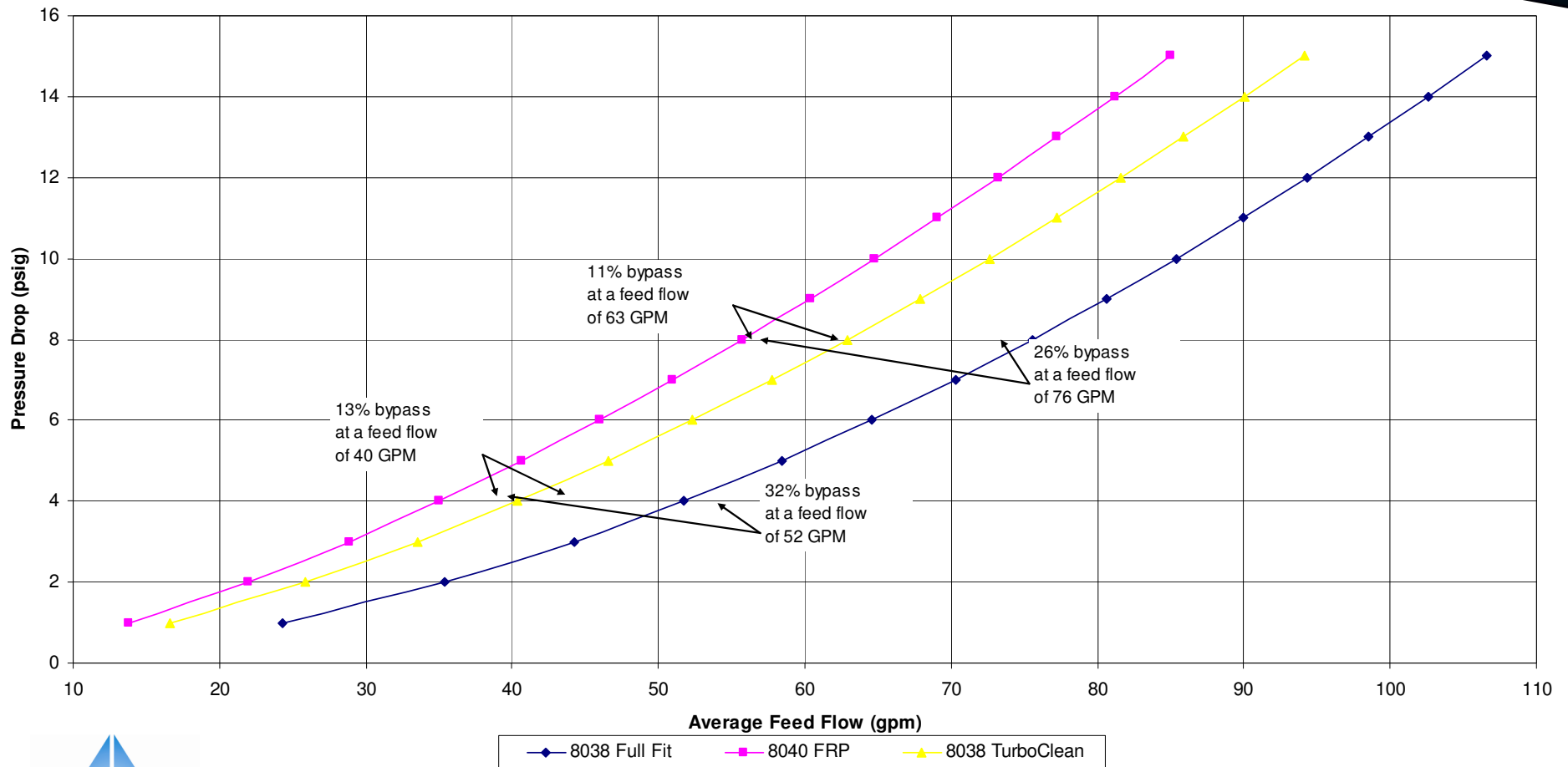
- ◆ Bypass area around full-fit = 1.241 sq in
- ◆ Bypass area around TurboClean = 0.436 sq in
- ⇒ **TurboClean leaves 65% less area for bypass flow**



Comparing Bypass Flows

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Pressure Drop Profiles of Different 8-inch Element Extentors



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Comparing Bypass Flows (Empirical)

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- 💧 TurboClean® Element Bypass: 12%
- 💧 Full-fit Element Bypass: 30%

If 50 GPM is fed to a housing, bypass flows will be:

- 💧 TurboClean: $50 \text{ GPM} * 0.12 = 6 \text{ GPM}$
- 💧 Full-fit: $50 \text{ GPM} * 0.30 = 15 \text{ GPM}$

⇒ **TurboClean has 60% less bypass flow**

⇒ **Nearly matches theoretical bypass flow**

If 50 GPM is fed to a housing, the actual feed flow will be:

- 💧 TurboClean: $50 \text{ GPM} * 0.88 = 44 \text{ GPM}$
- 💧 Full-fit: $50 \text{ GPM} * 0.70 = 35 \text{ GPM}$

⇒ **TurboClean has 26% higher feed flow**



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TurboClean® Bev Elements

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⇒ **TriSep offers a complete line of TurboClean elements for Beverage applications.**

Product Description	Model
Sanitary RO	TurboClean® Bev 8040-RO
Sanitary Low Energy RO	TurboClean® Bev 8040-RO-LE
Sanitary Low Fouling RO	TurboClean® Bev 8040-RO-X20
Sanitary Cellulose Acetate RO	TurboClean® Bev 8040-RO-CA
Sanitary CA RO (1.139" tube)	TurboClean® Bev 8040-RO-CA-O
Sanitary Cellulose Acetate NF	TurboClean® Bev 8040-NF-CA

Note: TriSep customizes elements with various:

- membranes (RO, NF, UF, MF)
- permeate tubes (1.125", 1.50", 1.139")
- feed spacers
- outer wraps



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Selecting the Right Product

- TriSep offers a wide range of products to meet a wide range of customer needs:
 - TurboClean® sanitary-style elements
 - Cellulose Acetate membranes
 - X-20™ low-fouling membrane
 - Direct retrofits for competitive products
 - Product customization
- ⇒ Select TriSep™ Membranes to Optimize Performance and minimize Risk of Microbiological Contamination



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