TriSep Corporation
Digital Product Catalog

Rev 012605

Thank you for your interest in TriSep Corporation products. Following is the latest version of our product catalog. In an effort to give our customers the most current information on our products in a timely and low cost format, we have spent considerable time and effort to make the catalog user friendly with detailed technical, administrative, and sales related information.

This catalog is in Adobe Acrobat format and you can browse the catalog one page at a time or you can jump to specific pages. Following this page is the table of contents which lists the page numbers. There are hyperlinks to the different sections, and if you click on the section you want in the contents, it will jump you to that page. To return to the first page, click on the double left arrow at the top of the page. To proceed one page at a time, click on the right arrow.

This new version of the catalog includes the new SpiraSep Backflushable Ultrafiltration Membrane element. This product is designed to remove suspended solids from surface and waste waters as well as removal of oocysts such as giardia and crytosporidium for drinking water applications.

New data on bypass information for our Turboclean sanitary elements shows how you can save up to 25-35% of your by-pass energy costs by using this product as compared to standard cage or net wrapped elements.

This manual also contains the newest manuals for our Troi design program as well as the new Tron normalization program.

CONTENTS

CONTENTS

WELCOME TO TRISEP™

Attached is TriSep Corporation's latest Product Catalog, containing current literature in support of our Reverse Osmosis, Softening, Nanofiltration , and Ultrafiltration spiral wound membrane products. TriSep has products that are specifically designed for municipal, industrial, food and dairy, and wastewater applications.

TriSep personnel have a long history of solving water treatment problems, with some having been involved in developing and manufacturing membrane elements since the early 1970's. TriSep has, and will continue to devote countless hours to engineering our membrane products to specifically meet your projects unique requirements**.** By providing technical support with the objectives of maximizing reliability and minimizing maintenance, TriSep is now established as a leading qualified supplier of spiral wound membrane elements worldwide. TriSep's elements are among the best in the industry, offering a combination of high product water flux and high salt rejection rates.

In 1991, TriSep purchased DuPont's entire spiral wound membrane element business. This acquisition included the Advanced Composite Membrane (ACM™) technology, which enabled us produce a full line of thin film composite membrane products to suit most reverse osmosis system requirements.

The DuPont acquisition also provided TriSep with the patented X-20™ Polyamide-Urea Composite, low fouling membrane. Originally developed by DuPont as the next generation of thin film composite membrane, the X-20 has been further developed and commercialized by TriSep. Superior fouling resistance and silica rejection compared to all other thin film composite membranes makes X-20 the membrane of choice for well in to the 21st century.

TriSep is the first membrane manufacturer in the world to develop its own line of spiral wound membrane support chemicals. Until now, RO system users could not be sure if their membrane elements, antiscalants, cleaners, and other support chemicals were compatible. Both product lines are normally proprietary and developed and manufactured by different companies. Recognizing this critical fact, TriSep's put it's experienced R&D team to work developing a complete chemical line for membrane separation elements. Their expertise in the chemistry of membranes and now with the chemicals has allowed TriSep to develop a chemical product line 100% compatible with current membrane technologies.

TriSep manufactures a complete range of spiral wound membrane products to accommodate just about any size requirement. If your water treatment needs require the use of reverse osmosis, Nanofiltration, Ultrafiltration or Microfiltration, TriSep's experienced professionals can provide you with application specific information and analysis that will assist you in making the optimal decision.

TriSep™ Web Site

Our catalog is intended to answer most of your basic questions. If we can assist you with specific questions or other membrane related matters, please contact TriSep directly. TriSep Corporation's professional staff and worldwide network of local representatives are always available to assist you with all your membrane separation needs.

This electronic catalog is up-to-date as of the time of printing. However, specifications and products are continually changing and the best way to insure you have the most up-to-date information is to check our web site. Our web address is http//www.trisep.com. The site contains all of our product information for elements and chemicals along with MSDS sheets for the chemicals.

Our TroiWin program can be downloaded for no charge. In addition, we regularly post updates on the element database for TroiWin that you can update. You must have TroiWin version 1.5.0 or later for this feature to work. This windows program allows you print a spec sheet for any of our elements directly from the program.

You can also download the most current version of this catalog at any time. We will update the catalog several times per year to give you the most current information.

The web site also has several nice features such as a interactive element and chemical cross reference guide, a literature request form, e-mail and telephone addresses, and technical product information.

Please visit our web site for more information.

SpiraSep™ Spiral Wound Backflushable Ultrafiltration Technology

Background

Membrane microfiltration (MF) and ultrafiltration (UF) are rapidly growing technolgies used to remove suspended solids and microbiological contaminents from water. They are replacing conventional filtration such as clarifiers, multimedia filters, sand filters, bag filters, and cartridge filters for applications where these technologies lack the required filtration performance. Historically, membrane MF and UF technologies have used fiber based or plate and frame membrane designs. These designs typically utilize some means of removing accumulated suspended solids from the surface of the membrane, either permeate back flushing, aeration, or a combination of the two. Although these designs are effective in certain applications, they have certain inherent weaknesses such as fiber breakage, high captitol cost, and low packing density.

In the early development of reverse osmosis (RO) elements, plate and frame and hollow fiber technolgies were among the first to be developed. Over time, the spiral wound element design proved to have the best combination of performance, flexibility in design, and cost versus the other technologies. Today, over 99% of the RO market is dominated by the spiral wound format. We believe that this evolution will likely develop in the MF and UF markets in the near future.

SpiraSep Technology

Custom wisdom held that spiral elements could not be back flushed. The TriSep development team challenged these beliefs and created the back flushable, immersed, negative pressure SpiraSep Ultrafiltration element. This element has been complety redesigned from a standard spiral element to give it the capability to be back flushed, operate at very high specific flux rates (up to 50 gfd/psi (1,200 lmh/bar)), and operate by being immersed in a tank with a vacuum driving pressure. The vacuum pressure can be created using a standard single stage centrifugal pump.

The current SpiraSep element contains 178 ft^2 (16.6 m^2) of active polyethersulfone membrane with a 125 mil (3.2 mm) feed spacer. The element is operated at a driving pressure of 1-2 psi (0.07 to 0.14 bar) of vacuum, and air is injected under the element at a rate of 3-8 scfm (5 - 13 m^3/hr) per element. Periodically, the permeate flow is reversed back through the membrane, or back flushed, to remove any accumlated suspended solids. The elements are suspended in the tank using a bayonett fitting on the element ATD that connects it to a stainless steel permeate manifold. The manifold acts as both the support structure and the permeate header.

The SpiraSep element can be used in many applications, on feedwaters with high suspended solids (up to 15,000 ppm) and high turbidity. These include treatment of surface water, seawater, well water, wastewater, and process streams across many industries. Industry examples are drinking water, municipal and industrial wastewater, lanfill leachate, food and dairy processing, boiler feedwater, aquaculture, beverage, mining, e-coat aint, breweries, wine, potota processing just to name a few. For more detailed informa-

TRISEP CORPORATION

SPIRASEP
Ultrafiltration Membrane Technology

Summary of Benefits

- ***Successful Operation on Wastewater, Surface Water and Potable Water***

  - ✓ Specially formulated, 0.05 micron, hydrophilic membrane chemistry allows for backflushing capabilities
  - ✓ Completely re-engineered spiral wound membrane for high flow, high solids applications delivers feedwater and aeration more efficiently
  - ✓ Air Scour & Backflushing minimize membrane fouling
  - ✓ Submersible, negative pressure design
  - ✓ High flow, low energy design minimizes fouling potential
  - ✓ No risk of fiber breakage

- ***High Quality Effluent***

  - ✓ Reduction of TSS, TOC and Color
  - ✓ < 0.1 NTU
  - ✓ < 3 SDI

- ***Energy Efficient***

  - ✓ Low TMP reduces energy costs
  - ✓ No recirculation pump
  - ✓ No backwash pump

- ***Lower Capital Costs***

  - ✓ Spiral format reduces membrane packaging costs
  - ✓ Immersed design simplifies construction

- ***Lower O&M Costs***

  - ✓ Spiral construction efficiency reduces replacement costs, no fiber breakage, no potting problems
  - ✓ Minimum pumping costs due to low negative pressure design
  - ✓ Infrequent cleaning
  - ✓ Minimum waste

- ***Lower Installation Costs***

  - ✓ Small Footprint due to high membrane packing density
  - ✓ Modular, Skid-mounted Designs

- ***Low Waste Volume***

  - ✓ Recoveries greater than 90 %
  - ✓ Low cleaning frequency

- ***Membrane Element Components Can Be Independently Selected***

  - ✓ High flexibility in element construction
  - ✓ Range of feed spacer / packing density combinations to accommodate varying feedwater solids

PRODUCT SPECIFICATION

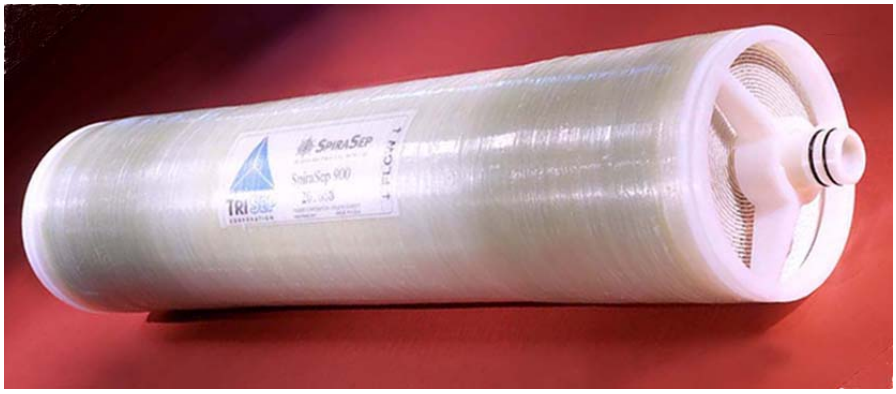
TRISEP CORPORATION

SPIRASEP
Ultrafiltration Membrane Technology

Model	Permeate Turbidity	Typical Pore Size
SpiraSep-900	<0.1 NTU	0.05 micron

Operation and Design Data

Membrane Type……Polyethersulfone Ultrafiltration Membrane
Configuration……Spiral Wound, Back flushable, Immersed, Negative Pressure
Recommended Applied Pressure……..-1 to-10 psi (-0.07 to -0.7 bar)
Maximum Applied Back-Pressure……..10 psi (0.7 bar)
Recommended Back-Pressure……...5-8 psi (0.34 – 0.55 bar)
Active Membrane Area..……..178 ft^2 (16.6 m^2)
Recommended Operating Temperature…35 - 113°F (2 - 45°C)
Feed water pH Range…… 2– 11 continuous
Air Scour Requirements……3-5 scfm(if applicable)
Chlorine tolerance…… 10 ppm continuous, 100 ppm periodic
Feed Spacer…… 125 mil thick



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Length (A):	42.8 (1087)	Permeate Tube (C):	1.87 0.D (47.5)

Units in pounds and inches, units in parenthesis in kilograms and millimeters

- Permeate specific flux is clean water flux at standard conditions above. Not applicable for all feed water conditions.

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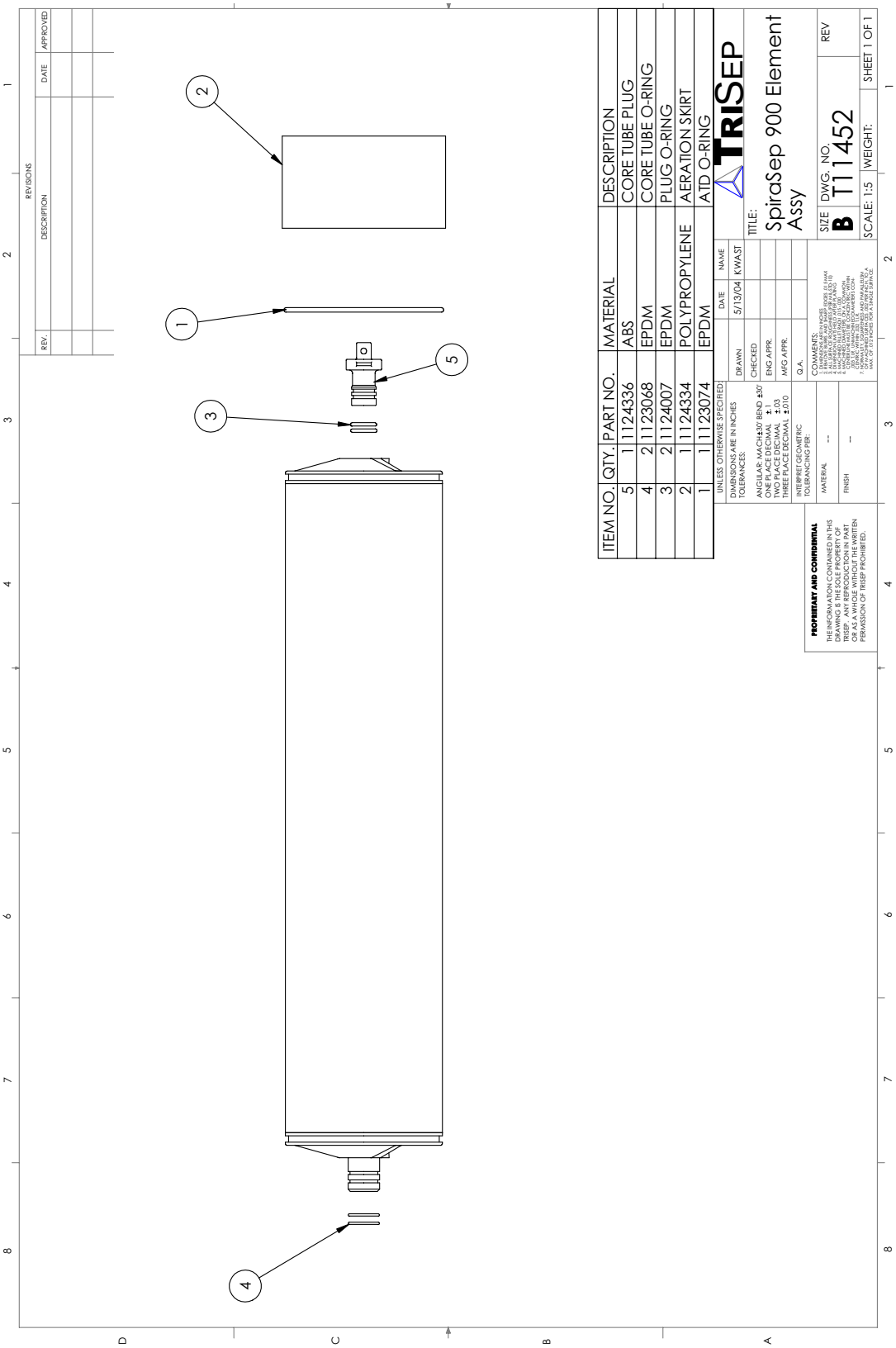
TRISEP CORPORATION

SPIRASEP
Ultrafiltration Membrane Technology

Submerged SpiraSep with Aeration

SpiraSep Manifold and Elements

SpiraSep Pilot Plant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APPROVED
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3 2 1124007 EPDM PLUG O-RING
2 1 1124334 POLYPROPYLENE AERATION SKIRT
1 1 1123074 EPDM ATD O-RING
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ONE PLACE DECIMAL ±.1
TWO PLACE DECIMAL ±.03
THREE PLACE DECIMAL ±.010
INTERPRET GEOMETRIC TOLERANCING PER:
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FINISH --
DRAWN 5/13/04 KWAST
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
TRISEP
TITLE:
SpiraSep 900 Element Assy
SIZE B
DWG. NO. T11452
REV
SCALE: 1:5
WEIGHT:
SHEET 1 OF 1
PROPRIETARY AND CONFIDENTIAL
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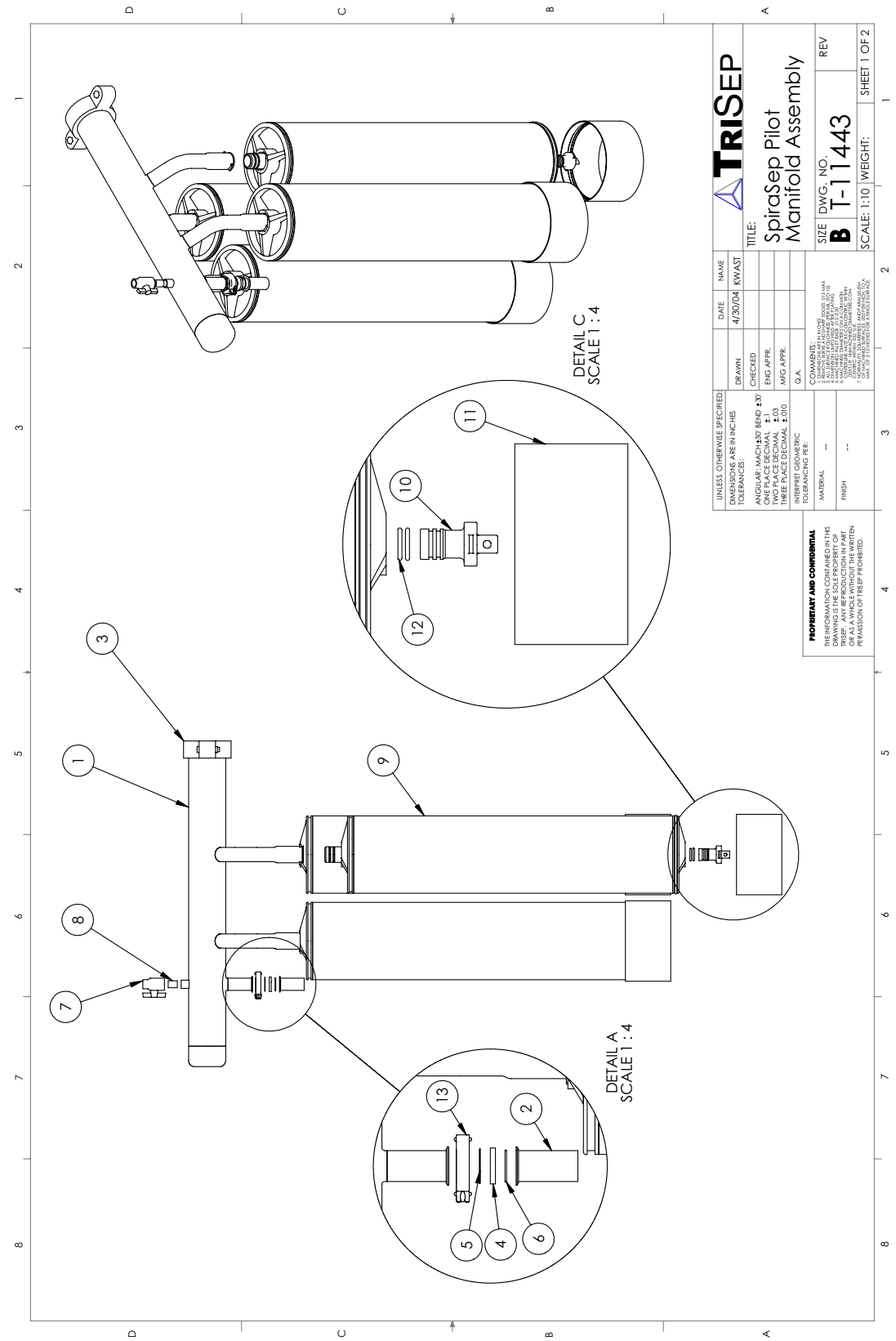
1
2
3
4
5
A
B
C
D


DETAIL C
SCALE 1 : 4
DETAIL A
SCALE 1 : 4
TRISEP
SpiraSep Pilot
Manifold Assembly
DWG. NO.
T-11443
SIZE
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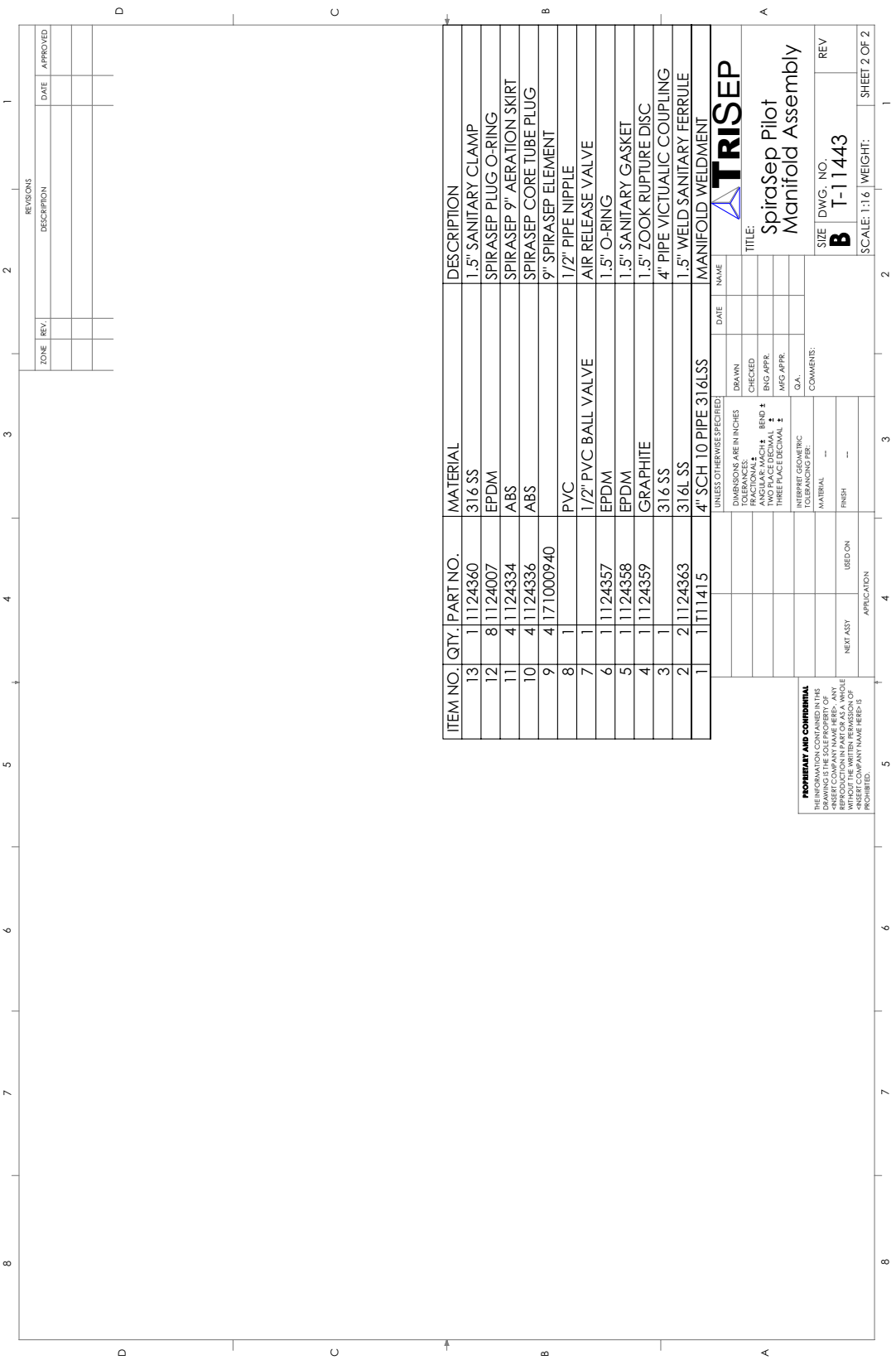
SCALE: 1:10
WEIGHT:
SHEET 1 OF 2
REV
PROPRIETARY AND CONFIDENTIAL



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11	4	1124334	ABS	SPIRASEP 9" AERATION SKIRT
10	4	1124336	ABS	SPIRASEP CORE TUBE PLUG
9	4	171000940		9" SPIRASEP ELEMENT
8	1		PVC	1/2" PIPE NIPPLE
7	1		1/2" PVC BALL VALVE	AIR RELEASE VALVE
6	1	1124357	EPDM	1.5" O-RING
5	1	1124358	EPDM	1.5" SANITARY GASKET
4	1	1124359	GRAPHITE	1.5" ZOOK RUPTURE DISC
3	1		316 SS	4" PIPE VICTUALIC COUPLING
2	2	1124363	316L SS	1.5" WELD SANITARY FERRULE
1	1	T11415	4" SCH 10 PIPE 316LSS	MANIFOLD WELDMENT

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED

UNLESS OTHERWISE SPECIFIED:
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TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL —
FINISH —
NEXT ASSY | USED ON
APPLICATION

DRAWN | DATE | NAME
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:

TRISEP

TITLE:
SpiraSep Pilot
Manifold Assembly

SIZE B | DWG. NO. T-11443 | REV
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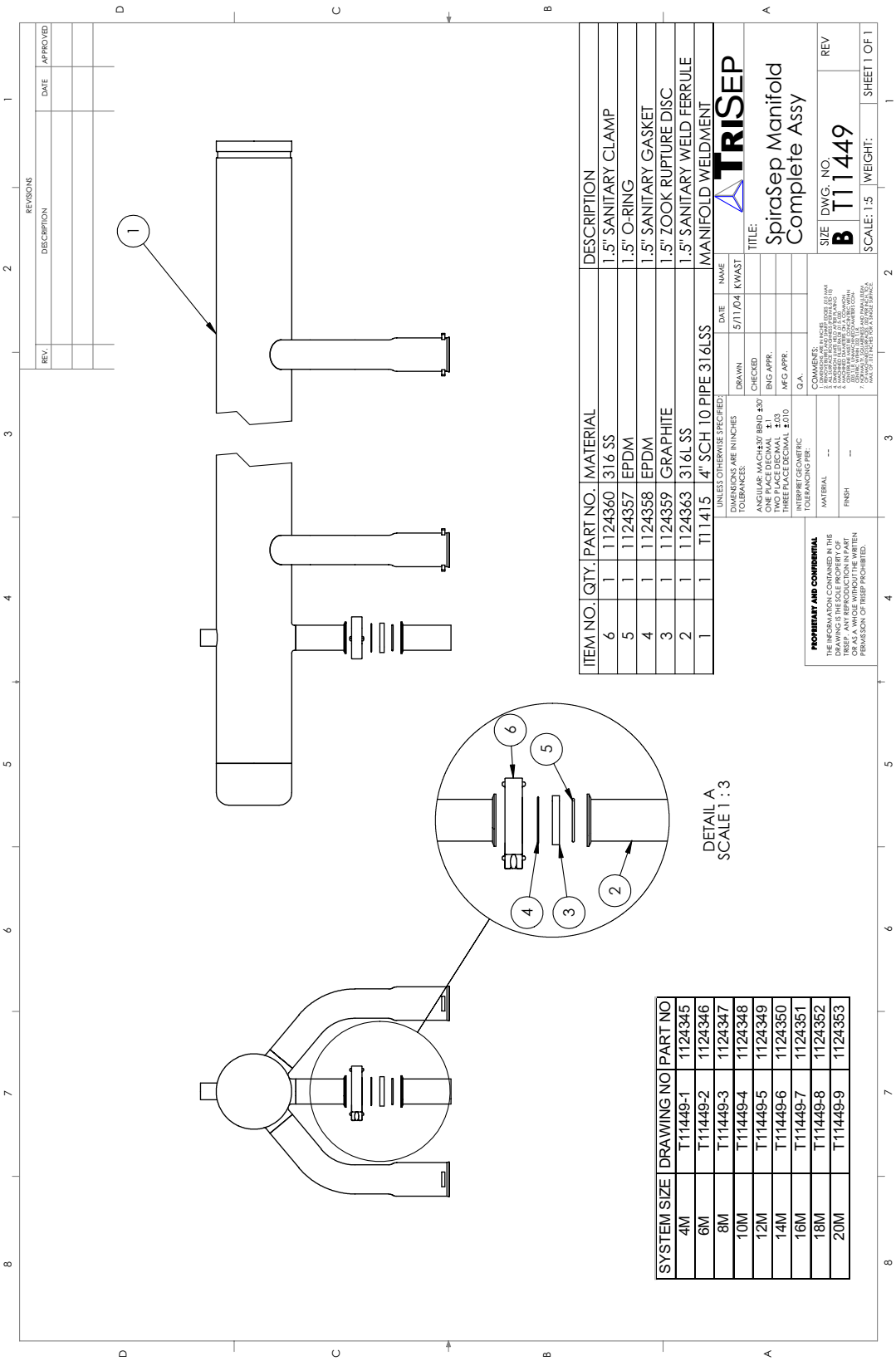
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REV.
DESCRIPTION
DATE
APPROVED
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5 1 1124357 EPDM 1.5" O-RING
4 1 1124358 EPDM 1.5" SANITARY GASKET
3 1 1124359 GRAPHITE 1.5" ZOOK RUPTURE DISC
2 1 1124363 316L SS 1.5" SANITARY WELD FERRULE
1 1 T11415 4" SCH 10 PIPE 316LSS MANIFOLD WELDMENT
UNLESS OTHERWISE SPECIFIED:
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TOLERANCES:
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ONE PLACE DECIMAL ±1
TWO PLACE DECIMAL ±.03
THREE PLACE DECIMAL ±.010
INTERPRET GEOMETRIC TOLERANCING PER:
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FINISH --
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CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
TRISEP
TITLE:
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SIZE B
DWG. NO. T11449
REV
SCALE: 1:5
WEIGHT:
SHEET 1 OF 1
PROPRIETARY AND CONFIDENTIAL
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DETAIL A
SCALE 1 : 3
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8M T11449-3 1124347
10M T11449-4 1124348
12M T11449-5 1124349
14M T11449-6 1124350
16M T11449-7 1124351
18M T11449-8 1124352
20M T11449-9 1124353

X-20™ Low Fouling RO Membrane
The Unique Chemistry that just works

Almost all commercially available reverse osmosis membranes available today are based on the chemistry patented by John Cadotte, patent number 4,277,344 (‘344). Most recent improvements in the RO industry have come from optimizing either the flux or the rejection of the ‘344 chemistry. This chemistry is classified as a fully aromatic polyamide, but has residual carboxylic acid groups on the surface which have a negative charge. Improvements in the ‘344 membranes have resulted in high flux and high rejection membranes. However, one of the major problems with the ‘344 membranes is that they are very susceptible to organic and particulate fouling, which results in decreased performance and increased operating costs.

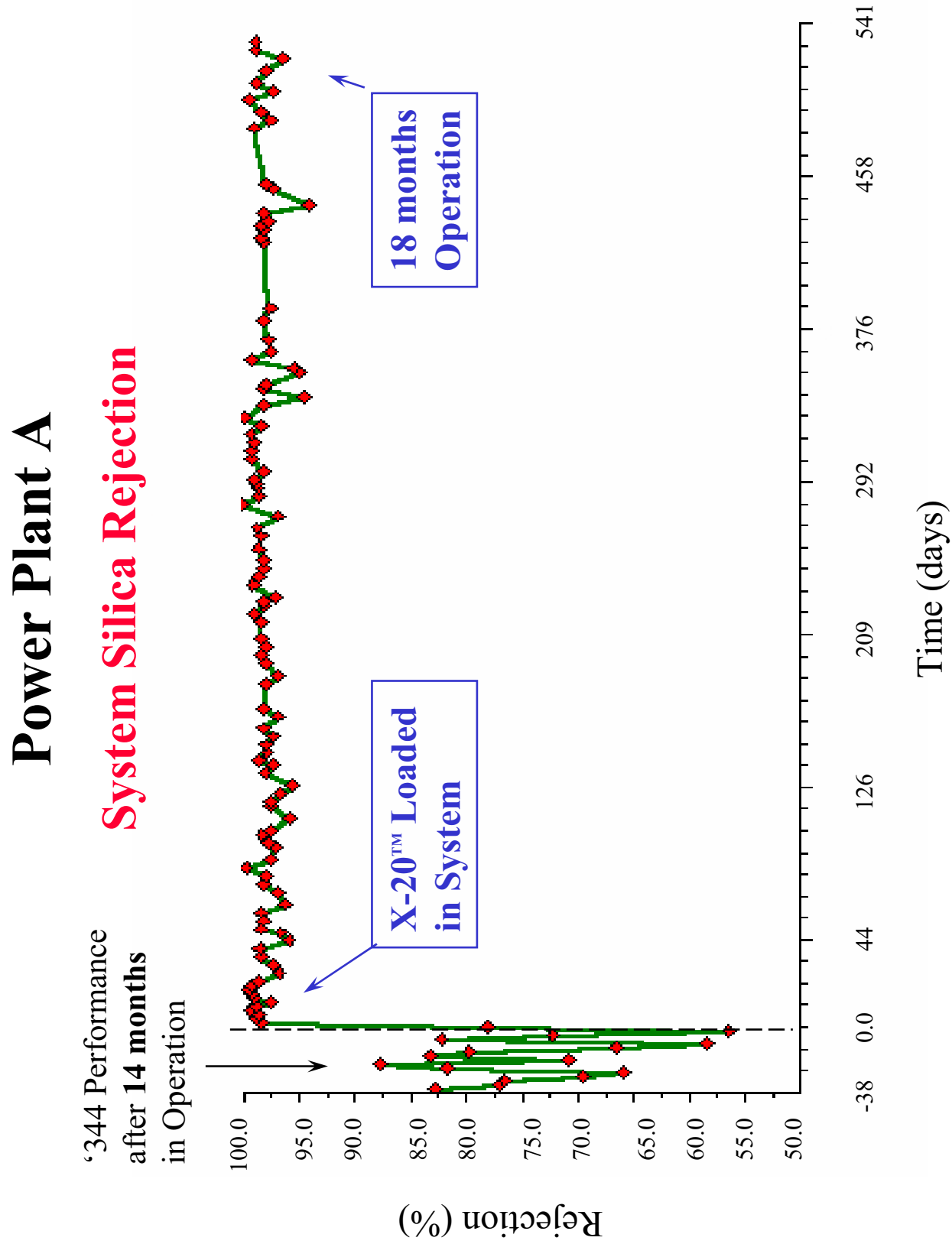
Developed by DuPont and commercialized by TriSep, a new fouling resistant RO membrane chemistry was created with the X-20. This new RO membrane, commercially known as the X-20™, has a different barrier layer, which is classified as a fully aromatic polyamide-urea. This new barrier layer, which has residual amino groups on the surface, which are neutral at most operating pH's, has proven superior in critical areas of reverse osmosis operation including fouling resistant property. This property represents a major breakthrough in RO technology.

The X-20 has been so succesful, that many competitors have tried to imitate it. These imitations are typically standard '344 membranes with a surface coating. The X-20's low fouling characteristics come from it's unique and patented poly amide-urea chemistry. This property is built into the polymer backbone and cannot wash off. The surface coatings on competitive products lack the durability of the X-20.

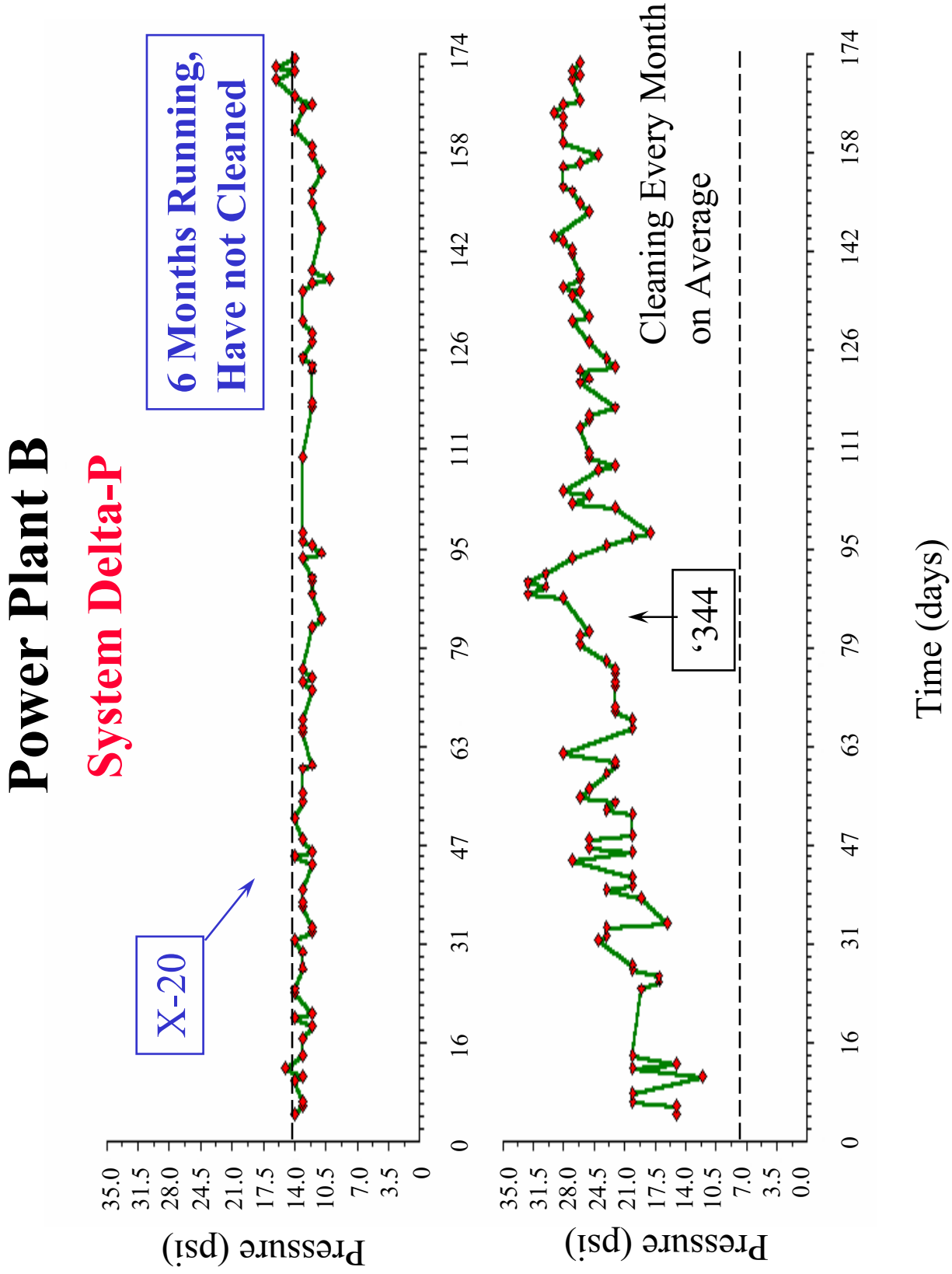
In summary, the benefits seen in system performance when using the X-20™ spiral wound elements include: significantly lower organic fouling, consistent overall salt rejection of 99%+, consistently high silica rejection of 99%+, lower and consistent system delta-P, system maintainability, ease of cleaning and returning performance back to start-up conditions, system durability, and up to 2700+ cleaning hours with little loss in performance.

For your difficult RO applications, choose the leader and still the best, TriSep's X-20™.

Comparison of X-20™ Silica Rejection versus Time



Comparison of X-20™ Delta P over Time versus Standard '344 Membrane



PRODUCT SPECIFICATION

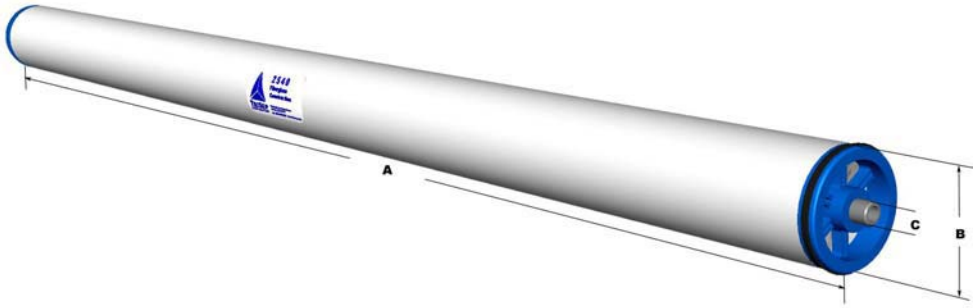
2.5" X-20 Low Fouling Turboclean Element

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
2540-X201-TSF	650 (2.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	26 ft² (2.4 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	6 GPM (1.4 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 7 (3.2)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 2.5 (63) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

TriSep Corporation • 93 South La Patera Lane • Goleta, California 93117, U.S.A.
Phone: (805) 964-8003 • Fax: (805) 964-1235 • www.trisep.com

PRODUCT SPECIFICATION

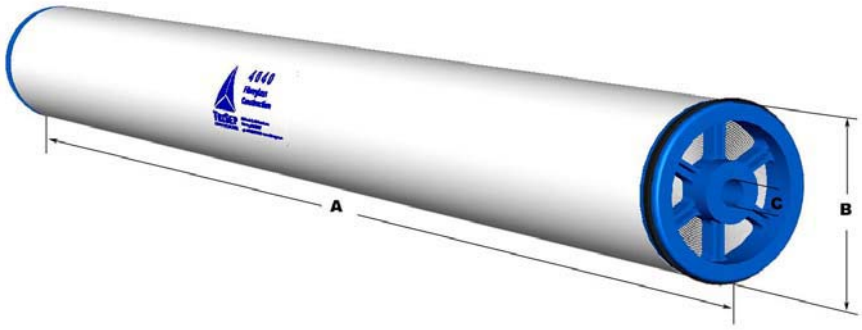
4" X-20 Low Fouling RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-X201-TSA	2,450 (9.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap with FoulGuard Technology
Active Membrane Area.....	88 ft² (8.2 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

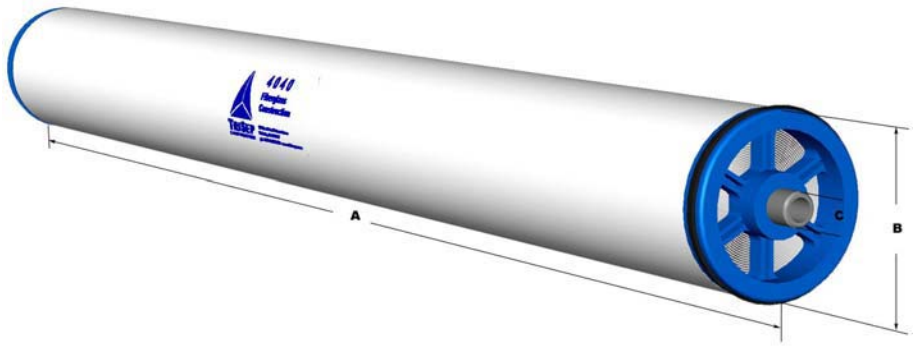
4" X-20 Low Fouling RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-X201-TSF	2,400 (9.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap with FoulGuard Technology
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

8" X-20 Low Fouling RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-X201-TSA	9,500 (35.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap with FoulGuard Technology
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

8" X-20 Low Fouling RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-X201-TSAN	9,500 (35.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap with FoulGuard Technology
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" X-20 Low Fouling RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-X201-UWA	10,400 (39.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap with FoulGuard Technology
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" X-20 Low Fouling RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-X201-UWAN	10,400 (39.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap with FoulGuard Technology
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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OPERATING INFORMATION

- Recommended operating pressure is given as a guideline, and may vary depending on the application, feed-water quality, and temperature.
- Rated permeate flow is based on standard test conditions and may not apply depending on the feed-water quality. Individual element's permeate flow may vary ± 15%.
- Design data may be exceeded under certain circumstances. Contact TriSep for specific application information and approval.
- Elements are shipped with a preservative, therefore the permeate from the first one hour of operation must be discarded.
- New and/or unused elements must be stored in a cool, dry place out of direct sunlight.
- Elements taken out of operation for a period of more than one week must be treated with a suitable biocide. Contact TriSep for more information.
- This element is covered under TriSep's *Standard Guarantee for Spiral Wound Products.*
- If the operating parameters are not followed, the guarantee will be void.
- TriSep's maximum total liability for all causes including any breach of warranty or failure to deliver conforming goods shall not exceed the value of the contract.

TurboClean™ Sanitary Elements
The New Standard of Performance

Spiral membrane elements used in sanitary operations, such as in the dairy industry for lactose and protein whey separations, are required by the USDA to ensure that a percentage of the feed must be free to by-pass or flow around the outside of the membrane element to assure this annular area is continuously flushed and that there are no stagnant areas which are not fully exposed to CIP sanitizing procedures.

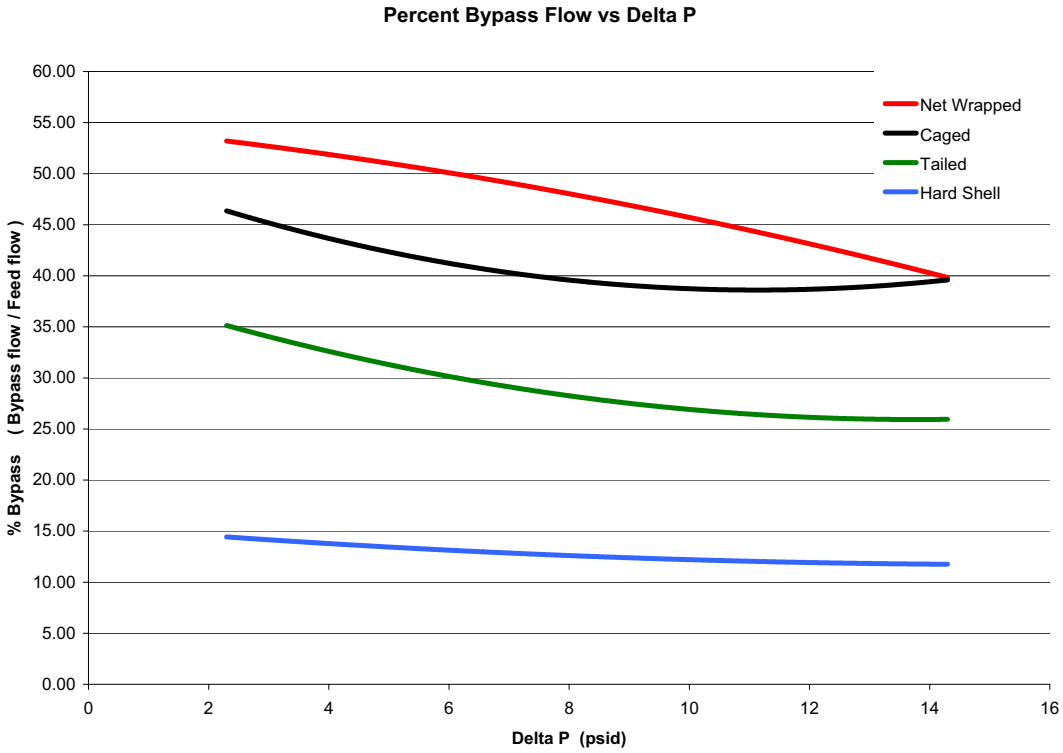
Conventional spiral membrane elements have been used historically in water, beverage, bottled water, and dialysis make-up water applications. These membrane elements use a brine or peripheral seal to prevent feed water from by-passing through the annular area formed between the vessel inner diameter and the membrane element outer diameter. This results in a dead or stagnant area between the outside of the membrane element and the inside of the housing that is prone to microbial contamination. Cleaning procedures, therefore, cannot adequately sanitize some areas of conventional membrane elements.

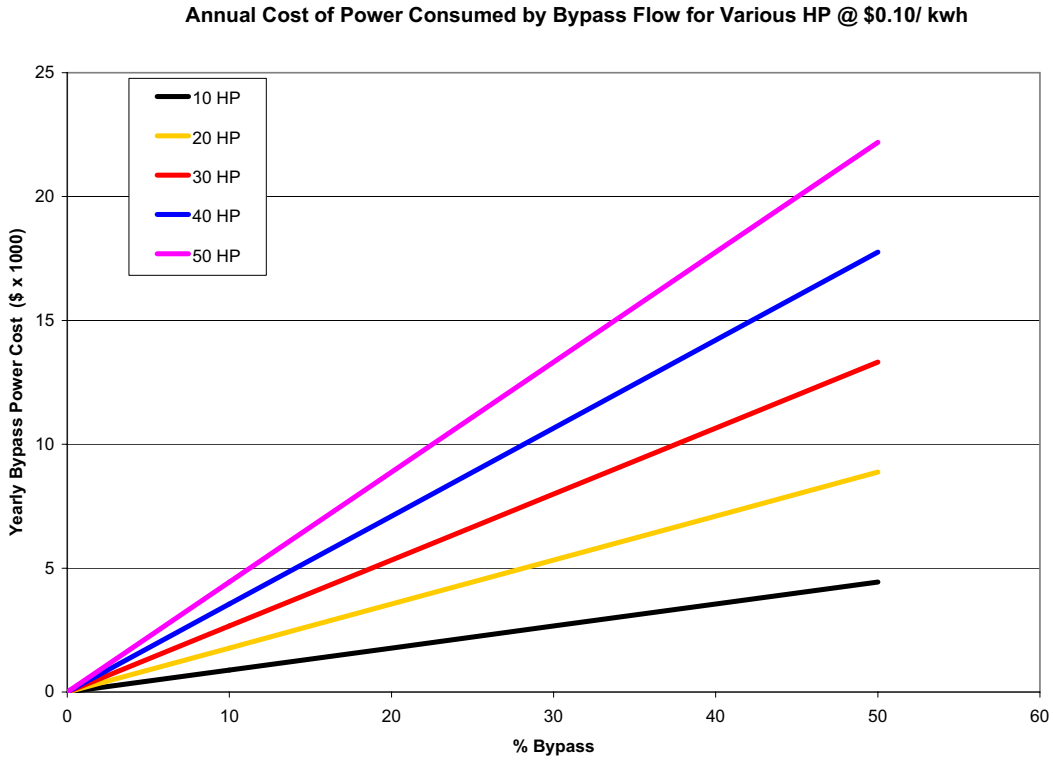
Different manufactures use different methods of enclosing their elements to maintain mechanical stability and to control the by-pass flow. Mechanical stability is important in both maintaining the integrity of the membrane element's configuration and maximizing element life. The enclosure type used has a major impact on both the element's mechanical stability and its efficiency in controlling by-pass flow. There are three basic design configurations for enclosing sanitary service elements. These three enclosure configurations are commonly designated as cage wrap, net wrap, and hard shell.

Controlling by-pass flow is critical for two reasons. First, if the individual element by-pass flows are different, there is no way of ensuring the membrane elements are operating as designed. This can have a detrimental effect on fouling rates and element life. Secondly, while there must be some by-pass flow around the element, any excess over the required minimum is a costly waste of power.

To determine the relative performance of each type of sanitary membrane element, tests were conducted first in our factory and then replicated by the engineering staff at the facility of one of the largest manufacturers of food and dairy processing equipment in North America. By-pass flows were reduced by up to 50% using the Turboclean element as opposed to standard net or cage wrapped elements.

TurboClean™ By-Pass Graphs versus Standard Sanitary Elements





PRODUCT SPECIFICATION

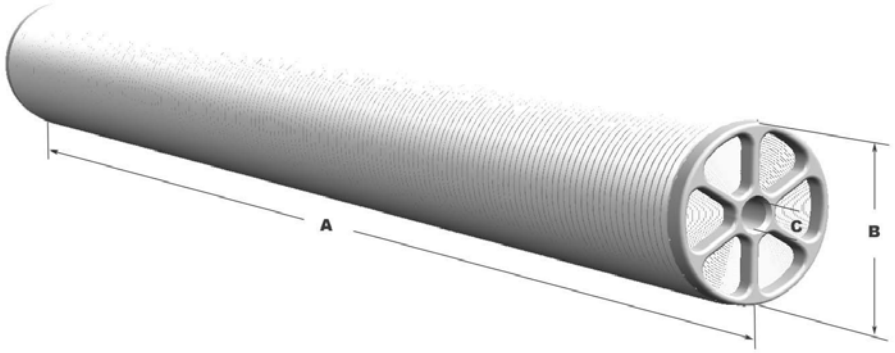
4" ACM RO Turboclean Element

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM1-TXS	1,450 (5.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Turboclean Shell
Active Membrane Area.....	65 ft² (5.9 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	25 GPM (5.6 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 12 (5.4)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.62 (15.9)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Desal/DuPont Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

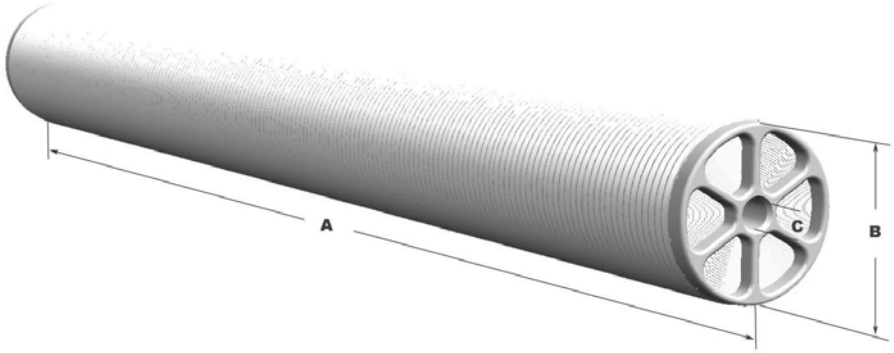
4" ACM RO Turboclean Element

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM2-TSS	2,400 (9.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Turboclean Shell
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.62 (15.9)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Desal/DuPont Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

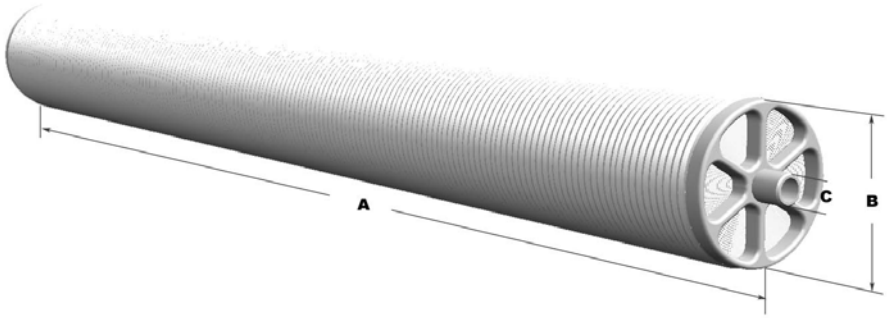
4" ACM RO Turboclean Element

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM2-TSFS	2,300 (8.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Turboclean Shell
Active Membrane Area.....	83 ft² (7.6 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

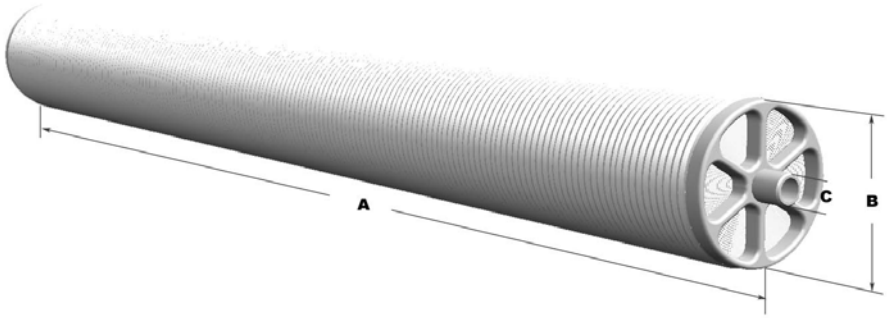
4" ACM RO Turboclean Element

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM3-TSFS	2,600 (9.0)	99.20	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Turboclean Shell
Active Membrane Area.....	83 ft² (7.6 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

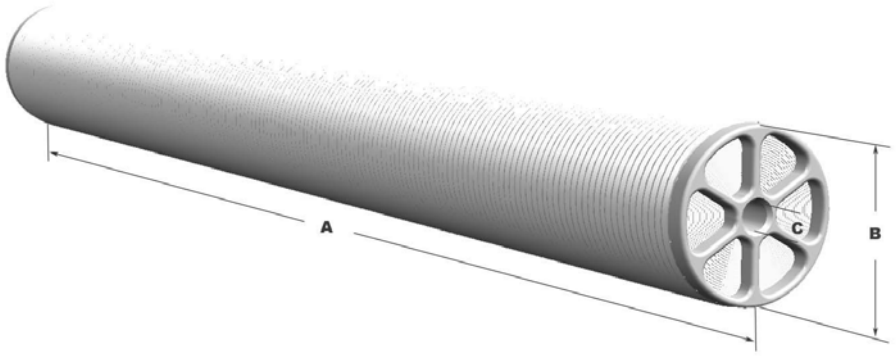
4" TS80 Nanofiltration Turboclean Element

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-TS80-TSS	1,900 (7.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Turboclean Shell
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Desal/DuPont Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

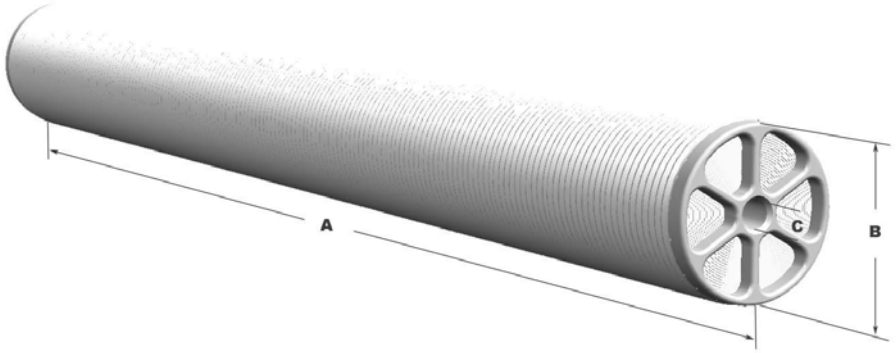
4" AUM Ultrafiltration Turboclean Element

Model	Permeate flow GPD (m3/day)*	M.W.C.O.
4040-UE50-QXS	3,700 (14.0)	100,000

Performance is based on the following test conditions: 500.0 ppm Dextran, 30.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	AUM Advanced Ultrafiltration Membrane
Configuration.....	Spiral Wound,Turboclean Shell
Active Membrane Area.....	67 ft² (6.2 m²)
Recommended Applied Pressure.....	20 - 200 psi(1.4 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	10.0 ppm
Maximum Feed Flow.....	25 GPM (5.6 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 12 (5.4)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.62 (15.9)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Desal/DuPont Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

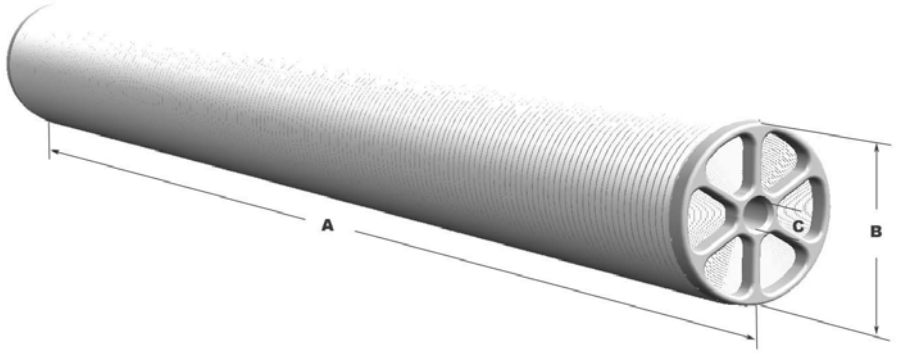
4" X-20 Low Fouling RO Turboclean Element

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-X201-TXS	1,800 (6.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Turboclean Shell with FoulGuard Technology
Active Membrane Area.....	65 ft² (5.9 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	25 GPM (5.6 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU



Element Weight : 12 (5.4)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.62 (15.9)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Desal/DuPont Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Turboclean Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM2-TSFS	9,400 (35.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Turboclean Shell
Active Membrane Area.....	355 ft² (32.6 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Turboclean Element

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS80-TSFS	8,000 (30.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Turboclean Shell
Active Membrane Area.....	355 ft² (32.6 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

8" X-20 Low Fouling RO Turboclean Element

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-X201-TSFS	9,200 (34.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Turboclean Shell with FoulGuard Technology
Active Membrane Area.....	355 ft² (32.6 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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TriSep ACM Composite
RO Membrane Elements
ACM1, ACM2, ACM3, ACM4, ACM5

TriSep offers five versions of it's popular ACM series reverse osmosis membrane elements. The ACM line is the workhorse of theTriSep RO line. It delivers high flux and high rejection in a durable and economical membrane. The membrane has good combination of chemical resistance and mechanical strength. This is exhibited by wide operating pH ranges (2-12), some resistance to oxidants such as chlorine (up to 2,000 ppm-hrs) and hydrogen peroxide, and pressures up to 1,000 psi (70 bar) with the proper construction.

ACM RO membranes typically have higher salt (NaCl) rejection than cellulose acetate or nanofiltration membranes, but in the ACM4 and ACM5 configurations have high specific flux rates and can, therefore, operate at lower feed pressures. ACM RO membranes have the ability to reject a wide range of feed species, specifically: particulates, colloidal and microbiological species, hardness, sulfate and other multivalent ions, and soluble low molecular weight (> 200 Daltons) neutral and charged organic compounds.

The ACM product line is available in 5 versions. The ACM1 and ACM2 offer the highest rejection (99.5%) and typically operate at 150 - 200 psi (10 - 14 bar). The ACM2 is one of our most popular membrane elements. It is a defacto standard for typical water purification requirements. The ACM1 and ACM2 are preferred in applications with high feedwater TDS (>3,000 ppm) and/or high recovery. The lower specific flux of these membranes compared to the ACM4 and ACM5 allows for a more balanced hydraulic flow through the system and more balanced permeate flux rates due to the high osmotic pressure of these feedwaters.

For applications where a lower operating pressure is required but you still need very high salt rejections, the ACM3 may fit the bill. This membrane typically operates at 125 - 175 psi (9 - 12 bar) but still maintains a very high salt rejection (99.5%).

For ultra low pressure operation, the ACM-LP line of ACM4 and the new ACM5 may be the best choise. These membranes have extremely high specific flux, comparable to NF membranes, while still offering excellent salt rejection (98.5-99.2%). These membranes typically operate at feed pressures of 75-150 psi (5 - 10 bar). Due to the high specific flux, these membranes are best suited to applicaitons with relatively low TDS (<3,000 ppm) to achieve balanced flux rates within the system.

TriSep ACM1 Composite RO Membrane Elements

The ACM1 offers the highest rejection (99.5%) and typically operate at 150 - 200 psi (10 - 14 bar). The ACM1 is preferred in applications with high feedwater TDS (>3,000 ppm) and/or high recovery. The lower specific flux of this membrane compared to the ACM4 and ACM5 allows for a more balanced hydraulic flow through the system and more balanced permeate flux rates due to the high osmotic pressure of these feedwaters.

4040-ACM1-TSA	4" diameter by 40" long, 0.75" I.D. female permeate tube, flush cut
4040-ACM1-TSF	4" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube
8040-ACM1-TSA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut
8040-ACM1-TXA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut, 47 mil feed spacer

PRODUCT SPECIFICATION

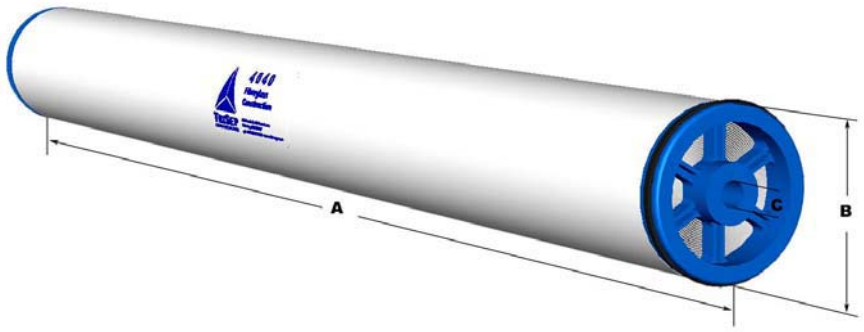
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM1-TSA	1,950 (7.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	88 ft² (8.1 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

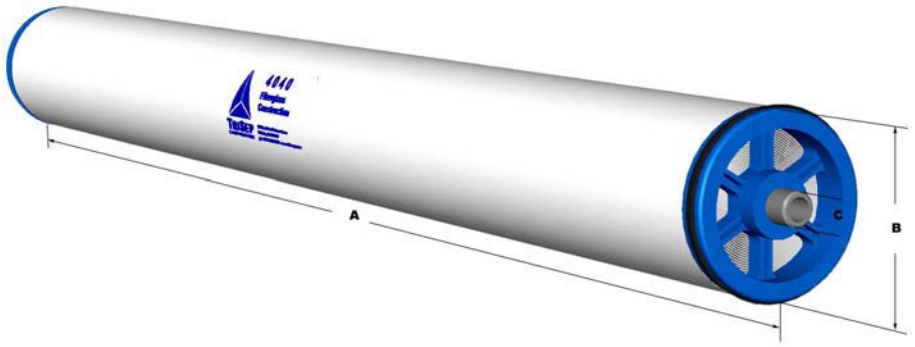
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM1-TSF	1,900 (7.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM1-TSA	8,000 (30.0)	99.50	99.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM1-TXA	6,000 (22.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	275 ft² (25.3 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	95 GPM (22 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 40 (18)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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TriSep ACM2 Composite RO Membrane Elements

The ACM2 membrane offers the highest rejection (99.5%) and typically operate at 150 - 200 psi (10 - 14 bar). The ACM2 is one of our most popular membrane elements. It is a defacto standard for typical water purification requirements. The ACM2 is preferred in applications with high feedwater TDS (>3,000 ppm) and/or high recovery. The lower specific flux of this membrane compared to the ACM4 and ACM5 allows for a more balanced hydraulic flow through the system and more balanced permeate flux rates due to the high osmotic pressure of these feedwaters.

2540-ACM2-TSF	**2.5" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube**
4040-ACM2-TSA	**4" diameter by 40" long, 0.75" I.D. female permeate tube, flush cut**
4040-ACM2-TSF	**4" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube**
4040-ACM2-TXA	**4" diameter by 40" long, 0.75" I.D. female permeate tube, flush cut, 47 mil feed spacer**
8040-ACM2-TSA	**8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut**
8040-ACM2-TSAN	**Same as 8040-ACM2-TSA but NSF approved**
8040-ACM2-UWA	**8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut, 400 ft^2**
8040-ACM2-UWAN	**Same as 8040-ACM2-UWA but NSF approved**
8340-ACM2-TSOA	**8.3" diameter by 40" long, Osmo style permeate tube and diameter.**
8540-ACM2-TSFA	**8.5" diameter by 40" long, 1.12" female permeate tube, flush cut**

PRODUCT SPECIFICATION

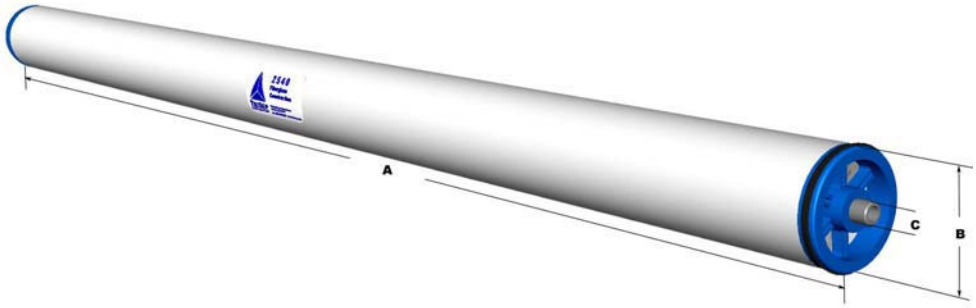
2.5" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
2540-ACM2-TSF	650 (2.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	26 ft² (2.4 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	6 GPM (1.4 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 7 (3.2)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 2.5 (63) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

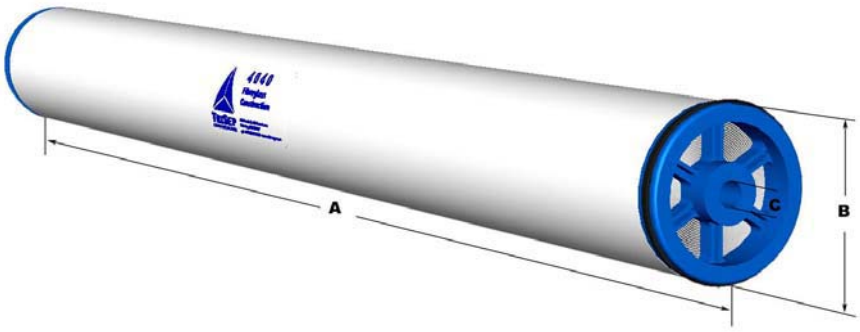
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM2-TSA	2,450 (9.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	88 ft² (8.1 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

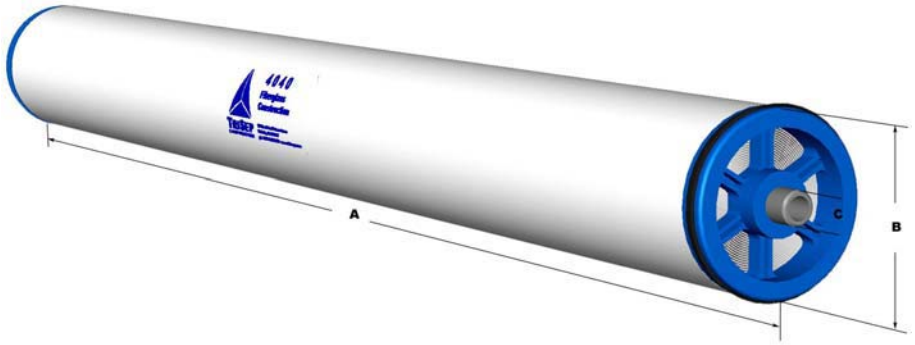
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM2-TSF	2,400 (9.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

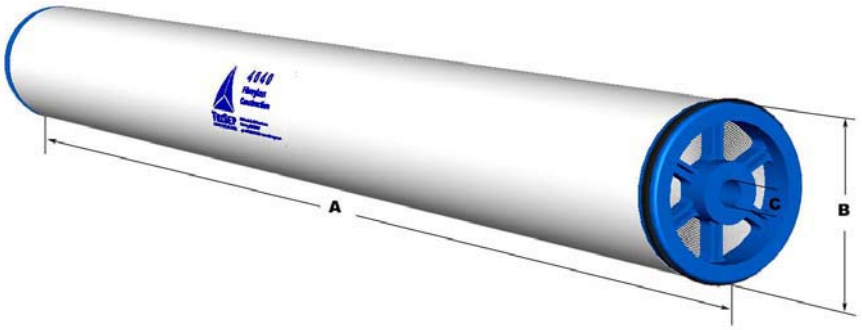
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM2-TXA	1,900 (7.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	67 ft² (6.2 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	25 GPM (5.6 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 12 (5.4)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM2-TSA	9,700 (36.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM2-TSAN	9,700 (36.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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Phone: (805) 964-8003 • Fax: (805) 964-1235 • www.trisep.com

PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM2-UWA	10,700 (40.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM2-UWAN	10,700 (40.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8.3" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8340-ACM2-TSOA	11,000 (41.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	415 ft² (38.1 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.3 (210) Permeate Tube **(C) :** 1.14 (29.0)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Osmo Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8.5" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8540-ACM2-TSFA	11,500 (43.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	440 ft² (40.4 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.5 (215) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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TriSep ACM3 Composite RO Membrane Elements

The ACM3 membrane offers the highest rejection (99.5%) but operates at lower pressure than the ACM1 or ACM2, typically at 125 - 175 psi (9 - 12 bar). The lower specific flux of this membrane compared to the ACM4 and ACM5 allows for a more balanced hydraulic flow through the system and more balanced permeate flux rates due to the high osmotic pressure of these feedwaters.

4040-ACM3-TSA	4" diameter by 40" long, 0.75" I.D. female permeate tube, flush cut
4040-ACM3-TSF	4" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube
8040-ACM3-TSA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut
8040-ACM3-TSAN	Same as 8040-ACM3-TSA but NSF approved
8040-ACM3-UWA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut, 400 ft^2
8040-ACM3-UWAN	Same as 8040-ACM3-UWA but NSF approved

PRODUCT SPECIFICATION

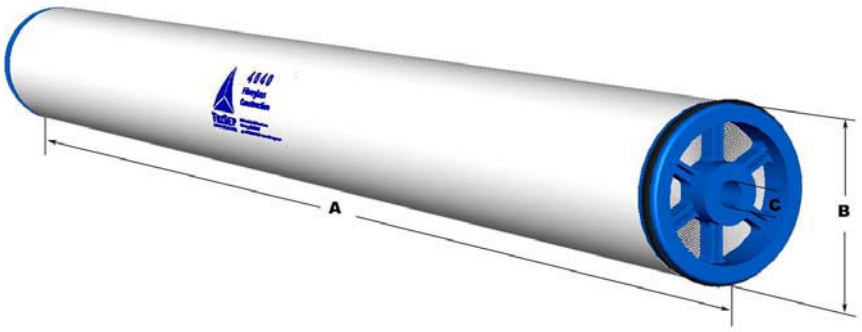
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM3-TSA	2,800 (10.0)	99.20	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	88 ft² (8.2 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

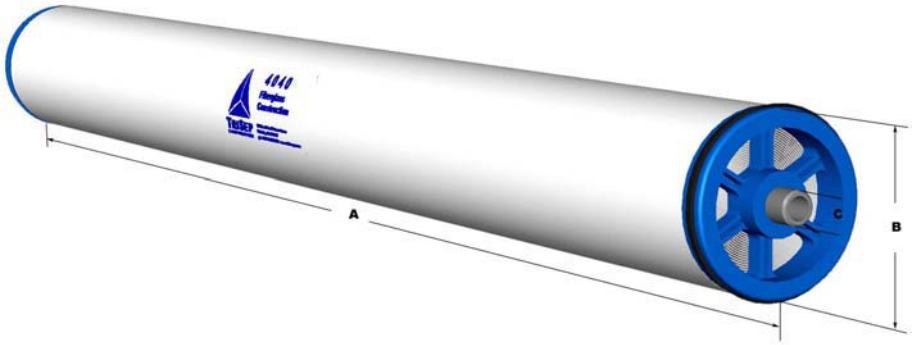
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM3-TSF	2,700 (10.0)	99.20	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM3-TSA	11,000 (41.0)	99.20	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM3-TSAN	11,000 (41.0)	99.20	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM3-UWA	12,000 (45.0)	99.20	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM3-UWAN	12,000 (45.0)	99.20	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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TriSep ACM4 Composite RO Membrane Elements

The ACM4 membrane offers higher flux than the ACM1 or ACM2 allowing operation at ultra low pressures. The ACM4 will typically operate at feed pressure of 100 - 150 psi (7 - 10 bar). Even at these high flux rates, the ACM4 still averages 99.2% salt rejection.

Due to the high specific flux, these membranes are best suited to applicaitons with relatively low TDS (<3,000 ppm) to achieve balanced flux rates within the system.

2540-ACM4-TSF	**2.5" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube**
4040-ACM4-TSA	**4" diameter by 40" long, 0.75" I.D. female permeate tube, flush cut**
4040-ACM4-TSF	**4" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube**
4040-ACM4-TWA	**4" diameter by 40" long, 0.75" I.D. female permeate tube, flush cut, 90 ft^2**
4040-ACM4-TWF	**4" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube, 90 ft^2**
4040-ACM4-TXF	**4" diameter by 40" long, 0.75" O.D. male tube, protruding tube, 47 mil feed spacer**
8040-ACM4-TSA	**8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut**
8040-ACM4-TSAN	**Same as 8040-ACM4-TSA but NSF approved**
8040-ACM4-TXA	**8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut, 47 mil feed spacer**
8040-ACM4-UWA	**8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut, 400 ft^2**
8040-ACM4-UWAN	**Same as 8040-ACM4-UWA but NSF approved**
8540-ACM4-TSFA	**8.5" diameter by 40" long, 1.12" I.D. female permeate tube, flush cut**

PRODUCT SPECIFICATION

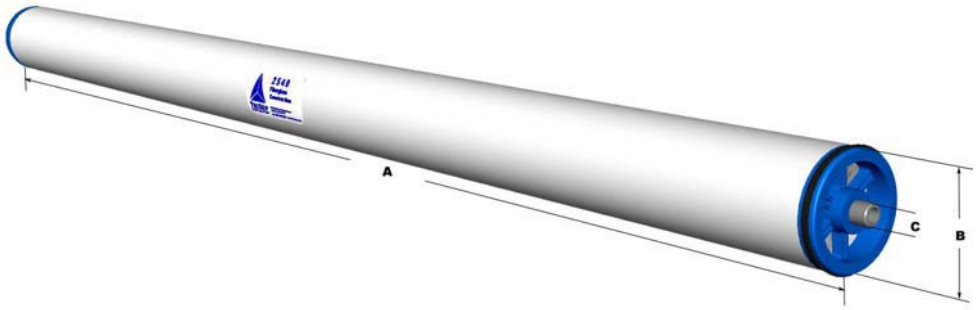
2.5" ACM-LP RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
2540-ACM4-TSF	1,000 (3.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	26 ft² (2.4 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	6 GPM (1.4 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 7 (3.2)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 2.5 (63) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

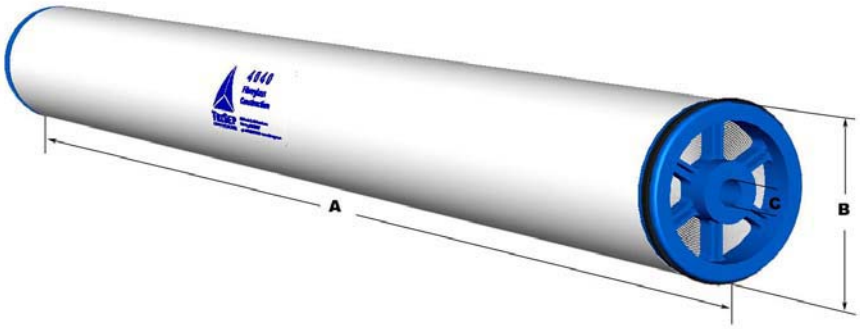
4" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM4-TSA	3,450 (13.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	88 ft² (8.2 m²)
Recommended Applied Pressure.....	40 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

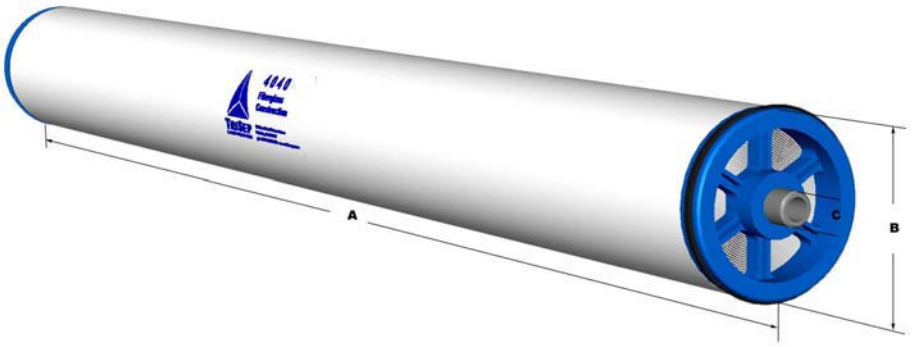
4" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM4-TSF	3,350 (12.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	40 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

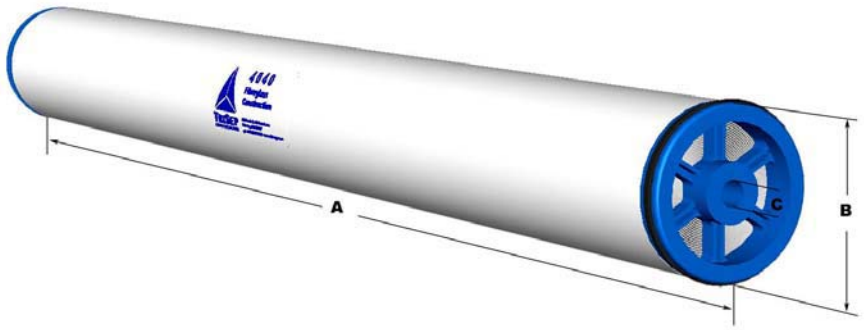
4" ACM-LP RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM4-TWA	3,600 (13.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	90 ft² (8.4 m²)
Recommended Applied Pressure.....	40 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

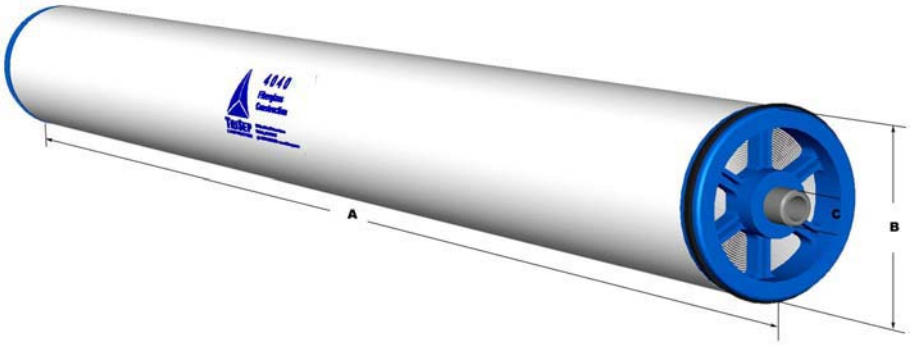
4" ACM-LP RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM4-TWF	3,500 (13.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	88 ft² (8.2 m²)
Recommended Applied Pressure.....	40 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	350 psi (24 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

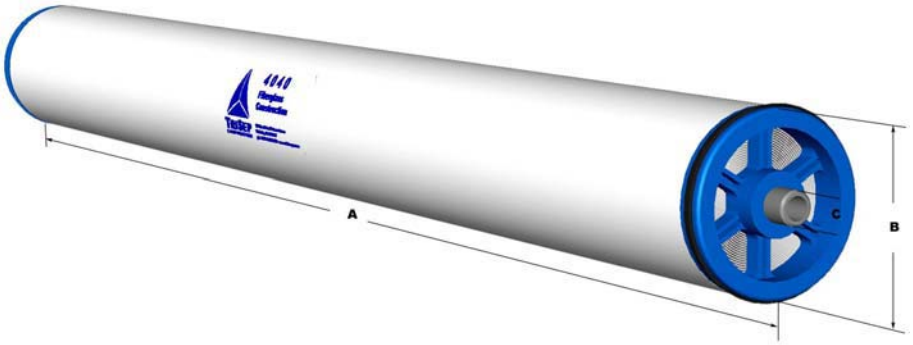
4" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM4-TXF	2,550 (9.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	65 ft² (6.0 m²)
Recommended Applied Pressure.....	40 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	25 GPM (5.6 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 12 (5.4)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM4-TSA	14,600 (55.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM4-TSAN	14,600 (55.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM4-TXA	11,000 (41.0)	98.50	97.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	275 ft² (25.3 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	95 GPM (22 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM4-UWA	16,000 (60.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound, Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM4-UWAN	16,000 (60.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound, Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8.5" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8540-ACM4-TSFA	17,500 (66.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	440 ft² (40.4 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.5 (215) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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TriSep ACM5 Composite RO Membrane Elements

The ACM5 membrane offers the highest flux in the ACM family allowing operation at ultra low pressures. The ACM5 will typically operate at feed pressure of 75 - 125 psi (5 - 9 bar). Even at these high flux rates, the ACM5 still averages 98.5% salt rejection.

Due to the high specific flux, these membranes are best suited to applicaitons with relatively low TDS (<3,000 ppm) to achieve balanced flux rates within the system.

2540-ACM5-TSF	2.5" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube
4040-ACM5-TWF	4" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube, 88 ft^2
8040-ACM5-TSA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut
8040-ACM5-URA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut, 430 ft^2
8040-ACM5-URA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut, 400 ft^2

PRODUCT SPECIFICATION

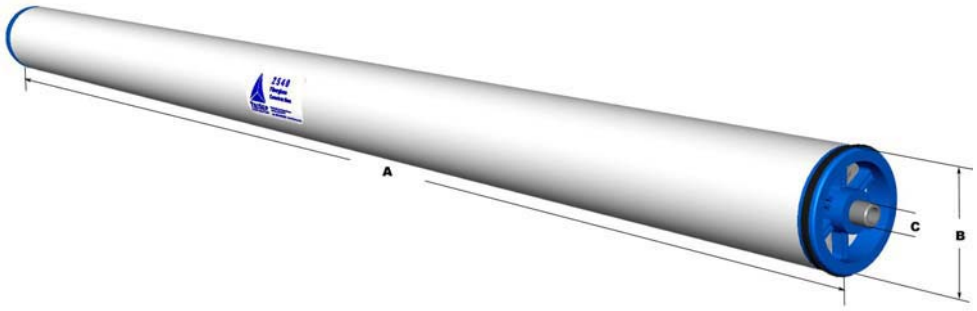
2.5" ACM-LP RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
2540-ACM5-TSF	800 (3.0)	98.50	97.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 150.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	26 ft² (2.4 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	6 GPM (1.4 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 7 (3.2)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 2.5 (63) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

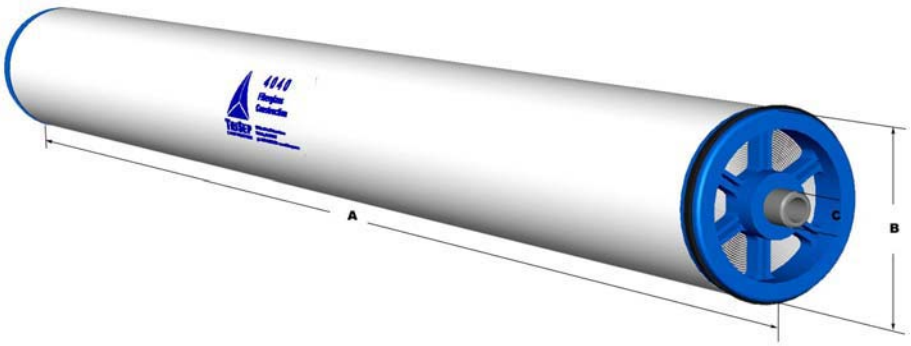
4" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM5-TWF	2,500 (9.0)	98.50	97.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 150.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	88 ft² (8.2 m²)
Recommended Applied Pressure.....	40 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM5-TSA	11,900 (45.0)	98.50	97.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 150.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM5-URA	13,000 (49.0)	98.50	97.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 150.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound, Fiberglass Outer Wrap
Active Membrane Area.....	430 ft² (40.0 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.026" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM5-UWA	12,500 (47.0)	98.50	97.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 150.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound, Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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TriSep TS80, TS83 and XN45 Low Fouling Nanofiltration Elements

TriSep offers two different nanofiltration (NF) membrane chemistries, the TS80 and the XN45. Both are based on proprietary and patented technology developed by DuPont. The unique chemistries of these membranes allow them to have lower organic fouling than standard '344 type NF membranes. The TS80 is typically used in municipal membrane softening applications. It has a higher relative sodium chloride rejection (~90%) than the XN45 (~30%). The TS80, or its higher flow cousin, are excellent choices to remove THM precursors, color, iron, and hardness from surface and well waters. The XN45 is typically used in process application where there is a desire to allow monovalent ions to pass through the membrane will rejecting divalent ions or low molecular weight organic molecules such as sugars. NF is a membrane process which can be applied to the treatment of a variety of water supplies with many economic and process advantages.

NF membranes typically have lower salt (NaCl) rejection than reverse osmosis membranes, but have higher specific flux rates and can, therefore, operate at lower feed pressures. NF membranes have the inherent ability to reject or separate different feed species, specifically: particulates, colloidal and microbiological species, hardness, sulfate and other multivalent ions, and soluble low molecular weight (> 200 Daltons) neutral and charged organic compounds.

These species typically contribute little to osmotic pressures even at high system recoveries. This is a property consistent with large molecular weight molecules, as is the case for THM's (trihalomethane precursors), or highly hydrated multivalent ions such as sulphate, magnesium and iron. At the same time, common monovalent (nonhydrated) ions, such as sodium and chloride, which are prevalent in feedwaters, are poorly rejected by most NF membranes, which also leads to lower osmotic pressures, therefore, permitting lower net driving pressures (NDP).

This in turn permits designs of nanofiltration systems capable of operation at relatively high specific flux rates and recoveries, with low feed pressures and low power requirements.

In the last five years, the range of applications has expanded widely. Starting with systems designed primarily for removal of THM precursors, color, and hardness from low TDS potable and brackish feed waters, many innovative combinations are now being offered. They are often described by such terms as "Integrated Membrane Systems" or "Hybrid Systems".

This trend has been greatly accelerated in the potable water field by increasingly stringent regulatory requirements. These requirements now require Turbidity (NTU) and particulate limits that are almost too low to measure, as well as lower disinfection byproduct (THM) and TOC limits.

NF can make major contributions to waste water recovery and re-use in both municipal and industrial applications. Increasingly, the quality of the reclaimed (generally low TDS) waters needs to be improved whether for re-injection, percolation, irrigation, boilers, and other industrial processes.

The needs to meet increasingly higher standards include 3-6 log reduction of pathogens, limits on Turbidity, TDS, TOC and chlorine demand.

TriSep TS80, TS83 and XN45
Low Fouling
Nanofiltration Elements

At the other end of the applications scale, NF is capable of providing many benefits for Sea Water (Very High TDS) desalination, by both membrane and thermal (distillation) processes. Sea Water contains significant concentrations of bicarbonate alkalinity and divalent ions, including magnesium, sulfate, and calcium.

For both membrane and thermal systems to achieve higher recoveries, one must add acid and/or antiscalant. The use of these chemicals, and controlling their dosage, can often present major problems in operation, such as brine disposal and biogrowth problems.

The use of NF as a first stage of a two stage Seawater Membrane System, or a NF-Distillation Hybrid system means that the second stage, be it reverse osmosis or distillation, can operate at maximum recovery, generally significantly above those ordinarily attainable, but with little or no chemical dosing or other pretreatment. In addition, there is some reduction in the TDS of the feedwater and less fouling of the downstage process.

TriSep TS80 and TS83 Composite Nanofiltration Membrane Elements

The TS80 and TS83 nanofiltration (NF) membranes are based on proprietary and patented technology developed by DuPont. The unique chemistry of these membranes allow them to have lower organic fouling than standard '344 type NF membranes. These memebrnaes are not hydrolyzed or oxidized standard ACM type RO membranes, but rather are formulated to naturally have the flow and rejection properties of a NF membrane. This makes the TS80 more rogbust and have better chemical resistance than a NF membrane that is made by degrading a RO membrane. All TS80 elements are factory tested on MgSO4 and water solutions.

The TS80 is typically used in municipal membrane softening applications. It has a higher relative sodium chloride rejection (~90%) than the XN45 (~30%). The TS80, or its higher flow cousin, the TS83, are excellent choices to remove THM precursors, color, iron, and hardness from surface and well waters.

2540-TS80-TSF	2.5" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube
4040-TS80-TSA	4" diameter by 40" long, 0.75" O.D. female permeate tube, flush cut
4040-TS80-TSF	4" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube
4040-TS83-TSF	4" diameter by 40" long, 0.75" O.D. male tube, protruding tube, higher flow
8040-TS80-TSA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut
8040-TS80-TSAN	Same as 8040-TS80-TSA but NSF approved
8040-TS80-UWA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut, 400 ft^2
8040-TS80-UWAN	Same as 8040-TS80-USA but NSF approved
8040-TS83-TSA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut
8040-TS83-TSAN	Same as 8040-TS83-TSA but NSF approved
8040-TS83-UWA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut, 400 ft^2
8040-TS83-UWAN	Same as 8040-TS83-USA but NSF approved
8540-TS83-TSFA	8.5" diameter by 40" long, 1.12" I.D. female permeate tube, flush cut

PRODUCT SPECIFICATION

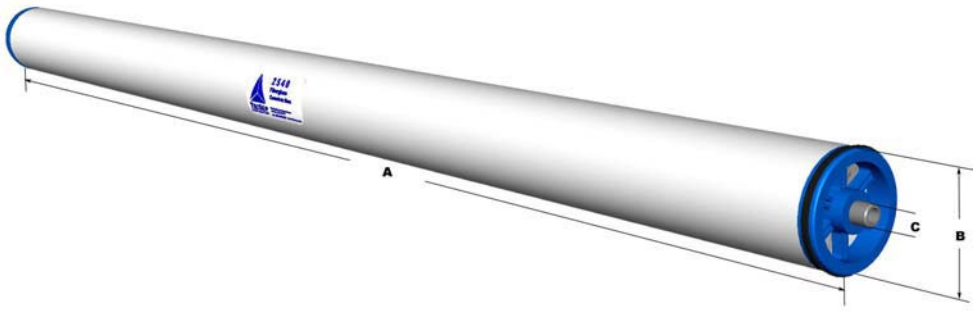
2.5" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
2540-TS80-TSF	650 (2.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	26 ft² (2.4 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	6 GPM (1.4 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 7 (3.2)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 2.5 (63) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

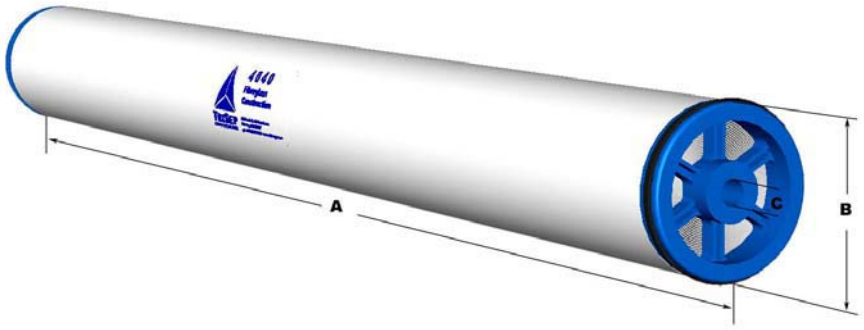
4" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-TS80-TSA	2,000 (7.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	88 ft² (8.1 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

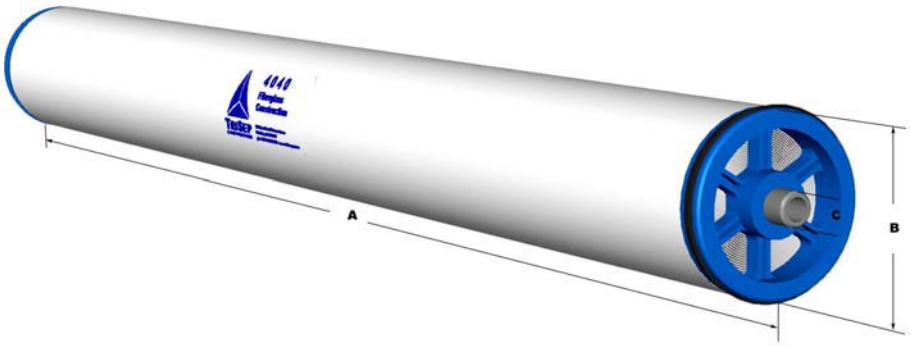
4" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-TS80-TSF	2,000 (7.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

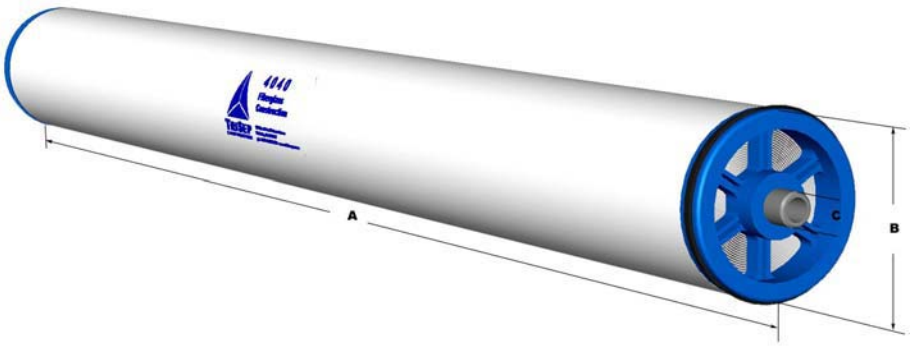
4" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-TS83-TSF	2,300 (8.0)	98.00	96.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS80-TSA	9,000 (34.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS80-TSAN	9,000 (34.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS80-UWA	10,000 (37.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS80-UWAN	10,000 (37.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS83-TSA	10,000 (37.0)	98.50	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS83-TSAN	10,000 (37.0)	98.50	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS83-UWA	11,000 (41.0)	98.50	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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Phone: (805) 964-8003 • Fax: (805) 964-1235 • www.trisep.com

PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS83-UWAN	11,000 (41.0)	98.50	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8.5" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8540-TS80-TSFA	10,800 (40.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	440 ft² (40.4 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.5 (215) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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TriSep XN45 Composite Nanofiltration Membrane Elements

The XN45 membranes are based on proprietary and patented technology developed by DuPont. The unique chemistry of this membrane allows it to have lower organic fouling than standard '344 type NF membranes. This membrane is not hydrolyzed or oxidized standard ACM type RO membranes, but rather is formulated to naturally have the flow and rejection properties of a NF membrane. This makes the XN45 more rogbust and have better chemical resistance than a NF membrane that is made by degrading a RO membrane. All XN45 elements are factory tested on MgSO4 and water solutions.

The XN45 is typically used in process application where there is a desire to allow monovalent ions to pass through the membrane will rejecting divalent ions or low molecular weight organic molecules such as sugars. The XN45 has 20-30% rejection of NaCl and 95-96% rejection of $MgSO_4$. NF is a membrane process which can be applied to the treatment of a variety of water supplies with many economic and process advantages.

2540-XN45-TSF	2.5" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube
4040-XN45-TSF	4" diameter by 40" long, 0.75" O.D. male permeate tube, protruding permeate tube
8040-XN45-TSA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut
8040-XN45-TXA	8" diameter by 40" long, 1.50" I.D. female permeate tube, flush cut, 47 mil feed spacer

PRODUCT SPECIFICATION

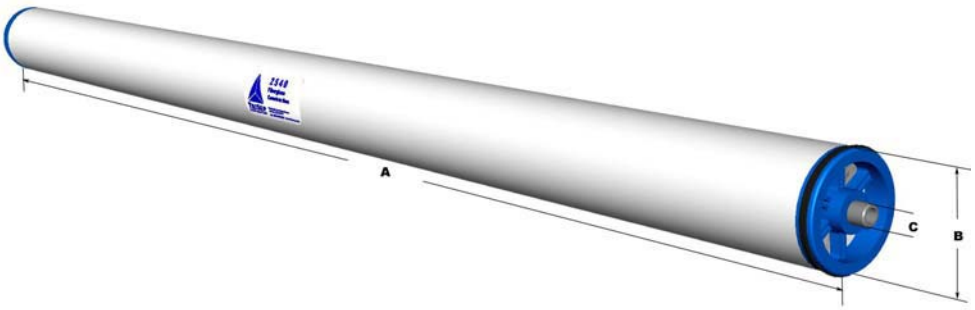
2.5" XN45 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
2540-XN45-TSF	600 (2.0)	95.00	92.50

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	XN45 Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	26 ft² (2.4 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	6 GPM (1.4 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 2.5 (63) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

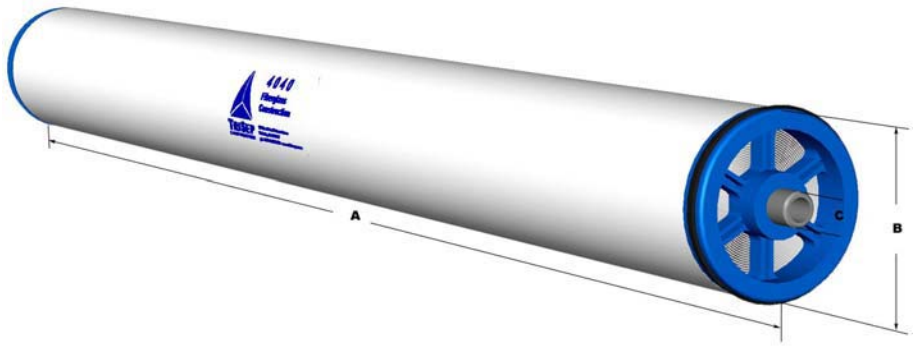
4" XN45 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-XN45-TSF	2,000 (7.0)	95.00	92.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	XN45 Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" XN45 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-XN45-TSA	9,500 (35.0)	95.00	92.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	XN45 Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" XN45 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-XN45-TXA	7,200 (27.0)	95.00	92.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	XN45 Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	275 ft² (25.3 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	95 GPM (22 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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TriSep Cellulose Acetate RO Membranes SB20, SB50, and SB90

Cellulose acetate (CA) membranes were the first commercialized RO membranes developed in the late 1960's. CA membranes offered a good combination of rejection, fouling resistance, and the ability to tolerate continous chlorine up to 1.0 ppm. Some of the reasons they lost favor to the new polyamide membranes was the requirement for acidification (CA membranes should be operated at a pH of between 4-6 to minimize hydrolysis), lower rejection (98% versus 99.5%) and higher net drive pressure requirements (300 psi/20 bar versus 150 psi/10 bary).

But in many applications, CA membranes operate very well and give long and usefull service lifes. They have an advantage over the newer polyamide membranes for applications with high organic fouling, such as wastewaters, and waters where biological growth is an issue (easily addressed using chlorine). There is large installed base of CA membranes in many different applications, and the SB series of membrane elements from TriSep can satisfy most retrofitting or new system applications.

The SB series of membrane elements from TriSep are available in 2.5", 4", 8", 8.3", and 8.5" diameters. There are three different membranes offered, the SB20, SB50, and SB90. The SB20 offers the highest rejection at 98%, while the SB50 offers 20% higher flow at 95% salt rejection. The SB90 is a nanofiltration (NF) membrane operating at about twice the flow of the SB20 at 85-90% rejection.

PRODUCT SPECIFICATION

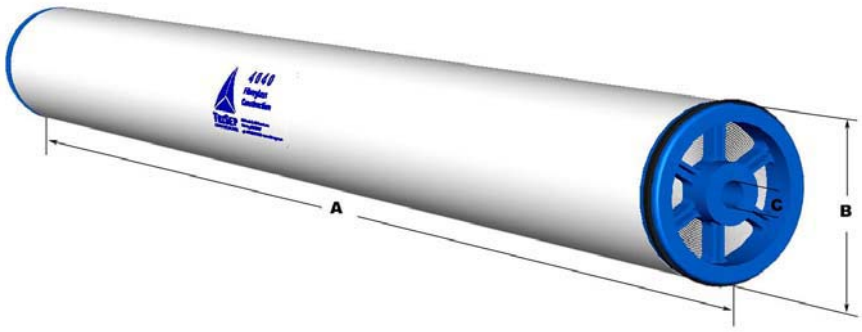
4" CA RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-SB20-TSA	1,600 (6.0)	98.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 420.0 psi, 25°C, 15% recovery, pH 5.5, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	SB Cellulose Acetate Blend
Configuration.....	Spiral Wound, Fiberglass Outer Wrap
Active Membrane Area.....	80 ft² (7.4 m²)
Recommended Applied Pressure.....	200 - 500 psi (14 - 34 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	50 - 90°F (10 - 32°C)
Feedwater pH Range.....	5.5 nominal, 4 - 7
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	20 GPM (4.5m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

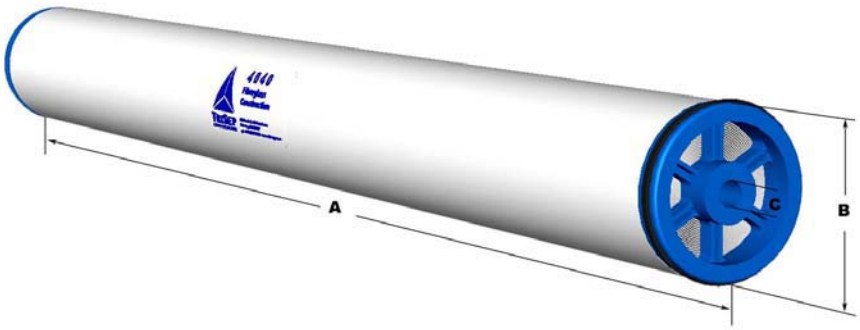
4" CA RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-SB50-TSA	2,000 (7.0)	95.00	92.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 420.0 psi, 25°C, 15% recovery, pH 5.5, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	SB Cellulose Acetate Blend
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	80 ft² (7.4 m²)
Recommended Applied Pressure.....	200 - 500 psi (14 - 34 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	50 - 90°F (10 - 32°C)
Feedwater pH Range.....	5.5 nominal, 4 - 7
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" CA RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-SB20-TSA	7,000 (26.0)	98.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 420.0 psi, 25°C, 15% recovery, pH 5.5, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	SB Cellulose Acetate Blend
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	350 ft² (32.5 m²)
Recommended Applied Pressure.....	200 - 500 psi (14 - 34 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	50 - 90°F (10 - 32°C)
Feedwater pH Range.....	5.5 nominal, 4 - 7
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" CA RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-SB50-TSA	8,500 (32.0)	95.00	92.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 420.0 psi, 25°C, 15% recovery, pH 5.5, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	SB Cellulose Acetate Blend
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	350 ft² (32.5 m²)
Recommended Applied Pressure.....	200 - 500 psi (14 - 34 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	50 - 90°F (10 - 32°C)
Feedwater pH Range.....	5.5 nominal, 4 - 7
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8.3" CA RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8340-SB20-TSOA	8,000 (30.0)	98.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 420.0 psi, 25°C, 15% recovery, pH 5.5, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	SB Cellulose Acetate Blend
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	415 ft² (38.1 m²)
Recommended Applied Pressure.....	200 - 500 psi (14 - 34 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	50 - 90°F (10 - 32°C)
Feedwater pH Range.....	5.5 nominal, 4 - 7
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.3 (210) Permeate Tube **(C) :** 1.14 (29.0)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Osmo Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8.5" CA RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8540-SB20-TSA	8,400 (31.0)	98.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 420.0 psi, 25°C, 15% recovery, pH 5.5, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	SB Cellulose Acetate Blend
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	440 ft² (40.4 m²)
Recommended Applied Pressure.....	200 - 500 psi (14 - 34 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	50 - 90°F (10 - 32°C)
Feedwater pH Range.....	5.5 nominal, 4 - 7
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.5 (215) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8.5" CA RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8540-SB50-TSA	10,000 (37.0)	95.00	92.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 420.0 psi, 25°C, 15% recovery, pH 5.5, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	SB Cellulose Acetate Blend
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	440 ft² (40.4 m²)
Recommended Applied Pressure.....	200 - 500 psi (14 - 34 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	50 - 90°F (10 - 32°C)
Feedwater pH Range.....	5.5 nominal, 4 - 7
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.5 (215) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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UE Ultrafiltration Membranes
100,000 MWCO

TriSep offers two conventional ultrafiltration (UF) membrane elements, the UE10 and the UE50. Both of these membranes are made from a polysulfone chemistry that offers high specific flux, uniform pore sizes, and excellent chemical resistance. The UE10 have a molecular weight cut off (MWCO) of 10,000 while the UE50 has a MWCO of 100,000.

UF membranes do not reject any dissolved salts, such as hardness, alkalinity, sodium, chloride, or sulphate. They do reject large organic molecules and are typically characterized by the molecular weight of a group of organic molecules where a minimum of 90% rejection is achieved. Rejection of organic molecules varies depending on the geometry of the molecule and the size and distribution of the membranes pore size.

TriSep characterizes the UE10 using a combination of proteins (Cytochrome C) and dextran molecules of varying molecular weight. The UE50 is tested on varying molecular weight dextran molecules. The UE10 has a clean water specific flux of aroung 1.3 gfd/psi (32 lmh/bar) while the UE50 has a specific flux of around 1.7 gfd/psi (42 lmh/bar).

The UE10 is typically used for applications where rejection of proteins is required such as for whey protein concentration in the dairy industry. The UE50 is used where removal of suspended solids are required such as for surface water treatment prior to an RO system or for removal of occysts such as cryptosporidium or giardia.

The UE10 and UE50 have excellent resistance to a wide range of pH's (2-12), excellent tolerance to chlorine (up to 1,000 ppm) and other oxidants, and excellent thermal stability (with the proper element construction up to 140°F/60°C).

The UE10 and UE50 membranes are not back flushable membranes like the UB50 membrane used in the SpiraSep. For applications with high loadings of suspended solids, the SpiraSep should be used rather than the UE10 or the UE50.

PRODUCT SPECIFICATION

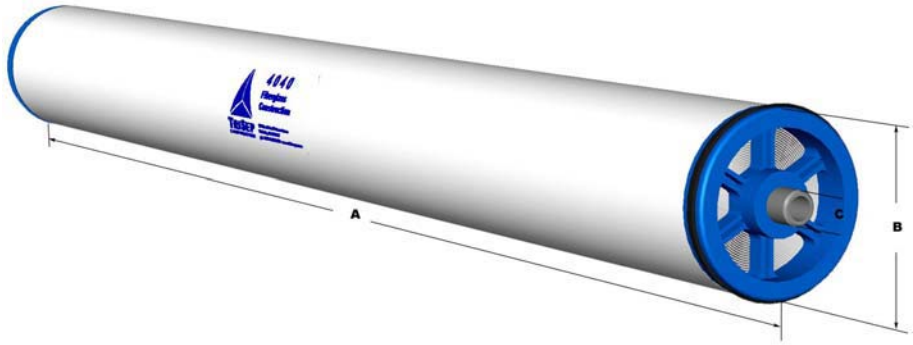
4" AUM Ultrafiltration Element Series

Model	Permeate flow GPD (m3/day)*	M.W.C.O.
4040-UE50-QSF	4,400 (16.0)	100,000

Performance is based on the following test conditions: 500.0 ppm Dextran, 30.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	AUM Advanced Ultrafiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	80 ft² (7.3 m²)
Recommended Applied Pressure.....	20 - 200 psi(1.4 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	10.0 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

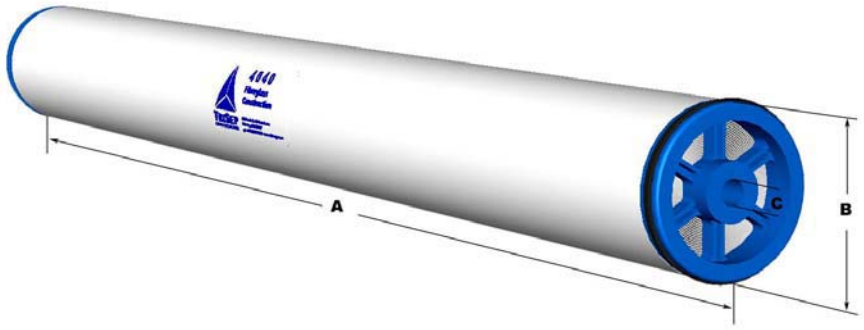
4" AUM Ultrafiltration Element Series

Model	Permeate flow GPD (m3/day)*	M.W.C.O.
4040-UE50-QXA	3,500 (13.0)	100,000

Performance is based on the following test conditions: 500.0 ppm Dextran, 30.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	AUM Advanced Ultrafiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	65 ft² (6.0 m²)
Recommended Applied Pressure.....	20 - 200 psi(1.4 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	10.0 ppm
Maximum Feed Flow.....	25 GPM (5.6 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 12 (5.4)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

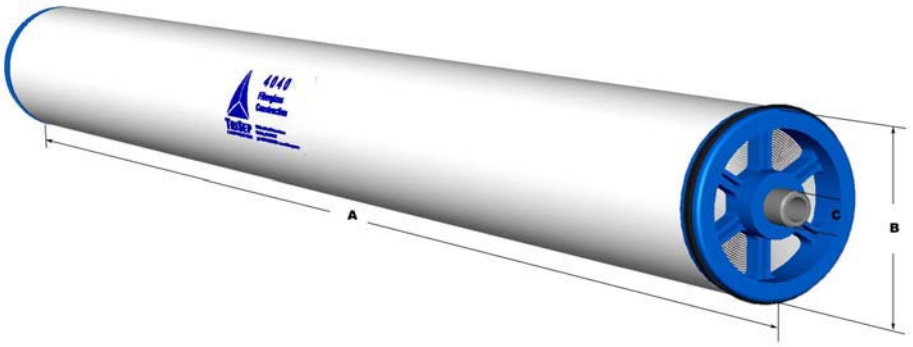
4" AUM Ultrafiltration Element Series

Model	Permeate flow GPD (m3/day)*	M.W.C.O.
4040-UE50-QXF	3,400 (12.0)	100,000

Performance is based on the following test conditions: 500.0 ppm Dextran, 30.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	AUM Advanced Ultrafiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	62 ft² (5.7 m²)
Recommended Applied Pressure.....	20 - 200 psi(1.4 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	10.0 ppm
Maximum Feed Flow.....	25 GPM (5.6 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 12 (5.4)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" AUM Ultrafiltration Element Series

Model	Permeate flow GPD (m3/day)*	M.W.C.O.
8040-UE50-QSA	20,000 (75.0)	100,000

Performance is based on the following test conditions: 500.0 ppm Dextran, 30.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	AUM Advanced Ultrafiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	360 ft² (33.4 m²)
Recommended Applied Pressure.....	20 - 200 psi (1.4 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	10.0 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" AUM Ultrafiltration Element Series

Model	Permeate flow GPD (m3/day)*	M.W.C.O.
8040-UE50-QXA	15,000 (56.0)	100,000

Performance is based on the following test conditions: 500.0 ppm Dextran, 30.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	AUM Advanced Ultrafiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	270 ft² (24.8m²)
Recommended Applied Pressure.....	20 - 200 psi (1.4 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	10.0 ppm
Maximum Feed Flow.....	95 GPM (22 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 40 (18)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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TM10 PVDF
Microfiltration Elements

The TM10 microfiltration membrane from TriSep is a 0.2 mircon nominal pore size membrane made from polyvinylidene flouride (PVDF). This membrane offers very high specific flus rates (5 gfd/psi (120lmh/bar)) with a uniform pore distribution. This membrane is characterized using a particle counter and bubble point testing.

This membrane is excellent for removal of suspended solids. Dissolved inorganic and organic materials are not rejected by this membrane. Typical applications include removal of oocysts such as giardia and cryptosporidium from drinking water, pretreatment of surface or wastewaters prior to an RO system, or clarification of process and food streams.

The PVDF chemistry of the TM10 membrane has excellent thermal and chemical properties. The membrane, with the appropriate element construction, can operate at temperatures of up to 165°F (75°C) and over a wide range of pH's (2-12). The membrane is resistant to a wide range of oxidants and can tolerate up to 1,000 ppm of chlorine.

The TM10 membranes are not back flushable membranes like the UB50 membrane used in the SpiraSep. For applications with high loadings of suspended solids, the SpiraSep should be used rather than the TM10.

PRODUCT SPECIFICATION

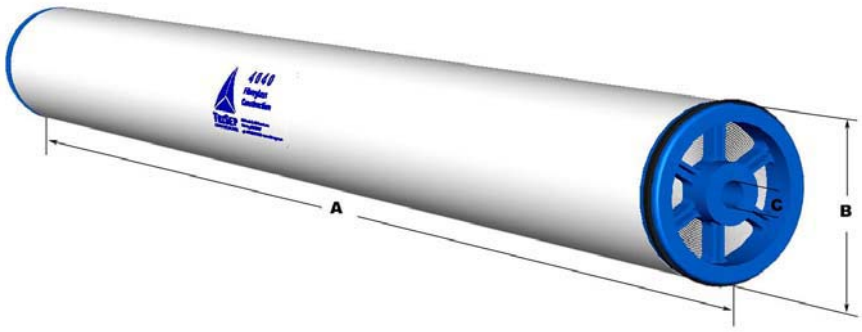
4" AMM Microfiltration Element Series

Model	Permeate flow GPD (m3/day)*	Pore Size
4040-TM10-QXA	2,600 (9.0)	0.2 microns

Permeate flow is based on the clean water flux at the following test conditions: 10.0 psi, 25°C, pH 8.0, 15% recovery, 15 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type	AMM Advanced Microfiltration Membrane
Configuration	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area	65 ft² (6.0 m²)
Recommended Applied Pressure	5 - 200 psi (0.3 - 14 bar)
Maximum Applied Pressure	600 psi (41 bar)
Recommended Operating Temperature	35 - 113°F (2 - 45°C)
Feedwater pH Range	2 - 11 continuous
Chlorine Tolerance	10.0 ppm
Maximum Feed Flow	25 GPM (5.6 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

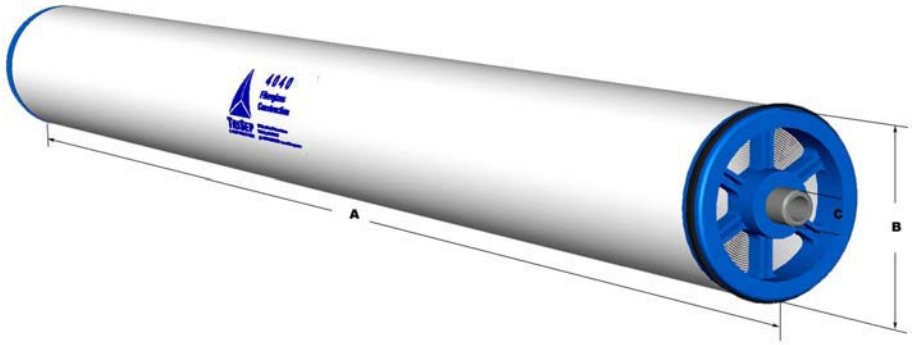
4" AMM Microfiltration Element Series

Model	Permeate flow GPD (m3/day)*	Pore Size
4040-TM10-QXF	2,500 (9.0)	0.2 microns

Permeate flow is based on the clean water flux at the following test conditions: 10.0 psi, 25°C, pH 8.0, 15% recovery, 15 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	AMM Advanced Microfiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	62 ft² (5.7 m²)
Recommended Applied Pressure.....	5 - 200 psi (0.3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	10.0 ppm
Maximum Feed Flow.....	25 GPM (5.6 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 12 (5.4)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" AMM Microfiltration Element Series

Model	Permeate flow GPD (m3/day)*	Pore Size
8040-TM10-QXA	10,800 (40.0)	0.2 microns

Permeate flow is based on the clean water flux at the following test conditions: 10.0 psi, 25°C, pH 8.0, 15% recovery, 15 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	AMM Advanced Microfiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	270 ft² (24.8 m²)
Recommended Applied Pressure.....	5 - 200 psi (0.3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	10.0 ppm
Maximum Feed Flow.....	95 GPM (22 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.047" thick parallel spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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Certified Products
NSF Standard 60 and 61
KIWA ATA

Historically, drinking water systems, membranes, and chemicals were not covered by any governing agency in the United States, and in most foreign countries. The FDA and USDA in the United States, regulated the food, dairy. beverage. bottled water, and pharmaceudical markets, but did not have jurisdiction over drinking water. With the increasing focus on water purity, this is rapidly changing. Many states in the US now require NSF approved membrane elements and antiscalants. Many European countries have their own governmental approval aganecy such as KIWA in the Netherlands.

NSF International, The Public Health and Safety Company™, a not-for-profit, non-governmental organization, is the world leader in standards development, product certification, education, and risk-management for public health and safety. For 60 years, NSF has been committed to public health, safety, and protection of the environment. While focusing on food, water, indoor air, and the environment, NSF develops national standards, provides learning opportunities through its Center for Public Health Education, and provides third-party conformity assessment services while representing the interests of all stakeholders. The primary stakeholder groups include industry, the regulatory community, and the public at large. Listings can be checked on the NSF website at www.nsf.org .

Two standards from NSF apply to TriSep products. NSF standard 60 is used to test and approve various chemicals that may be added to drinking water for toxicological effects on humans. A maximum dose rate is established based on the toxicity and use of the chemicals. Two TriSep products have NSF 60 certification, the TriPol 8510 and TriPol 9010 antiscalants. These can be used as an antiscalant to an RO system at a concentration up to 4 ppm and 10 ppm respectively.

A number of TriSep membrane elements have been approved under NSF Standard 61. This is a relatively new development as in the past NSF would not certify membrane elements as stand alone devices. This standard does not validate the performance of the element, but tests for any toxicological concerns regarding the leaching any residual chemicals into the permeate water.

The Netherlands has a governmental agency, KIWA, that is owned by the local water municipalities. This organization tests many items used in the purification and distribution of water. The 8040-TS82-TSA membrane element from TriSep is KIWA ATA approved for use in producing drinking water by nanofiltration.

TriSep NSF Standard 61
Element Listing

NSF/ANSI STANDARD 61
Drinking Water System Components - Health Effects

NOTE: Unless otherwise indicated for Materials, Certification is only for the Water Contact Material shown in the Listing. Click here for a list of Abbreviations used in these Listings.

TRISEP CORPORATION
93 SOUTH LA PATERA
GOLETA, CA 93117
805-964-8003

Facility : GOLETA, CA

Mechanical Devices

Trade Designation	Size	Water Contact Temp	Water Contact Material
Reverse Osmosis Element			
8040-ACM2-TSAN[1] [2]	NA	CLD 23	MLTPL
8040-ACM2-UWAN[1] [2]	NA	CLD 23	MLTPL
8040-ACM3-TSAN	NA	CLD 23	MLTPL
8040-ACM3-UWAN	NA	CLD 23	MLTPL
8040-ACM4-TSAN[1] [2]	NA	CLD 23	MLTPL
8040-ACM4-UWAN[1] [2]	NA	CLD 23	MLTPL
8040-ACM5-TSAN	NA	CLD 23	MLTPL
8040-ACM5-UWAN	NA	CLD 23	MLTPL
8040-TS80-TSAN[1] [2]	NA	CLD 23	MLTPL
8040-TS80-UWAN[1] [2]	NA	CLD 23	MLTPL
8040-TS83-TSAN	NA	CLD 23	MLTPL
8040-TS83-UWAN	NA	CLD 23	MLTPL
8040-X201-TSAN[1] [2]	NA	CLD 23	MLTPL
8040-X201-UWAN[1] [2]	NA	CLD 23	MLTPL
8040-X20LP-TSAN	NA	CLD 23	MLTPL
8040-X20LP-UWAN	NA	CLD 23	MLTPL

[1] Certified for a minimum flow of 1,100 gallons per day. Product requires a 1 hour conditioning flush with potable water prior to use.
[2] Serial number 191709 and greater.

ANSI/NSF STANDARD 60
Drinking Water Treatment Chemicals - Health Effects

TRISEP CORPORATION

93 SOUTH LA PATERA LANE
GOLETA, CA 93117
805-964-8003

Plant at: GOLETA, CA

Miscellaneous Water Supply Products

Trade Designation	*Product Function*	*Max Use*
TriPol 8500	Reverse Osmosis Antiscalant	4 mg/L
TriPol 8510	Reverse Osmosis Antiscalant	4 mg/L
TriPol 9000	Reverse Osmosis Antiscalant	10 mg/L
TriPol 9005	Reverse Osmosis Antiscalant	10mg/L
TriPol 9010	Reverse Osmosis Antiscalant	10 mg/L
TriPol 9013	Reverse Osmosis Antiscalant	10mg/L

Plant at: ROANOKE, VA

Miscellaneous Water Supply Products

Trade Designation	*Product Function*	*Max Use*
TriPol 9010	Reverse Osmosis Antiscalant	10mg/L
TriPol 9000	Reverse Osmosis Antiscalant	10mg/L
TriPol 8510	Reverse Osmosis Antiscalant	4mg/L
TriPol 8500	Reverse Osmosis Antiscalant	4mg/L
TriPol 9005	Reverse Osmosis Antiscalant	10mg/L
TriPol 9013	Reverse Osmosis Antiscalant	10mg/L

PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM2-TSAN	9,700 (36.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in parenthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM2-UWAN	10,700 (40.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM3-TSAN	11,000 (41.0)	99.20	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM3-UWAN	12,000 (45.0)	99.20	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM4-TSAN	14,600 (55.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM4-UWAN	16,000 (60.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound, Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM5-TSAN	11,900 (45.0)	98.50	97.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 150.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS80-TSAN	9,000 (34.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS80-UWAN	10,000 (37.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS82-TSA	10,000 (37.0)	98.00	96.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

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Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS83-TSAN	10,000 (37.0)	98.50	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS83-UWAN	11,000 (41.0)	98.50	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" X-20 Low Fouling RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-X201-TSAN	9,500 (35.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap with FoulGuard Technology
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" X-20 Low Fouling RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-X201-UWAN	10,400 (39.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap with FoulGuard Technology
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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Competitive Element Replacement Guide

Replacing elements from one competitor to the next can be a difficult and frustrating task. Inboard adpaters, the piece that adapts the first and last element within a pressure tube to the pressure tube end cap, must be designed and manufactured for both the proper element and pressure tube. This makes for a large matrix of possible combinations. Although TriSep stocks a large variety of inboard adapters, in many cases customers want an exact mechanical retofit to their existing elements.

Most variations in elements center around different permeate tube diameters and/or configurations (male versus female). There are also special element diameters (8.3" and 8.5") that some manufacturers have produced to try and minimize competition.

To address different permeate tube diameters, TriSep makes a variety of elements to exactly retrofit many of our competitors elements. In the 4" diameter, we offer both the TriSep style permeate tube (0.75" I.D. female permeate tube) as well as the more common Dow/Filmtec style permeate tube (0.75" O.D. male permeate tube). In the 8" diameter element, TriSep makes a standard TriSep style (1.5" I.D. female permeate tube which is also being adopted by Dow/Filmtec on their LE and XLE elements), a Dow/Filmtec style (1.12" I.D. female permeate tube), and GE/Osmonics style (1.19" I.D. female permeate tube), and a Desal/DuPont style (1.18" I.D. female permeate tube).

In 1991, TriSep purchased the Spiral Wound Assets from E.I. DuPont de Nemours and Company. DuPont had a line of spiral wound elements that had permeate tube dimensions that are the same as the Desal permeate tubes.

To address different element diameters, TriSep makes an 8.3" diameter element to retrofit Osmonics elements, as well as 8.5" diameter elements to retrofit Hydranautics style elements.

Attached in this section is a copy of our competitive element replacement guide to help you in selecting the proper TriSep element for your element replacement needs. Most of these elements are non-standard and are made to order. The only exceptions are the 4040-XXXX-TSF which are normally stocked by TriSep.

Competitive Element Replacement Guide

Desal/DuPont Replacement Elements

TriSep Model Number	Desal Model Number	DuPont Model Number	Comments
4040-ACM2-TSDA	AG4040F/SG4040F	2440	Same diameter and permeate tube
4040-TS80-TSDA	HL4040F		Same diameter and permeate tube
4040-X201-TSDA			
8040-ACM1-TSDA	SG8040F	2840	Same diameter and permeate tube
8040-ACM2-TSDA	AG8040F	2840	Same diameter and permeate tube
8040-TS80-TSDA	HL8040F		Same diameter and permeate tube

Dow/Filmtec Replacement Elements

TriSep Model Number	Dow/Filmtec	Comments
4040-ACM1-TSF		Same diameter and permeate tube
4040-ACM2-TSF	BW30-4040	Same diameter and permeate tube
4040-ACM3-TSF	BW30HP-4040	Same diameter and permeate tube
4040-ACM4-TSF	BW30-LE4040	Same diameter and permeate tube
4040-ACM5-TSF	XLE-4040	Same diameter and permeate tube
4040-ACM5-TWF	XLE-4040	Same diameter and permeate tube
4040-TS80-TSF	NF90-4040/NF70-4040	Same diameter and permeate tube
4040-TS83-TSF		
4040-X201-TSF		
8040-ACM2-TSFA	BW30-8040/BW30-365	Same diameter and permeate tube
8040-ACM2-UWFA	BW30-400/BW30-440	Same diameter and permeate tube
8040-ACM4-TSFA	BW30-LE 400	Same diameter and permeate tube
8040-ACM5-UWFA	XLE-400/LE 400/LE 440	Same diameter and permeate tube
8040-TS80-UWFA	NF90-400/NF70-400	Same diameter and permeate tube
8040-X201-TSFA	BW30-365FR	Same diameter and permeate tube

Toray Replacement Elements

TriSep Model Number	Toray Model Number	Comments
4040-ACM2-TSR	SU-710/SU-710L/TM-710	Same diameter and permeate tube
4040-SB20-TSR	SC-4100/SC-6100	Same diameter and permeate tube
8040-SB20-TSR	SC-3200/SC-4200	Same diameter and permeate tube
	SC-6200	

GE/Osmonics Replacement Elements

TriSep Model Number	GE/Osmonics Model	Comments
4040-ACM2-TSOA	411-HR(PA)/411-HF(PA)	Same diameter and permeate tube
8340-ACM2-TSOA	811-HR(PA)/811-HF(PA)	Same diameter and permeate tube
8340-SB20-TSOA	811-HR	Same diameter and permeate tube

Hydranautics Replacement Elements

TriSep Model Number	Hydranautics Model	Comments
8540-ACM2-TSFA	8540-LSY-CPA2	Same diameter, different permeate tube
8540-ACM4-TSFA	8540-UHY-ESPA	Same diameter, different permeate tube
8540-SB20-TSA	8540-MSY-CAB2	Same diameter, different permeate tube
8540-SB50-TSA	8540-MSY-CAB1	Same diameter, different permeate tube
8540-TS80-TSFA		Same diameter, different permeate tube

Competitive Element Replacement Guide
Desal/DuPont Style Elements

TriSep Model Number	Desal Model Number	DuPont Model Number	Comments
4040-ACM2-TSDA	AG4040F/SG4040F	2440	Same diameter and permeate tube
4040-TS80-TSDA	HL4040F		Same diameter and permeate tube
4040-X201-TSDA			
8040-ACM1-TSDA	SG8040F	2840	Same diameter and permeate tube
8040-ACM2-TSDA	AG8040F	2840	Same diameter and permeate tube
8040-TS80-TSDA	HL8040F		Same diameter and permeate tube

PRODUCT SPECIFICATION

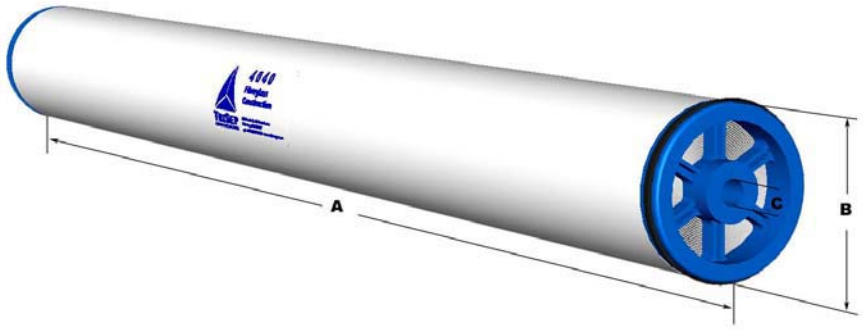
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM2-TSDA	2,450 (9.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	88 ft² (8.1 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.62 (15.9)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Desal/DuPont Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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PRODUCT SPECIFICATION

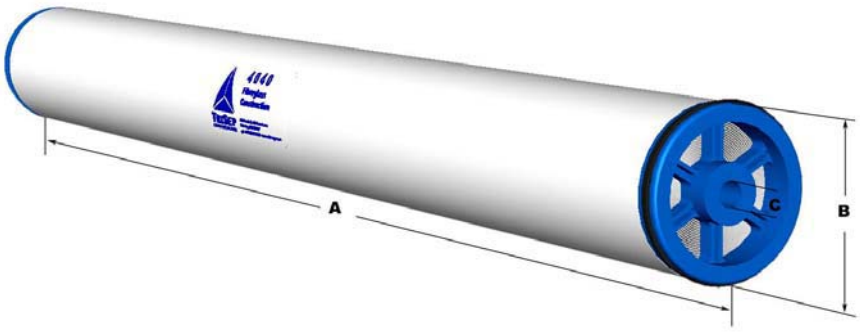
4" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-TS80-TSDA	2,000 (7.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	88 ft² (8.2 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.62 (15.9)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Desal/DuPont Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

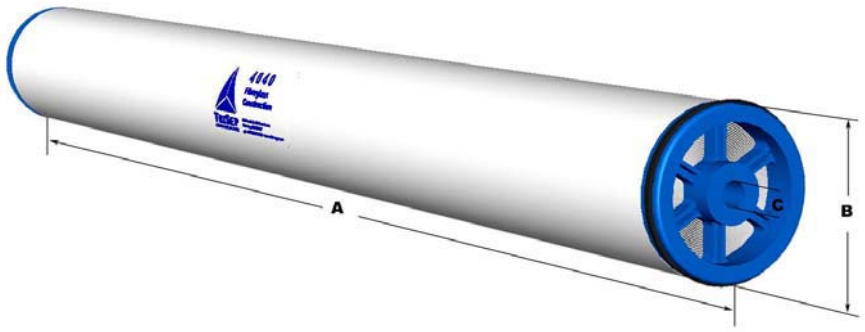
4" X-20 Low Fouling RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-X201-TSDA	2,450 (9.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap with FoulGuard Technology
Active Membrane Area.....	88 ft² (8.2 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.62 (15.9)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Desal/DuPont Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM1-TSDA	8,000 (30.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.19 (30.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Desal/DuPont Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM2-TSDA	9,700 (36.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.19 (30.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Desal/DuPont Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS80-TSDA	9,000 (34.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.19 (30.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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Competitive Element Replacement Guide
Dow/Filmtec Style Elements

Dow/Filmtec Replacement Elements

TriSep Model Number	Dow/Filmtec	Comments
4040-ACM1-TSF		Same diameter and permeate tube
4040-ACM2-TSF	BW30-4040	Same diameter and permeate tube
4040-ACM3-TSF	BW30HP-4040	Same diameter and permeate tube
4040-ACM4-TSF	BW30-LE4040	Same diameter and permeate tube
4040-ACM5-TSF	XLE-4040	Same diameter and permeate tube
4040-ACM5-TWF	XLE-4040	Same diameter and permeate tube
4040-TS80-TSF	NF90-4040/NF70-4040	Same diameter and permeate tube
4040-TS83-TSF		
4040-X201-TSF		
8040-ACM2-TSFA	BW30-8040/BW30-365	Same diameter and permeate tube
8040-ACM2-UWFA	BW30-400/BW30-440	Same diameter and permeate tube
8040-ACM4-TSFA	BW30-LE 400	Same diameter and permeate tube
8040-ACM5-UWFA	XLE-400/LE 400/LE 440	Same diameter and permeate tube
8040-TS80-UWFA	NF90-400/NF70-400	Same diameter and permeate tube
8040-X201-TSFA	BW30-365FR	Same diameter and permeate tube

PRODUCT SPECIFICATION

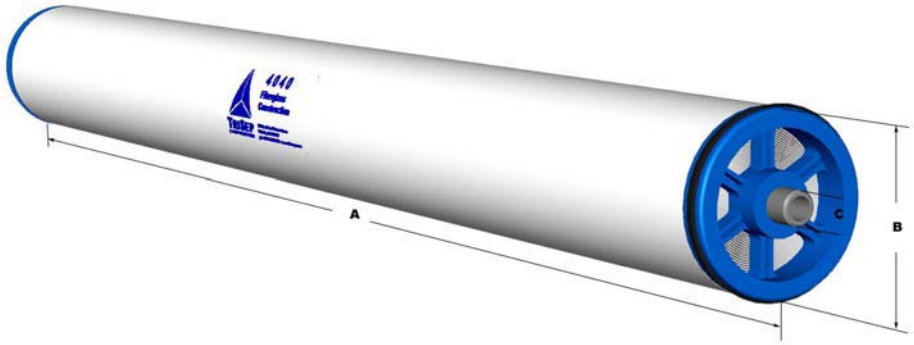
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM1-TSF	1,900 (7.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

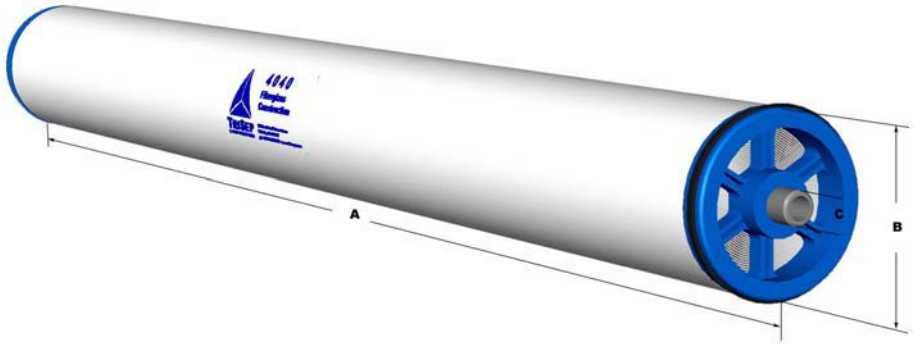
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM2-TSF	2,400 (9.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

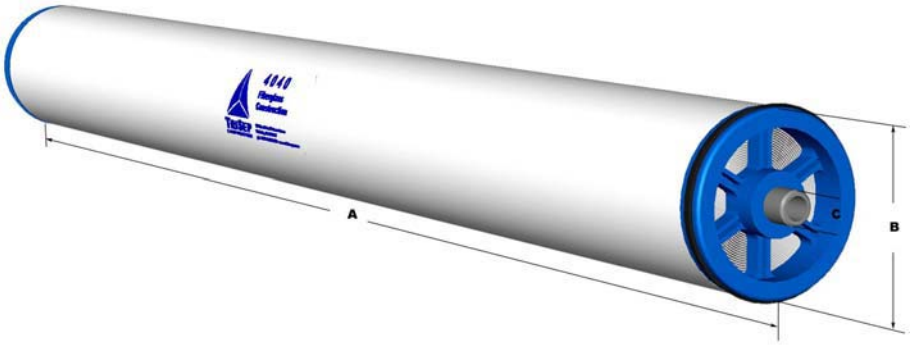
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM3-TSF	2,700 (10.0)	99.20	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

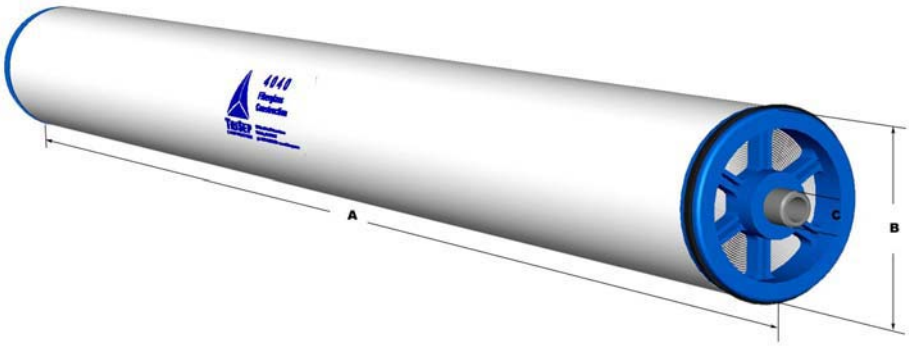
4" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM4-TSF	3,350 (12.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	40 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

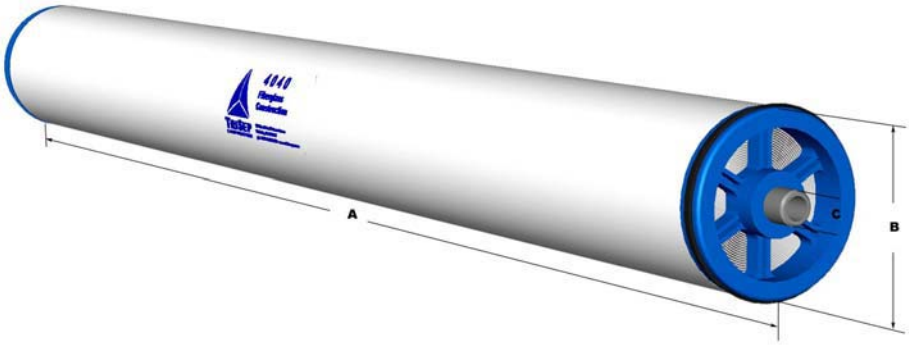
4" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM5-TWF	2,500 (9.0)	98.50	97.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 150.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	88 ft² (8.2 m²)
Recommended Applied Pressure.....	40 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

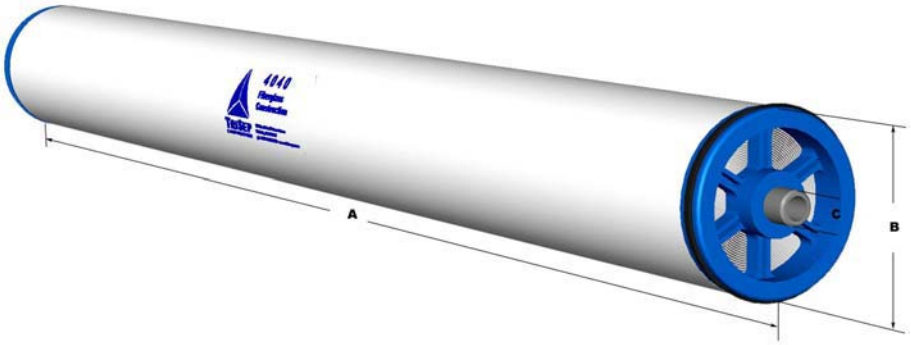
4" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-TS80-TSF	2,000 (7.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

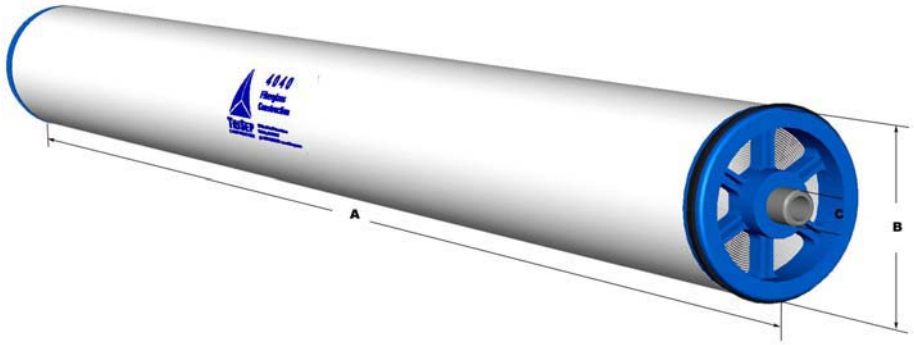
4" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-TS83-TSF	2,300 (8.0)	98.00	96.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

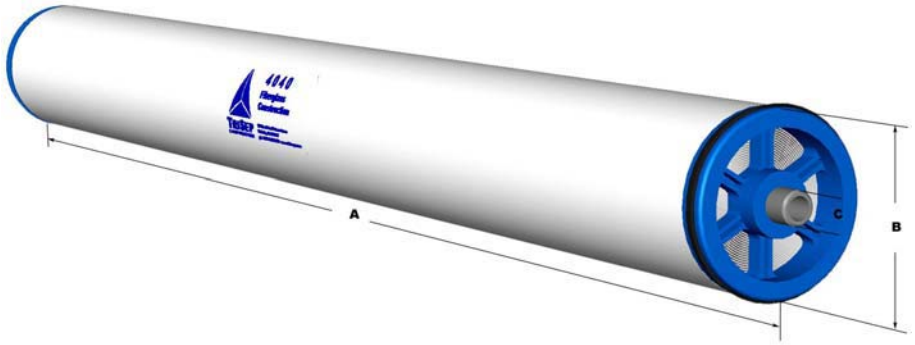
4" X-20 Low Fouling RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-X201-TSF	2,400 (9.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap with FoulGuard Technology
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.75 (19.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM2-TSFA	9,700 (36.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM2-UWFA	10,700 (40.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-ACM4-TSFA	14,600 (55.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-TS80-UWFA	10,000 (37.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	400 ft² (37.2 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	4.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.028" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" X-20 Low Fouling RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-X201-TSFA	9,500 (35.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	X20 Fully Aromatic Polyamide-Urea Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap with FoulGuard Technology
Active Membrane Area.....	365 ft² (33.5 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	2 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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Competitive Element Replacement Guide
Toray Style Elements

Toray Replacement Elements

TriSep Model Number	Toray Model Number	Comments
4040-ACM2-TSR	SU-710/SU-710L	/TM-710Same diameter and permeate tube
4040-SB20-TSR	SC-4100/SC-6100	Same diameter and permeate tube
8040-SB20-TSR	SC-3200/SC-4200 SC-6200	Same diameter and permeate tube

PRODUCT SPECIFICATION

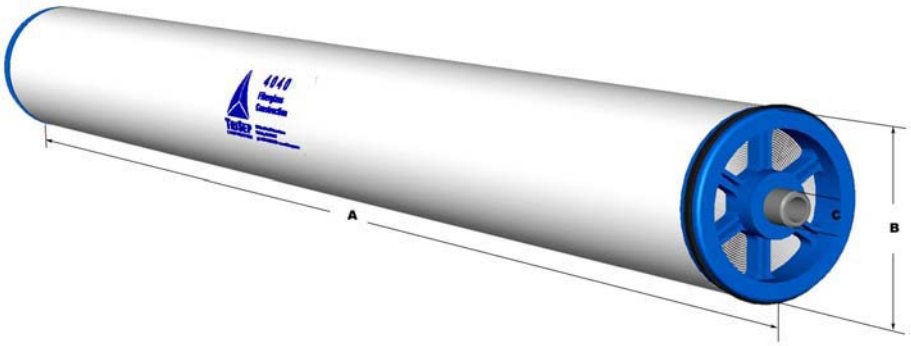
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM2-TSR	2,400 (9.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	85 ft² (7.9 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.83 (21.0)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Toray Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

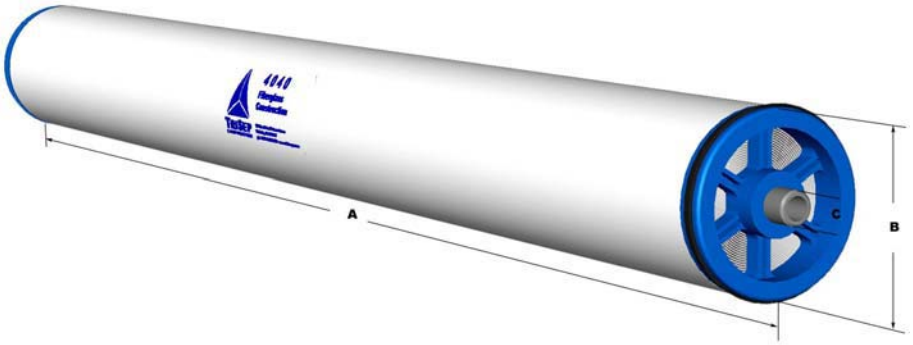
4" CA RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-SB20-TSR	1,500 (5.0)	98.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 420.0 psi, 25°C, 15% recovery, pH 5.5, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	SB Cellulose Acetate Blend
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	75 ft² (7.0 m²)
Recommended Applied Pressure.....	200 - 500 psi (14 - 34 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	50 - 90°F (10 - 32°C)
Feedwater pH Range.....	5.5 nominal, 4 - 7
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.83 (21.0)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Toray Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8" CA RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8040-SB20-TSR	7,000 (26.0)	98.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 420.0 psi, 25°C, 15% recovery, pH 5.5, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	SB Cellulose Acetate Blend
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	350 ft² (32.5 m²)
Recommended Applied Pressure.....	200 - 500 psi (14 - 34 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	50 - 90°F (10 - 32°C)
Feedwater pH Range.....	5.5 nominal, 4 - 7
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 7.9 (200) Permeate Tube **(C) :** 1.26 (32.0)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Toray Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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Competitive Element Replacement Guide
GE/Osmonics Style Elements

GE/Osmonics Replacement Elements

TriSep Model Number	GE/Osmonics Model	Comments
4040-ACM2-TSOA	411-HR(PA)/411-HF(PA)	Same diameter and permeate tube
8340-ACM2-TSOA	811-HR(PA)/811-HF(PA)	Same diameter and permeate tube
8340-SB20-TSOA	811-HR	Same diameter and permeate tube

PRODUCT SPECIFICATION

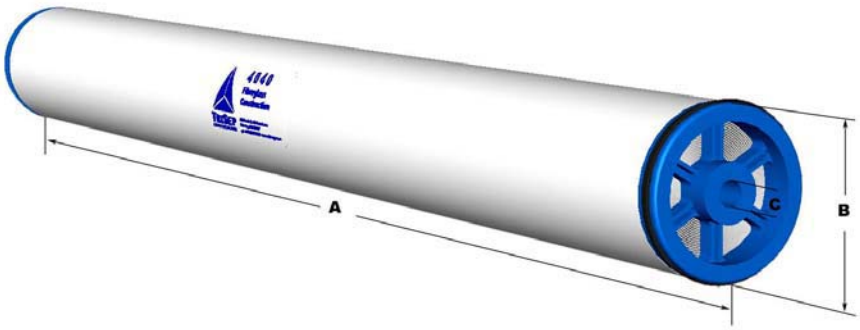
4" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
4040-ACM2-TSOA	2,450 (9.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	88 ft² (8.1 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	20 GPM (4.5 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU



Element Weight : 15 (7)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 4.0 (101) Permeate Tube **(C) :** 0.78 (19.8)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Osmo Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8.3" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8340-ACM2-TSOA	11,000 (41.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	415 ft² (38.1 m²)
Recommended Applied Pressure.....	100 - 300 psi (7 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.3 (210) Permeate Tube **(C) :** 1.14 (29.0)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Osmo Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8.3" CA RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8340-SB20-TSOA	8,000 (30.0)	98.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 420.0 psi, 25°C, 15% recovery, pH 5.5, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	SB Cellulose Acetate Blend
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	415 ft² (38.1 m²)
Recommended Applied Pressure.....	200 - 500 psi (14 - 34 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	50 - 90°F (10 - 32°C)
Feedwater pH Range.....	5.5 nominal, 4 - 7
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.3 (210) Permeate Tube **(C) :** 1.14 (29.0)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Osmo Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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Competitive Element Replacement Guide
Hydranautics Style Elements

Hydranautics Replacement Elements

TriSep Model Number	Hydranautics Model	Comments
8540-ACM2-TSFA	8540-LSY-CPA2	Same diameter, different permeate tube
8540-ACM4-TSFA	8540-UHY-ESPA	Same diameter, different permeate tube
8540-SB20-TSA	8540-MSY-CAB2	Same diameter, different permeate tube
8540-SB50-TSA	8540-MSY-CAB1	Same diameter, different permeate tube
8540-TS80-TSFA		Same diameter, different permeate tube

PRODUCT SPECIFICATION

8.5" ACM RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8540-ACM2-TSFA	11,500 (43.0)	99.50	98.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM Fully Aromatic Polyamide Advanced Composite Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	440 ft² (40.4 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.5 (215) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

TriSep Corporation • 93 South La Patera Lane • Goleta, California 93117, U.S.A.
Phone: (805) 964-8003 • Fax: (805) 964-1235 • www.trisep.com

PRODUCT SPECIFICATION

8.5" ACM-LP Low Pressure RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8540-ACM4-TSFA	17,500 (66.0)	99.00	98.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 225.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ACM-LP Fully Aromatic Polyamide Low Pressure Advanced Composite
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	440 ft² (40.4 m²)
Recommended Applied Pressure.....	50 - 300 psi (3 - 21 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 45 (20)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.5 (215) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8.5" CA RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8540-SB20-TSA	8,400 (31.0)	98.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 420.0 psi, 25°C, 15% recovery, pH 5.5, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	SB Cellulose Acetate Blend
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	440 ft² (40.4 m²)
Recommended Applied Pressure.....	200 - 500 psi (14 - 34 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	50 - 90°F (10 - 32°C)
Feedwater pH Range.....	5.5 nominal, 4 - 7
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.5 (215) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8.5" CA RO Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8540-SB50-TSA	10,000 (37.0)	95.00	92.50

Performance is based on the following test conditions: 2,000.0 ppm NaCl, 420.0 psi, 25°C, 15% recovery, pH 5.5, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	SB Cellulose Acetate Blend
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	440 ft² (40.4 m²)
Recommended Applied Pressure.....	200 - 500 psi (14 - 34 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	50 - 90°F (10 - 32°C)
Feedwater pH Range.....	5.5 nominal, 4 - 7
Chlorine Tolerance.....	0.5 ppm nominal, 1.0 ppm max
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.5 (215) Permeate Tube **(C) :** 1.50 (38.1)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: TriSep Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

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PRODUCT SPECIFICATION

8.5" TS80 Nanofiltration Element Series

Model	Permeate flow GPD (m3/day)*	Average Salt Rejection (%)	Minimum Salt Rejection (%)
8540-TS80-TSFA	10,800 (40.0)	99.00	97.00

Performance is based on the following test conditions: 2,000.0 ppm MgSO4, 110.0 psi, 25°C, 15% recovery, pH 8.0, 30 minutes operation.

OPERATIONAL AND DESIGN DATA

Membrane Type.....	ANM Aromatic Polyamide Advanced Nanofiltration Membrane
Configuration.....	Spiral Wound,Fiberglass Outer Wrap
Active Membrane Area.....	440 ft² (40.4 m²)
Recommended Applied Pressure.....	40 - 200 psi (3 - 14 bar)
Maximum Applied Pressure.....	600 psi (41 bar)
Recommended Operating Temperature.....	35 - 113°F (2 - 45°C)
Feedwater pH Range.....	2 - 11 continuous
Chlorine Tolerance.....	<0.1 ppm
Maximum Feed Flow.....	80 GPM (18 m3/hr)
Minimum Brine Flow/Permeate Flow Ratio....	5:1
Maximum SDI (15 minutes)	5.0
Maximum Turbidity.....	1 NTU

Element Weight : 50 (23)

Length (**A**) : 40.0 (1,016) Diameter (**B**) : 8.5 (215) Permeate Tube **(C) :** 1.12 (28.6)

Units in pounds and inches, units in paranthesis in kilograms and millimetes.

Mechanical Configuration: Filmtec Style Core Tube

Feed Spacer: 0.031" thick diamond spacer

* Permeate flow is clean water flux at standard conditions above. Not applicable for all feedwater conditions. Individual element's permeate flow may vary +/- 15%.

Engineered Membrane SOLUTIONS

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TriSep Corporation
Membrane Support Chemicals

Following is a copy of TriSep's chemical catalog with information about our full line of membrane support chemicals.

Two of the greatest concerns facing membrane system designers and operators are control of foulants and developing efficient system cleaning protocols that do not adversely affect membrane performance. As a leading manufacturer of membrane elements, TriSep made these two criteria the cornerstones for developing our chemical product line.

In 1995, TriSep assigned a team of engineers and chemists the task of developing membrane support products that would provide maximum efficiency with 100% membrane compatibility. After extensive laboratory research and highly successful long term field testing on membrane systems with challenging feed streams, TriSep began marketing our membrane support chemicals in January of 1996.

Find out how TriPol™ antiscalents, TriClean™ cleaners, and TriStat™ bio-control chemical products can save you money and enhance your membrane system performance. Please call your TriSep representative, listed on the back of the enclosed brochure, for free technical information or to discuss your specific requirements.

TriPol scale inhibitors are engineered to protect the integrity of the membrane surface and to provide superior control of calcium carbonate, calcium sulfate, barium sulfate, strontium sulfate, silica, metal oxides, colloids, calcium fluoride, and calcium phosphate.

TriPol™ Scale Inhibitors

TriPol is the first line of high performance scale inhibitors developed by a leading membrane manufacturer specifically for use with the latest reverse osmosis (RO) an nanofiltration (NF) membranes. Using our proprietary knowledge of membrane chemistry, design and fouling characteristics, TriSep developed scale inhibitors to be 100% compatible with today's high-tech membrane chemistries while providing maximum control of the highest levels of the most common membrane foulants.

TriPol 8010

TriPol 8010 is a good performance, low cost, scale inhibitor formulated to protect and enhance the performance of RO and NF membranes by inhibiting the formation of carbonate scales associated with calcium, barium, and strontium as well as sulfate scales. TriPol 8010 is a pure acrylic acid product with no added phosphates or phosphanates.

TriPol 8510

TriPol 8510 was scientifically designed to provide control for waters with moderate to high scaling tendencies with moderate levels of silica. This high tech scale inhibitor contains a blend of an acrylic acid co-polymer and an organic phosphonate that gives a high degree of protection, especially with high levels of saturation of sulfate scales. TriPol 8510 is approved by NSF for use in drinking water at feed concentration of up to 4 ppm.

TriPol 9010

TriPol 9010 was chemically engineered to meet the pretreatment demands of state of the art high recovery RO and NF system with high fouling tendencies. TriPol 9010 offers increased protection against calcium carbonate scaling while still providing a high degree of sulfate scale inhibition. This high tech scale inhibitor contains a blend of an acrylic acid co-polymer and an organic phosphonate that gives a high degree of protection, especially with high levels of saturation of sulfate scales. TriPol 9010 is approved by NSF for use in drinking water at feed concentration of up to 10 ppm.

TriPol 9510

TriPol 9510 is a high performance scale inhibitor and dispersant that provides the highest level of silica dispersion as well as excellent control of mineral scales, colloids, and metal oxides. Developed with a complete understanding of the proprietary membrane chemistries, TriPol 9510 is 100% compatible with all membrane types.

Maximum Saturation Allowances for TriPol Antiscalants

AntiScalant	Maximum LSI	Maximum CaSO4 (%)	Maximum SrSO4 (%)	Maximum BaSO4 (%)	Maximum CaF2 (%)	Maximum Silica (%)	Maximum Al (ppm)	Maximum Fe + Mn (ppm)
8010	1.0	150	200	200	2,000	100	0.1	0.1
8510	2.0	400	1,200	12,000	8,000	100	0.5	0.5
9010	2.6	300	800	10,000	10,000	100	0.3	0.3
9510	2.6	400	1,200	12,000	10,000	200	4.0	4.0

Saturation levels for CaSO4, SrSO4, BaSO4, CaF2, and Silica are percent of saturation index where 100% is assumed saturated. These values should be calculated using Troi version 1.5.0 or later. Maximum recommended concentration of any antiscalant should not exceed 50 ppm in the concentrate.

TRIPOL 8010
SCALE INHIBITOR

- Extends useful membrane life
- Superior control of calcium carbonate

PROBLEM

In many installations worldwide, higher permeate recoveries from reverse osmosis (RO) systems are often limited by the potential for calcium carbonate scale. This is especially problematic for the new generation polyamide composite membranes since feedwater acidification is no longer required to insure long service lifes. In many application, the tendency for calcium carbonate scale formation has the effect of lowering the system recovery that could adversely effect the system economics.

SOLUTION

TriPol 8010 protects and enhances the operation of RO and NF systems, by controlling mineral scale formation due to carbonate, sulfate, and fluoride compounds. In most water types, proper use of TriPol 8010 can significantly increase allowable system recoveries and thus expand the suitability for use in a wider range of applications.

APPLICATION

TriPol 8010 is metered into the feed water at a point where turbulent flow will ensure adequate chemical mixing prior to entering the RO or NF system. This is usually done prior to the cartridge filters and high pressure pump. Dosing rates vary depending on feedwater quality and recovery but normally run between 2 and 5 ppm. For exact dosing, use the latest version of TroiWin. TriPol 8010 should not be used if there is more than 0.1 ppm of iron or other metal hydroxides in the feedwater. Since this product is anionic in nature, care should be taken when using cationic polyelectrolytes in the pretreatment system.

PERFORMANCE

Max. Langlier Saturation Index	+1.0*
Max. CaSO4 Saturation	150%*
Max. SrSO4 Saturation	200%*
Max. BaSO4 Saturation	200%*
Max. CaF_2 Saturation	2,000%*
Silica	100%*

(* in the concentrate)

PACKAGING

TriPol 8010 is shipped as a liquid in ½ gallon sample sizes, 5 gallon (40 lb) plastic pails, and 55 (500 lb) gallon plastic drums. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

For the most up to date information on MSDS sheets, please contact our web site at www.trisep.com

TRIPOL 8510 SCALE INHIBITOR/ DISPERSANT

- Superior control of carbonate and sulfate scales
- Iron and silica dispersant capability

PROBLEM

In many installations worldwide, higher permeate recoveries from reverse osmosis (RO) systems are often limited by the potential for sulfate scales. This is especially problematic for waters with high amounts of silica or metal hydroxides, which can form insoluble polymeric gels with conventional acrylic acid scale inhibitors. In many applications, the tendency for sulfate scale formation has the effect of lowering the system recovery that could adversely effect the system economics.

SOLUTION

TriPol 8510 protects and enhances the operation of RO and NF systems, by controlling mineral scale formation due to carbonate, sulfate, and fluoride compounds. In most water types, proper use of TriPol 8510 can significantly increase allowable system recoveries and thus expand the suitability for use in a wider range of applications.

APPLICATION

TriPol 8510 is metered into the feed water at a point where turbulent flow will ensure adequate chemical mixing prior to entering the RO or NF system. This is usually done prior to the cartridge filters and high pressure pump. Dosing rates vary depending on feedwater quality and recovery but normally run between 2 and 5 ppm. For exact dosing, use the latest version of TroiWin. TriPol 8510 contains a dispersant and can be used if there are iron or other metal hydroxides in the feedwater. Since this product is anionic in nature, care should be taken when using cationic polyelectrolytes in the pretreatment system.

PERFORMANCE

Max. Langlier Saturation Index	+2.0*
Max. CaSO4 Saturation	400%*
Max. SrSO4 Saturation	1,200%*
Max. BaSO4 Saturation	12,000%*
Max. CaF_2 Saturation	8,000%*
Silica	100%*

(* in the concentrate. Levels may be exceeded on occasion. Contact TriSep for advice.)

PACKAGING

TriPol 8510 is shipped as a liquid in ½ gallon sample sizes, 5 gallon (40 lb) plastic pails, and 55 (500 lb) gallon plastic drums. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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TRIPOL 9010 SCALE INHIBITOR/ DISPERSANT

- Extends useful membrane life
- Superior control of carbonate scales
- Some Iron and silica dispersant capability

PROBLEM

In many installations worldwide, higher permeate recoveries from reverse osmosis (RO) systems are often limited by the potential for carbonate and sulfate scales. This is especially problematic for well waters with high dissolved solids where significant amounts of sulfates and alkalinity may be present. In many applications, the tendency for scale formation has the effect of lowering the system recovery that could adversely effect the system economics.

SOLUTION

TriPol 9010 protects and enhances the operation of RO and NF systems, by controlling mineral scale formation due to carbonate, sulfate, and fluoride compounds. In most water types, proper use of TriPol 9010 can significantly increase allowable system recoveries and thus expand the suitability for use in a wider range of applications.

APPLICATION

TriPol 9010 is metered into the feed water at a point where turbulent flow will ensure adequate chemical mixing prior to entering the RO or NF system. This is usually done prior to the cartridge filters and high pressure pump. Dosing rates vary depending on feedwater quality and recovery but normally run between 2 and 5 ppm. For exact dosing, use the latest version of TroiWin. TriPol 9010 contains a dispersant and can be used if there is iron or other metal hydroxides in the feedwater.

PERFORMANCE

Max. Langlier Saturation Index	+2.6*
Max. CaSO4 Saturation	300%*
Max. SrSO4 Saturation	800%*
Max. BaSO4 Saturation	10,000%*
Max. CaF_2 Saturation	10,000%*
Silica	100%*

(* in the concentrate. Levels may be exceeded on occasion. Contact TriSep for advice.)

PACKAGING

TriPol 9010 is shipped as a liquid in ½ gallon sample sizes, 5 gallon (40 lb) plastic pails, and 55 (500 lb) gallon plastic drums. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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TRIPOL 9510 SCALE/SILICA INHIBITOR AND DISPERSANT

- Silica dispersant capability.
- Superior control of sulfate scales
- Iron and silica dispersant capability

PROBLEM

In many installations worldwide, higher permeate recoveries from reverse osmosis (RO) systems are often limited by the potential for silica scales. This is especially problematic for well waters in certain geographic locations that have high levels of silica. In many applications, the tendency for silica scale formation has the effect of lowering the system recovery that could adversely effect the system economics.

SOLUTION

TriPol 9510 protects and enhances the operation of RO and NF systems, by controlling mineral scale formation due to silica, carbonate, sulfate, and fluoride compounds. In most water types, proper use of TriPol 9510 can significantly increase allowable system recoveries and thus expand the suitability for use in a wider range of applications.

APPLICATION

TriPol 9510 is metered into the feed water at a point where turbulent flow will ensure adequate chemical mixing prior to entering the RO or NF system. This is usually done prior to the cartridge filters and high pressure pump. Dosing rates vary depending on feedwater quality and recovery but normally run between 2 and 5 ppm. For exact dosing, use the latest version of TroiWin. Since this product is anionic in nature, care should be taken when using cationic polyelectrolytes in the pretreatment system.

PERFORMANCE

Max. Langlier Saturation Index	+2.6*
Max. CaSO4 Saturation	400%*
Max. SrSO4 Saturation	1,200%*
Max. BaSO4 Saturation	12,000%*
Max. CaF_2 Saturation	10,000%*
Silica	200%**

(* in the concentrate. Levels may be exceeded on occasion. Contact TriSep for advice.
** Silica saturation levels depend on a number of factors including trivalent metal ion concentration, pH, and temperature.)

PACKAGING

TriPol 9510 is shipped as a liquid in ½ gallon sample sizes, 5 gallon (40 lb) plastic pails, and 55 (500 lb) gallon plastic drums. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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TriClean™ Membrane Cleaners

TriClean is the only line of membrane cleaners engineered by a leading membrane manufacturer for use with high-tech reverse osmosis (RO) and nanofiltration (NF) elements. Using proprietary knowledge of membrane chemistry and fouling characteristics, TriSep has developed TriClean cleaners to be compatible with today's membrane chemistries while providing maximum removal of mineral scales, silica, metal oxides, colloids, organics and biological fouling.

TRICLEAN 210

TriClean 210 is a high performance low pH cleaner formulated to remove acid soluble mineral scales, such as calcium carbonate, metal oxides, and sulfate scales from RO and NF membrane elements.

TRICLEAN 211

TriClean 211 is a cleaner additive used to boost the performance of TriClean 210 or TriClean 217. This surfactant based cleaner should be used when polymer fouling or manganese dioxode fouling are suspected.

TRICLEAN 212CA

TriClean 212CA is specifically formulated as a buffered high pH cleaner for cellulose acetate (CA) membranes. Buffered to a pH of 7 to protect CA membrane from hydrolysis during cleaning, this cleaner will remove organic and biological fouling from CA membrane.

TRICLEAN 212TF

TriClean 212TF is a broad spectrum high pH cleaner used for today's high performance polyamide composite membranes. This versatile cleaner should be used at a pH of 11.5 to remove biological, organic, and silt.

TRICLEAN 213

TriClean 213 is a non chlorine oxidizer that should be used if other cleaners have failed to remove heavy organic or biological fouling. Since it is an oxidizer, performance loss can occur when used with polyamide composite membranes.

TRICLEAN 214CA

This is a 20% concentration, liquid version of the TriClean 212CA. Use when handling and mixing powders is undesirable.

TRICLEAN 214TF

TriClean 214TF is a 50% concentration, liquid version of the TriClean 212TF. Use when handling and mixing powders is undesirable.

TRICLEAN 217

TriClean 217 can be used to remove manganese dioxide or sulfate scale when used in conjunction with TriClean 211.

TRICLEAN 218

TriClean 218 is a liquid high pH cleaner especially formulated for use in the dairy and food industry where daily high pH cleanings and sanitizations are required.

TRICLEAN 310

Liquid version, 40% concentration, of TriClean 210.

TRICLEAN 210
LOW PH POWDER ACID MEMBRANE CLEANER

- Removes iron and metal hydroxide fouling.
- Removes calcium carbonate scale

PROBLEM

In many installations worldwide, RO membranes can become fouled with calcium carbonate scale and/or iron and other metal hydroxide colloids. These foulants can quickly lead to a loss of system performance associated with a decrease in permeate flow, and increase in differential pressure, and a loss of element rejection. If left unchecked, this fouling can permanently damage the membrane elements leading to costly and premature membrane replacement.

SOLUTION

TriClean 210 removes calcium carbonate scale and iron and metal hydroxide colloids without damaging sensitive polyamide composite membrane elements. Used after a system has exhibited performance loss or as a preventative maintenance cleaning, TriClean 210 should be the first step in any cleaning regime.

APPLICATION

TriClean 210 should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This cleaner works best when applied at a temperature of 40°-45°C, a pH of 2.5 to 3.5, and at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi. Add 1.5 lbs of TriClean 210 per 10 gallons of RO permeate or DI water. Check and adjust pH if necessary. Add sodium hydroxide to increase the pH and add more TriClean 210 to decrease the pH. Recirculate solution for 1 hour checking pH regularly. Shutdown pump and allow to soak for 1 hour. After soak, recirculate for an additional 20 minutes and then rinse.

PACKAGING

TriClean 210 is shipped as a powder in 4 lb, 10 x 4 lb, 40 lb, or 100 lb plastic containers. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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TRICLEAN 211
CLEANER ADDITIVE

- Can be added to TriClean 210 to aid in sulfate scale removal.
- Surfactant additive to TriClean 217 improves removal of polymers and emulsified oil.

PROBLEM

In many installations worldwide, RO membranes can become fouled with sulfate scale, polymers, and/or manganese dioxide. These foulants can quickly lead to a loss of system performance associated with a decrease in permeate flow, and increase in differential pressure, and a loss of element rejection. If left unchecked, this fouling can permanently damage the membrane elements leading to costly and premature membrane replacement.

SOLUTION

TriClean 211, when used in conjunction with TriClean 210 or TriClean 217, removes sulfate scale, polymer fouling, and/or manganese dioxide without damaging sensitive polyamide composite membrane elements.

APPLICATION

TriClean 211 should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This cleaner works best when applied at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi. Add 1 gallon of TriClean 211 per 100 gallons of RO permeate or DI water. Recirculate solution for 1 hour checking pH regularly. Shutdown pump and allow to soak for 1 hour. After soak, recirculate for an additional 20 minutes and then rinse.

PACKAGING

TriClean 211 is shipped as a liquid in ½ gallon, 10 x ½ gallon, 5 gallon, and 55 gallon plastic containers. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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TRICLEAN 212CA HIGH PH POWDER CLEANER

- Used to remove biological, organic, and colloidal fouling on CA membrane.
- Buffered pH to prevent hydrolysis of CA membrane.

PROBLEM

In many installations worldwide, celluslose acetate (CA) RO membranes can become fouled with biological, organic, and colloidal foulants. These foulants can quickly lead to a loss of system performance associated with a decrease in permeate flow, and increase in differential pressure, and a loss of element rejection. If left unchecked, this fouling can permanently damage the membrane elements leading to costly and premature membrane replacement.

SOLUTION

TriClean 212CA removes biological, organic, and colloidal foulants without damaging sensitive CA membrane elements.

APPLICATION

TriClean 212CA should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This cleaner works best when applied at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi at a pH of 7-7.8. Add 2 lbs of TriClean 212CA per 15 gallons of RO permeate or DI water. Recirculate solution for 1 hour checking pH regularly. Use sulfuric acid to lower pH and add additional TriClean 212CA or sodium hydroxide to increase pH. Shutdown pump and allow to soak for 1 hour. After soak, recirculate for an additional 20 minutes and then rinse.

PACKAGING

TriClean 212CA is shipped as a powder in 4 lb, 10 x 4 lb, 40 lb, and 100 lb plastic containers. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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TRICLEAN 212TF HIGH PH POWDER CLEANER

- Used to remove biological, organic, and colloidal fouling on Polyamide Composite membrane.
- Effective for emulsified oil and silica

PROBLEM

In many installations worldwide, polyamide composite RO and NF membranes can become fouled with biological, organic, and colloidal foulants. These foulants can quickly lead to a loss of system performance associated with a decrease in permeate flow, and increase in differential pressure, and a loss of element rejection. If left unchecked, this fouling can permanently damage the membrane elements leading to costly and premature membrane replacement.

SOLUTION

TriClean 212TF removes biological, organic, and colloidal foulants without damaging sensitive polyamide composite membrane elements.

APPLICATION

TriClean 212TF should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This cleaner works best when applied at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi at a pH of 11.5. (For silica, use at a pH of 12. Use caution as pH's above 12 may damage membrane) Add 2 lbs of TriClean 212TF per 15 gallons of RO permeate or DI water. Recirculate solution for 1 hour checking pH regularly. Use sulfuric acid to lower pH and add additional TriClean 212TF or sodium hydroxide to increase pH. Shutdown pump and allow to soak for 1 hour. After soak, recirculate for an additional 20 minutes and then rinse. This solution should be used after a low pH cleaning with TriClean 210, except for emulsified oil fouling in which case the order should be reversed.

PACKAGING

TriClean 212TF is shipped as a powder in 4 lb, 10 x 4 lb, 40 lb, and 100 lb plastic containers. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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TRICLEAN 213 OXIDIZING POWDER CLEANER

- Aggressive cleaner used to remove biological, organic, and colloidal fouling on Polyamide Composite and CA membrane.

PROBLEM

In many installations worldwide, polyamide composite RO and NF membranes can become fouled with biological, organic, and colloidal foulants. These foulants can quickly lead to a loss of system performance associated with a decrease in permeate flow, and increase in differential pressure, and a loss of element rejection. If left unchecked, this fouling can permanently damage the membrane elements leading to costly and premature membrane replacement.

SOLUTION

TriClean 213 removes biological, organic, and colloidal foulants when other conventional cleaners, such as TriClean 212TF have failed. This is a non-chlorine oxidizing cleaner which can result in performance loss of CA and polyamide composite membranes.

APPLICATION

TriClean 213 should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This cleaner works best when applied at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi at a pH of 11.5 for polyamide membranes and7.8 for CA membranes. Add 1.1 lbs of TriClean 213 per 25 gallons of RO permeate or DI water. Recirculate solution for 1 hour checking pH regularly. Use sulfuric acid to lower pH and add additional TriClean 213 to increase pH. Shutdown pump and allow to soak for 1 hour. After soak, recirculate for an additional 20 minutes and then rinse.

PACKAGING

TriClean 213 is shipped as a powder in 40 lb and 100 lb plastic containers. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

For the most up to date information on MSDS sheets, please contact our web site at www.trisep.com

TRICLEAN 214CA LIQUID HIGH PH CLEANER

- Used to remove biological, organic, and colloidal fouling on CA membrane.

PROBLEM

In many installations worldwide, polyamide composite RO and NF membranes can become fouled with biological, organic, and colloidal foulants. These foulants can quickly lead to a loss of system performance associated with a decrease in permeate flow, and increase in differential pressure, and a loss of element rejection. If left unchecked, this fouling can permanently damage the membrane elements leading to costly and premature membrane replacement.

SOLUTION

TriClean 214CA is a liquid version of TriClean 212CA for applications where handling of powdered cleaners is not desirable. TriClean 214CA is buffered to a pH of 7.8 to prevent hydrolysis of CA membranes while removing biological, organic, and colloidal foulants.

APPLICATION

TriClean 214CA should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This cleaner works best when applied at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi at a pH of 7 to 7.8 for CA membranes. Add 3 gallons of TriClean 214CA per 100 gallons of RO permeate or DI water. Recirculate solution for 1 hour checking pH regularly. Use sulfuric acid to lower pH and add additional TriClean 214CA to increase pH. Shutdown pump and allow to soak for 1 hour. After soak, recirculate for an additional 20 minutes and then rinse.

PACKAGING

TriClean 214CA is shipped as a liquid in 5 gallon plastic pails and 55 gallon plastic drums. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

For the most up to date information on MSDS sheets, please contact our web site at www.trisep.com

TRICLEAN 214TF HIGH PH LIQUID CLEANER

- Used to remove biological, organic, and colloidal fouling on Polyamide Composite membrane.
- Effective for emulsified oil and silica

PROBLEM

In many installations worldwide, polyamide composite RO and NF membranes can become fouled with biological, organic, and colloidal foulants. These foulants can quickly lead to a loss of system performance associated with a decrease in permeate flow, and increase in differential pressure, and a loss of element rejection. If left unchecked, this fouling can permanently damage the membrane elements leading to costly and premature membrane replacement.

SOLUTION

TriClean 214TF is a liquid version of TriClean 212TF, used where powdered cleaners are undesirable, to remove biological, organic, and colloidal foulants without damaging sensitive polyamide composite membrane elements.

APPLICATION

TriClean 214TF should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This cleaner works best when applied at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi at a pH of 11.5. (For silica, use at a pH of 12. Use caution as pH's above 12 may damage membrane. Please see 'Guidelines For Operation for pH and temperature limits, Pg 137) Add 3 gallons of TriClean 214TF per 100 gallons of RO permeate or DI water. Recirculate solution for 1 hour checking pH regularly. Use sulfuric acid to lower pH and add additional TriClean 214TF to increase pH. Shutdown pump and allow to soak for 1 hour. After soak, recirculate for an additional 20 minutes and then rinse. This solution should be used after a low pH cleaning with TriClean 210 or TriClean 310, except for emulsified oil fouling in which case the order should be reversed.

Please see guielines for operation for Ph and temprature limits

PACKAGING

TriClean 214TF is shipped as a liquid in 5 gallon plastic pails or 55 gallon plastic drums. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

For the most up to date information on MSDS sheets, please contact our web site at www.trisep.com

TRICLEAN 217 LOW PH LIQUID CLEANER

- Used to remove polymers, emulsified oil, and manganese dioxide.

PROBLEM

In many installations worldwide, polyamide composite RO and NF membranes can become fouled with polymers, emulsified oil, or manganese dioxide foulants. These foulants can quickly lead to a loss of system performance associated with a decrease in permeate flow, and increase in differential pressure, and a loss of element rejection. If left unchecked, this fouling can permanently damage the membrane elements leading to costly and premature membrane replacement.

SOLUTION

TriClean 217 is a low pH cleaner that should be used in conjunction with TriClean 211. This combination of cleaners will remove polymers, emulsified oil, or manganese dioxide foulants without damaging sensitive polyamide composite membrane elements.

APPLICATION

TriClean 217 should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This cleaner works best when applied at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi at a pH of 2-3. Add 1 gallon of TriClean 217 per 25 gallons of RO permeate or DI water, and an additional 0.25 gallons of TriClean 211. Recirculate solution for 1 hour checking pH regularly. Use sulfuric acid to lower pH and sodium hydroxide to increase pH. Shutdown pump and allow to soak for 1 hour. After soak, recirculate for an additional 20 minutes and then rinse.

PACKAGING

TriClean 217 is shipped as a liquid in 5 gallon plastic pails or 55 gallon plastic drums. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

For the most up to date information on MSDS sheets, please contact our web site at www.trisep.com

TRICLEAN 218 HIGH PH LIQUID CLEANER

- Used to remove biological, organic, and colloidal fouling on Polyamide Composite membrane.
- Specifically formulated for use in dairy and food processing plants

PROBLEM

In most dairy and food processing plants worldwide, RO, NF, and UF membranes can become fouled with biological, organic, and colloidal foulants. These plants must be cleaned on a daily basis to maintain a sanitary environment. This rigorous cleaning regime requires a high performance cleaner that will not adversely affect the long term membrane performance while not introducing any chemicals that may be harmful to the process.

SOLUTION

TriClean 218 is a specifically designed to handle the daily cleaning rigors of the dairy or food processing membrane plant. TriClean 218 will remove biological, organic, and colloidal foulants without damaging RO, NF or UF membrane elements.

APPLICATION

TriClean 218 should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This cleaner works best when applied at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi at a pH of 11.5. (Caution, pH's above 12 may damage membrane) Add 0.5 gallons of TriClean 218 per 100 gallons of RO permeate or DI water. Recirculate solution for 1 hour checking pH regularly. Use sulfuric acid to lower pH and add additional TriClean 218 to increase pH. Shutdown pump and allow to soak for 1 hour. After soak, recirculate for an additional 20 minutes and then rinse.

PACKAGING

TriClean 218 is shipped as a liquid in 5 gallon plastic pails or 55 gallon plastic drums. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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TRICLEAN 310
LOW PH LIQUID ACID MEMBRANE CLEANER

- Removes iron and metal hydroxide fouling.
- Removes calcium carbonate scale
- Removes sulfate scales

PROBLEM

In many installations worldwide, RO membranes can become fouled with calcium carbonate scale and/or iron and other metal hydroxide colloids. These foulants can quickly lead to a loss of system performance associated with a decrease in permeate flow, and increase in differential pressure, and a loss of element rejection. If left unchecked, this fouling can permanently damage the membrane elements leading to costly and premature membrane replacement.

SOLUTION

TriClean 310, a 40% concentration liquid version of the TriClean 210, can be used where powder cleaners are undesirable. TriClean 310 removes calcium carbonate scale and iron and metal hydroxide colloids without damaging sensitive polyamide composite membrane elements.

APPLICATION

TriClean 310 should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This cleaner works best when applied at a temperature of 40°-45°C, a pH of 2.5 to 3.5, and at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi. Add 5 gallons of TriClean 310 per 100 gallons of RO permeate or DI water. Check and adjust pH if necessary. Add sodium hydroxide to increase the pH and add more Tri-Clean 310 to decrease the pH. Recirculate solution for 1 hour checking pH regularly. Shutdown pump and allow to soak for 1 hour. After soak, recirculate for an additional 20 minutes and then rinse.

PACKAGING

TriClean 310 is shipped as a liquid in 5 gallon plastic pails or 55 gallon plastic drums. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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SUPPORT CHEMICALS

The following are support chemicals used in the operation of membrane treatment plants. These biocides and polymers are specifically formulated to work with cellulose acetate, polyamide composite, and ultratfiltration membrane elements.

TRISTAT 110

TriStat 110 is a non oxidizing biocide used to sterilize polyamide composite and CA membrane systems. This biocide is effective at low concentrations and is also suitable for long term element storage.

TRISTAT 410

TriStat 410 is a oxidizing biocide based on peracetic acid and hydrogen peroxide which can be used in sanitary applications where traditional biocides are unacceptable. Can be used for dairy, beverage, food, and potable water applications.

TRIPOL 1210

TriPol 1210 is a polymer additive used to enhance the rejection of CA reverse osmosis elements. This polymer can reduce salt transmission by 20 to 80% while decreasing permeate flow by 20 to 30%.

TRISTORE 110

TriStore 110 is a premixed preservative solution used to store RO, NF, and UF membrane elements. It will prevent biogrowth and offer some freeze protection and should be used for long term element storage.

TRISTAT 110
LIQUID BIOCIDE

- Broad spectrum biocide
- Effective on bacteria, mold, fungus, and yeasts.

PROBLEM

In many installations worldwide, membranes can accumulate and even promote the growth of biological organisms. This is especially problematic for polyamide membranes which cannot tolerate free chlorine. If left unchecked, these organisms can quickly lead to a loss of system performance associated with a decrease in permeate flow, and increase in differential pressure, and a loss of element rejection.

SOLUTION

TriStat 110 is a non-oxidizing biocide effective against a broad range of bacteria, molds, fungi, and yeasts. TriStat 100 can be used on a periodic sanitization basis or as an on-line injectable. (Not approved for use in food, beverage, potable water, or dairy applications. Do not use as an on-line injectable for ultrapure water applications as it can lead to TOC breakthrough of the DI columns.).

APPLICATION

TriStat 110 should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This biocide works best when applied at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi. Add 1 gallon of TriStat 110 per 50 gallons of RO permeate or DI water. Recirculate solution for 20minutes, shutdown pump and allow to soak for 2 hours. After soak, recirculate for an additional 20 minutes and then rinse. As an on-line injectable, inject 2-3 ppm on a continuous basis. Can be added to high or low pH cleaning solutions at 10-20 ppm. (Solutions over 50 ppm must be deactivated prior to disposal. See below on how to deactivate TriStat 110)

PACKAGING

TriStat 110 is shipped as a liquid in ½ gallon, 10 x ½ gallon, 5 gallon plastic pails, or 55 gallon plastic drums. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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Deactivating TriStat 110

When used in concentrations greater than 50 ppm, TriStat 110 should be deactivated prior to disposal using the following procedure. (Check with Federal, State, and local regulations in your area concerning disposal.)

1) Calculate total gallon volume of Tristat 110 solution in the cleaning tank and in the piping, hoses and pressure vessels.
2) For every gallon of solution, add ½ lb. of sodium metabisulfite and mix thoroughly.
3) Adjust pH to 4.0 using sulfuric acid.
4) Recirculate for 20 minutes and then shutdown pump.
5) Allow to static soak for 1 hour.
6) Rinse to appropriate drain.

TriStat 110 Toxicological Report

Species:	Ceriodaphnia dubia (Daphnia Waterflea)	Pimephales promelas (Fathead Minnow)
48 Hour LC50		
Estimated LC50	156.10 mg/L	105.30 mg/L
95% Upper C.L.	172.60 mg/L	113.80 mg/L
95% Lower C.L.	141.60 mg/L	97.44 mg/L
Chronic Biomonitoring (1100 hrs)		
Survival		
LOEC	200.00 mg/L	100.00 mg/L
NOEC	150.00 mg/L	50.00 mg/L
Reproduction		
LOEC	150.00 mg/L	
NOEC	100.00 mg/L	
Growth		
LOEC		N/A
NOEC		50.00 mg/L

LOEC = Lowest Observable Effect Concentration
NOEC = No Observable Effect Concentration

Do not discharge TriStat 110 into lakes, streams, ponds or public water unless in accordance with a NPDES permit. For guidance, contact your regional office of EPA. Do not contaminate public waters by cleaning equipment or disposal of wastes.

TRISTAT 410 SANITARY LIQUID BIOCIDE

- Sanitary, low temperature sterilant.
- Peracetic acid, hydrogen peroxide base.
- Suitable for dairy, food, beverage, and potable water membrane applications.

PROBLEM

In many installations worldwide, membranes can accumulate and even promote the growth of biological organisms. This is especially problematic for polyamide membranes which cannot tolerate free chlorine. If left unchecked, these organisms can quickly lead to a loss of system performance associated with a decrease in permeate flow, and increase in differential pressure, and a loss of element rejection.

SOLUTION

TriStat 410 is an non chlorine oxidizing biocide effective against a broad range of bacteria, molds, fungi, and yeasts. TriStat 410 should be used on a periodic sanitization basis in applications where traditional biocides are unacceptable.

APPLICATION

TriStat 410 should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This biocide works best when applied at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi. Solution should be used at a temperature of 20° to 25°C. Add 2 gallon of TriStat 410 per 100 gallons of RO permeate or DI water. The pH should be between 3-4. Recirculate solution for 30 - 40 minutes, and then rinse. Dilute 1% solutions loose 50% of the peracetic acid after 7 days. Make up dilute solutions fresh the day of use. Concentrated solutions do not decay. Store in cool dark place for maximum shelf life. Spent solution is biodegradable and will decompose to oxygen, water, and acetic acid.

PACKAGING

TriStat 410 is shipped as a liquid in 5 gallon plastic pails, or 55 gallon plastic drums. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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please contact our web site at www.trisep.com

TRIPOL 1210 MEMBRANE POLYMER TREATMENT

- Restores rejection of CA elements

PROBLEM

In many installations worldwide, CA membranes can lose rejection over time due to many factors. If left unchecked, this loss of rejection can quickly lead to a loss of system performance that may result in premature replacement of the membrane elements.

SOLUTION

TriPol 1210 is a specially formulated polymer used to increase the rejection of CA elements. This polymer can reduce salt transmission by 20-80% with only a 20-30% loss in permeate flow. This product is only effective if the membrane surface is clean. As a result, a complete membrane cleaning should be performed prior to application of the TriPol 1210 polymer.

APPLICATION

TriPol 1210 should be mixed in a cleaning tank equipped with a mechanical mixer, heater, low pressure recirculation pump, and cartridge or bag filter. This polymer works best when applied at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 20-50 psi. Adjust pH to 8 with ammonium hydroxide. Add 1.6 gallons of TriPol 1210 per 100 gallons of RO permeate or DI water. Recirculate solution for 15 minutes, then flush. Can also be added in-line by injecting 15 – 25 ppm (discontinue addition of scale inhibitor during dosing). Bring system on-line and adjust feedwater pH to 5.3 to 6.0.

PACKAGING

TriPol 1210 is shipped as a liquid in 5 gallon plastic pails. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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TRISTORE 110 MEMBRANE STORAGE SOLUTION

- Preserves elements for long term storage

PROBLEM

In many installations worldwide, RO, NF, and UF membrane elements need to be stored for extended periods of time. If not stored properly, elements may foul from biological growth, dry out, or freeze. This can result in irreverisble loss of permeate flow and rejection.

SOLUTION

TriStore 110 is a specially formulated storage solution that will not harm polyamide, cellulose acetate, polysulfone, or other types of RO, NF, and UF membrane elements.

APPLICATION

TriStore 110 should be mixed in a cleaning tank equipped with a mechanical mixer, low pressure recirculation pump, and cartridge or bag filter. This solution should be applied at a flow rate of 8-10 gpm per 4" pressure tube or 30-40 gpm per 8" pressure tube at a pressure of between 60-120 psi. Adjust pH to 4-6 with sodium hydroxide. Add 1 gallon of TriStore 110 per 5 gallons of RO permeate or DI water. Recirculate solution for 15 to 30 minutes, or until some permeate is produced. This indicates the storage solution has permeated the membrane. The above solution will provide freeze protection down to 26°F (-3°C). For lower temperatures, the solution may be added at a ratio of 1 gallon of TriStore to 1 gallon of RO permeate or DI water. This will protect the membranes down to a temperature of 19°F (-7°C). This solution should be replaced every 3-6 months. Flush permeate to drain for at least 30 minutes prior to bringing system back on line.

PACKAGING

TriStore 110 is shipped as a liquid in 5 gallon plastic pails or 55 gallon plastic drums. Pricing is F.O.B. our factory in Goleta, CA. Delivery for most orders is 1-2 days after receipt of order.

MSDS SHEETS

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HOW TO DETERMINE WHEN TO CLEAN YOUR MEMBRANES

Although there are Flow Normalization calculations that are based on projected membrane performance data, system design or operational modifications can hinder the accuracy of these calculations. In order to simplify the calculation and to track your system's actual performance, this calculation will help to determine present membrane performance vs. performance at start-up. If the calculation determines that Normalized Flow has declined by 10% or more, it is time to schedule a cleaning for the membranes.

The readings that will be used as "Start-Up" data for the calculation should be taken and logged for reference after the system has operated for 24 to 48 hours from the time of initial start-up or start-up of newly loaded membranes.

Temperature Compensation Factor: Look up this factor on the Table that is provided on the reverse side.

Pressure Compensation Factor: You calculate the PCF by dividing Start-Up Feed Pressure by the Present Feed Pressure reading (Start-Up PSI/Present PSI). *(Example: If Start-up Feed Pressure was 230 psi and the Present Feed Pressure is 250 psi, the calculation would be 230/250 = 0.92 Pressure Compensation Factor)*

Information required:

	Start-up	Present
Feed Pressure (psi)	_____	_____
Product Flow (gpm)	_____	_____
Feedwater Temperature	_____	_____

Sample Calculation:

Feed Pressure	230	250
Feed Temperature	66°F	71°F
Product Flow	40 gpm	39 gpm
Temp. Correction Factor	1.2	1.1
Temp. Corrected Flow	48 (40 x 1.2)	42.9 (39 x 1.1)
Pressure Correction Factor	(230/250)	0.92
Pressure Corrected Flow	N/A	39.468 (42.9 x 0.92)
Normalized Flow	48 gpm	39.468 gpm
Difference	(48 - 39.468)	8.532 gpm
% Flow Decline	(8.532 / 48)	17.775% decline

When Flow Decline is 15% or greater, it is time to clean membranes. If the Flow Decline comes out as a negative number, double-check your calculations and readings. If it is still a negative number, check TDS readings and Rejection rates, as there is a possibility of O-ring or membrane problems.

TEMPERATURE CORRECTION FACTOR

C	F	Factor	C	F	Factor
1.0	33.8	2.21	18.5	65.3	1.22
1.5	34.7	2.17	19.0	66.2	1.2
2.0	35.6	2.13	19.5	67.1	1.19
2.5	36.5	2.1	20.0	68.0	1.17
3.0	37.4	2.06	20.5	68.9	1.15
3.5	38.3	2.02	21.0	69.8	1.13
4.0	39.2	1.99	21.5	70.7	1.11
4.5	40.1	1.95	22.0	71.6	1.1
5.0	41.0	1.92	22.5	72.5	1.08
5.5	41.9	1.89	23.0	73.4	1.06
6.0	42.8	1.85	23.5	74.3	1.05
6.5	43.7	1.82	24.0	75.2	1.03
7.0	44.6	1.79	24.5	76.1	1.02
7.5	45.5	1.76	25.0	77.0	1.00
8.0	46.4	1.73	25.5	77.9	0.98
8.5	47.3	1.7	26.0	78.8	0.97
9.0	48.2	1.67	26.5	79.7	0.96
9.5	49.1	1.64	27.0	80.6	0.94
10.0	50.0	1.62	27.5	81.5	0.93
10.5	50.9	1.59	28.0	82.4	0.91
11.0	51.8	1.56	28.5	83.3	0.90
11.5	52.7	1.54	29.0	84.2	0.89
12.0	53.6	1.51	29.5	85.1	0.87
12.5	54.5	1.49	30.0	86.0	0.86
13.0	55.4	1.46	30.5	86.9	0.85
13.5	56.3	1.44	31.0	87.8	0.84
14.0	57.2	1.42	31.5	88.7	0.82
14.5	58.1	1.39	32.0	89.6	0.81
15.0	59.0	1.37	32.5	90.5	0.80
15.5	59.9	1.35	33.0	91.4	0.79
16.0	60.8	1.33	33.5	92.3	0.78
16.5	61.7	1.3	34.0	93.2	0.77
17.0	62.6	1.28	34.5	94.1	0.76
17.5	63.5	1.26	35.0	95.0	0.75
18.0	64.4	1.24	35.5	95.9	0.73

PRESCRIBED CLEANINGS

Membrane Type Thin Film	CA	Types Of Foulant	Prescribed Cleaning (In order of use)
X	X	Minerals scales /metal Oxides	TSC-1, TSR-1, TSR-2
X		Silts/ Colloids /Organics	TSC-3, TSR-1, TSR-2
	X	Silts/ Colloids /Organics	TSC-4, TSR-1, TSR-2
X		Scales / metals / silt / Colloids /Organics	TSC-1, TSR-2, TSC-3, TSR-1, TSR-2
	X	Scales / metals / silt / Colloids /Organics	TSC-1, TSR-1, TSC-4, TSR-1, TSR-2
X	X	Light Biological	TSC-5, TSR-1, TSR-2
X		Moderate Biiological with / without scales/metals and/or silt/organic/colloid	TSC-1, TSR-1, TSC-2, TSR-1, TSC-3, TSR-1, TSR-2
	X	Moderate Biological with / without scales/metals and/or silt/organic/colloid	TSC-1, TSR-1, TSC-2, TSR-1, TSC-4, TSR-1, TSR-2
X		Very Heavy Biological with / without scales/metals and/or silt/organic/colloid	TSC-1, TSR-1, TSC-2, TSR-1, TSC-7, TSR-1, TSR-2
	X	Very Heavy Biological with / without scales/metals and/or silt/organic/colloid	TSC-1, TSR-1, TSC-2, TSR-1, TSC-6, TSR-1, TSR-2 (Performance Loss is possible with TSC-6)

TriSep Corporation Cleaning (TSC) and Rinsing (TSR) Methods

Cleaning (TSC) Methods

TSC-1: Low pH Cleaning (Powder)

A) Clean and fill solution tank with proper volume of RO Permeate Water.
B) Start water recirculating through pump and back into the tank during chemical mixing.
C) Add 1.5 pounds of TriClean 210 per every 10 gallons of water in the tank. Allow to recirculate until thoroughly mixed.
D) (Optional) Add 1 gallon of TriClean 211 per every 100 gallons of water in the tank. Allow to recirculate until thoroughly mixed.
E) Check pH of solution (proper range is between 2.5 and 3.5 unless otherwise specified by membrane manufacturer). pH may be raised by adding sodium hydroxide or lowered by adding additional TriClean 210.
F) Isolate first pass to be cleaned. With Concentrate and Product Lines diverted to proper drain, slowly run cleaning solution through pressure vessels until all remaining water is out of vessels and cleaning solution is coming out of concentrate line. Shutdown pump and divert Concentrate and Product lines to cleaning solution tank.
G) If tank volume is now too low, mix additional cleaning solution.
H) Start recirculating the cleaning solution through the vessels at specified flow rate (or, if different, at manufacturer's specified flow rate) per vessel. Pump pressure should be between 20 and 50 psi. Recirculate for 1 hour checking pH periodically. If pH goes above 4.0, a new solution will have to be mixed.
I) Shutdown pump and allow to static soak for 1 hour while cleaning additional passes.
J) Follow same procedure for cleaning additional passes.
K) After soaking, recirculate each pass for 20 minutes.
L) Rinse using rinsing method TSR-1.

TSC-2: Sterilization

A) Clean solution tank and fill with appropriate volume of RO Permeate water.
B) Start water recirculating through pump and back to tank.
C) Add 1 gallon of TriStat 110 per 50 gallons of water and recirculate until thoroughly mixed.
D) To displace water in vessels, divert Concentrate and Product lines to drain and slowly pump solution into vessels until it is coming out of Concentrate line. Shutdown pump and divert Concentrate and Product lines to cleaning solution tank.
E) If tank level is too low, mix additional solution.
F) Start recirculating solution through vessels at appropriate flows and pressures.
G) Recirculate for 20 minutes, shutdown pump and allow to static soak for 2 hours.
H) Sterilize additional passes in the same manner while first pass soaks.
I) After soaking, recirculate each pass for 15 minutes.
J) Rinse using rinse method TSR-1.

TSC-3: High pH Cleaning for Thin Film Composite Elements (Powder)

A) Clean out solution tank and add appropriate volume of RO Permeate Water.
B) Start water recirculating through pump and back to tank.
C) Add 2 pounds of TriClean 212TF per every 15 gallons of water in tank. Recirculate until completely dissolved.
D) Check pH of solution. Range should be between 10.5 and 11.5 unless otherwise specified by membrane manufacturer. pH may be raised by adding additional TriClean 212TF or lowered by adding sulfuric acid.
E) Displace water in vessels by diverting Concentrate and Product lines to an appropriate drain and slowly pumping solution into vessels until it is visible coming from the Concentrate line. Shutdown the pump and divert Concentrate and Product lines back to cleaning solution tank.
F) Recirculate solution through vessels at appropriate flow and pressure for 30 minutes.
G) Shutdown pump and allow to static soak for 1 hour.
H) Clean additional passes in the same manner while first pass soaks.
I) After soaking, recirculate each pass for 30 minutes.
J) Rinse using rinsing method TSR-1.

TSC-4: High pH Cleaning for Cellulose Acetate Elements (Powder)

A) Clean out solution tank and add appropriate volume of RO Permeate Water.
B) Start water recirculating through pump and back to tank.
C) Add 2 pounds of TriClean 212CA per every 15 gallons of water in tank. Recirculate until completely dissolved.
D) Check pH of solution. Range should be between 7.0 and 7.8 unless otherwise specified by membrane manufacturer. pH may be raised by adding additional TriClean 212CA or lowered by adding sulfuric acid.
E) Displace water in vessels by diverting Concentrate and Product lines to an appropriate drain and slowly pumping solution into vessels until it is visible coming from the Concentrate line. Shutdown the pump and divert Concentrate and Product lines back to cleaning solution tank.
F) Recirculate solution through vessels at appropriate flow and pressure for 30 minutes.
G) Shutdown pump and allow to static soak for 1 hour.
H) Clean additional passes in the same manner while first pass soaks.
I) After soaking, recirculate each pass for 30 minutes.
J) Rinse using rinsing method TSR-1.

TSC-6: Aggressive Biological and Organic Cleaning

NOTE: This cleaning is extremely aggressive and may result in some loss of membrane performance.

A) Clean and fill solution tank with proper volume of RO Permeate Water.
B) Start water recirculating through pump and back into the tank during chemical mixing.
C) Add 1.1 pounds of TriClean 213 per every 25 gallons of water in the tank. Allow to recirculate until thoroughly mixed.
D) Check pH of solution (proper range is below 11.5 for thin film composite elements and below 7.8 for CA elements unless otherwise specified by membrane manufacturer). pH may be lowered by adding sulfuric acid.

E) Isolate first pass to be cleaned. With Concentrate and Product Lines diverted to proper drain, slowly run cleaning solution through pressure vessels until all remaining water is out of vessels and cleaning solution is coming out of concentrate line. Shutdown pump and divert Concentrate and Product lines to cleaning solution tank.
F) If tank volume is now too low, mix additional cleaning solution.
G) Start recirculating the cleaning solution through the vessels at specified flow rate (or, if different, at manufacturer's specified flow rate) per vessel. Pump pressure should be between 20 and 50 psi. Recirculate for 1 hour checking pH periodically
H) Shutdown pump and allow to static soak for 1 hour while cleaning additional passes.
I) Follow same procedure for cleaning additional passes.
J) After soaking, recirculate each pass for 20 minutes.
K) Rinse using rinsing method TSR-1.

TSC-7: Biological and Organic Cleaning
A) Clean and fill solution tank with proper volume of RO Permeate Water.
B) Start water recirculating through pump and back into the tank during chemical mixing.
C) Add 3 gallons of TriClean 214 per every 100 gallons of water in the tank. Allow to recirculate until thoroughly mixed.
D) Check pH of solution (proper range is below 11.5 for thin film composite elements and below 7.8 for CA elements unless otherwise specified by membrane manufacturer). pH may be lowered by adding sulfuric acid.
E) Isolate first pass to be cleaned. With Concentrate and Product Lines diverted to proper drain, slowly run cleaning solution through pressure vessels until all remaining water is out of vessels and cleaning solution is coming out of concentrate line. Shutdown pump and divert Concentrate and Product lines to cleaning solution tank.
F) If tank volume is now too low, mix additional cleaning solution.
G) Start recirculating the cleaning solution through the vessels at specified flow rate (or, if different, at manufacturer's specified flow rate) per vessel. Pump pressure should be between 20 and 50 psi. Recirculate for 1 hour checking pH periodically
H) Shutdown pump and allow to static soak for 1 hour while cleaning additional passes.
I) Follow same procedure for cleaning additional passes.
J) After soaking, recirculate each pass for 20 minutes.
K) Rinse using rinsing method TSR-1.

TSC-8: Low pH Cleaning
A) Clean and fill solution tank with proper volume of RO Permeate Water.
B) Start water recirculating through pump and back into the tank during chemical mixing.
C) Add 1 gallon of TriClean 217 per every 25 gallons of water in the tank. Allow to recirculate until thoroughly mixed.
D) Add 1 gallon of TriClean 211 per every 100 gallons of water in the tank. Allow to recirculate until thoroughly mixed.
E) Check pH of solution (proper range is between 2.0 and 3.5 unless otherwise specified by membrane manufacturer).

F) Isolate first pass to be cleaned. With Concentrate and Product Lines diverted to proper drain, slowly run cleaning solution through pressure vessels until all remaining water is out of vessels and cleaning solution is coming out of concentrate line. Shutdown pump and divert Concentrate and Product lines to cleaning solution tank.
G) If tank volume is now too low, mix additional cleaning solution.
H) Start recirculating the cleaning solution through the vessels at specified flow rate (or, if different, at manufacturer's specified flow rate) per vessel. Pump pressure should be between 20 and 50 psi. Recirculate for 1 hour checking pH periodically. If pH goes above 5.0, a new solution will have to be mixed.
I) Shutdown pump and allow to static soak overnight.

After soaking, recirculate each pass for 20 minutes.

J) Rinse using rinsing method TSR-1.

Rinsing (TSR) Procedures

TSR-1: Post Cleaning Rinse

A) With pump in the off position, divert Concentrate and Product lines to appropriate drain.
B) Thoroughly rinse out solution tank and fill with RO Permeate or Deionized water.
C) Start pump and begin rinse water through vessels.
D) Rinse for a minimum of 20 minutes.
E) Test pH of water in solution tank and then test pH of Concentrate water.
F) When both pH readings are similar, rinse one more tank volume of water through vessels.
G) Rinse additional passes in the same manner.
H) Shutdown pump and go on to next cleaning method or if cleaning is complete, go to rinse method TSR-2

TSR-2: RO Start-Up

A) Return RO manifolds to normal operating configuration.
B) Divert Concentrate and Product lines to drain.
C) Start water flowing through RO at city water pressure only. DO NOT START PUMP.
D) Allow water to flow through vessels for a minimum of 15 minutes and until all air is out of the system.
E) Start RO pump and adjust pressures and flows to normal operating perameters.
F) Flush to drain for a minimum of 30 minutes.
G) Test pH or Conductivity of Concentrate and Product waters and compare to pre-cleaning readings.
H) When pH or Conductivity is similar to pre-cleaning readings, shutdown RO pump and divert Concentrate and Product lines back to normal operating configuration.
I) Restart RO.

Note: Unless otherwise noted in Cleaning Method or recommended by membrane

TriSep Flat Sheet Membrane

TRISEP ACM™ AND ANM™ MEMBRANES

TriSep Corporation offers an expanding line of cellulose acetate blend and thin film polyamide membranes for reverse osmosis and nanofiltration elements / applications. A general description of the TriSep thin film membranes is presented below. TriSep ACM™ and ANM™ membranes continue to prove to be of outstanding quality, performance, high flux, and solute rejection. All flat sheet membranes are sold wet in 42" wide rolls.

Reverse Osmosis Advanced Composite Membranes (ACM™)

ACM1	In the cases where a product of equal or better performance capabilities, tolerances, and proven quality, we offer the equivalent ACM1 membrane.
ACM2	For slightly higher flux requirements, while maintaining high salt rejection, we offer the equivalent ACM2 membrane.
ACM3	ACM3 offers high flux and salt rejection characteristics. Like the ACM1 and ACM2 membranes, the ACM3 is forgiving of system upsets. There is not a comparable thin film membrane product available to date by any of the other membrane manufacturers.
ACM4	ACM4 membrane, is a thin film membrane of similar chemistries to the other ACM membranes. This is a higher flux membrane than the ACM3, with nominal salt rejections in the 99.0% range.
ACM5	ACM5 offers the highest flow of any TriSep RO membrane. Rejection is 98.5% when tested at 150 psi.
X20	X20 membrane is a fully aromatic polyamide urea reverse osmosis thin film with nominal salt rejections over 99.5% and flux rates comparable to the ACM1. The X20 membrane shows some fouling resistance characteristics that most other thin film membranes available on the market do not have.

Nanofiltration / Softening Membranes (ANM™)

XN45	XN45 membrane is an aromatic polyamide Advanced Nanofiltration Membrane (ANM™) with nominal solute rejections of 10-30% NaCl, and greater than 90% MgSO4 and sucrose. The XN45 membrane offers high flux rates with high rejection characteristics of multivalent ions and organics, at typical net driving pressures in the range of 100 psi net.
TS80	TS80 membrane is an semi-aromatic polyamide Advanced Nanofiltration Membrane (ANM™) with nominal solute rejections of 90% NaCl, and greater than 99% MgSO4 and sucrose. The TS80 membrane offers high flux rates with high rejection characteristics of multivalent ions and organics, at typical net driving pressures in the range of 100 psi net.

Ultrafiltration / Microfiltration Membranes

UE50	UE50 membrane is a 150,000 MWCO Advanced Ultrafiltration Membrane (AUM™) made from a poly sulfone polymer. This membrane has a rejection for Dextran of 100,000 MW of about 90%. When tested on clean water at 30 psi, the membrane exhibits a flux rate of 40-50 gfd.
UE10	UE10 membrane is a 10,000 MWCO Advanced Ultrafiltration Membrane (AUM™) made from a polysulfone polymer. This membrane has a rejection for Cytochrome C, a amino acid with a MW of around 12,000 of about 95%. When tested on clean water at 30 psi, the membrane exhibits a flux rate of 20-30 gfd.
TM10	TM10 membrane is a 0.2 micron Advanced Microfiltration Membrane (AMM™) made from polyvinylidene fluoride. This membrane has a nominal pore size of 0.2 microns. When tested on clean water at 10 psi, the membrane exhibits a flux rate of 20-30 gfd.

TriSep Flat Sheet Membrane

TRISEP CORPORATION MEMBRANE FLAT SHEET SPECIFICATIONS

Typical TriSep membranes flux, in gallons per square foot per day (GFD), and salt rejections, are listed below:

Membrane Type	Minimum Flux (GFD)	Nominal Flux (GFD)	Maximum Flux (GFD)	Minimum Salt Rejection (%)	Nominal Salt Rejection (%)
Advanced Composites (1) (RO)					
ACM1	20	22	24	99.0	99.5
ACM2	25	28	30	99.0	99.5
ACM3	31	34	37	98.5	99.2
ACM4	38	40	45	98.0	99.0
X20	23	25	28	99.0	99.5
Advanced Composites (2) (NF)					
XN45	25	30	35	10.0	20.0
TS80	25	30	35	80.0	90.0
Cellulose Acetate Blend (3) (RO)					
SB50	24	27	30	94.0	96.0
Ultrafiltration(4) (UF)					
UE50	24	27	30	94.0	96.0
UE10	24	27	30	94.0	96.0
Microfiltration (5) (MF)					
TM10	24	27	30	94.0	96.0

(1) ACM1, ACM2, ACM3, ACM4, and X20 membrane types are provided rolled, in approximately 300 ft. (91.44 m) lengths, on a 42 in. (106.7 cm) wide nominal, polyester substrate. Above performance based on 2000 ppm NaCl + DI water, 225 psig (15.3 bar), 77oF (25oC), negligible recovery, pH 8, 1 hour operation. Chlorine tolerance = <0.1 ppm.

(2) XN45 membrane type is provided rolled, in approximately 300 ft. (91.44 m) lengths, on a 42 in. (106.7 cm) wide nominal, polyester substrate. Above performance based on 500 ppm NaCl + DI water, 100 psig (6.8 bar), 77oF (25oC), negligible recovery, pH 8, 1 hour operation. Chlorine tolerance = <0.1 ppm.

(3) SB50, cellulose triacetate blend membrane is provided rolled, in approximately 250 ft. (76.2 m) lengths, on a 39.8 in. (101.1 cm) wide nominal, polyester substrate. Above performance based on 2000 ppm NaCl + DI water, 420 psig (28.6 bar), 77oF (25oC), negligible recovery, pH 5.5, 30 minutes operation. Chlorine tolerance = 0.5 ppm nominal, 1.0 ppm maximum.

(4) UE50 and UE10 membrane type is provided rolled, in approximately 300 ft. (91.44 m) lengths, on a 42 in. (106.7 cm) wide nominal, polyester substrate. Above performance based on 500 ppm Dextran + DI water, 30 psig (2 bar), 77oF (25oC), negligible recovery, pH 8, 1 hour operation. Chlorine tolerance = 1,000 ppm. Flux rates based on clean water flux.

(5) TM10 membrane type is provided rolled, in approximately 300 ft. (91.44 m) lengths, on a 42 in. (106.7 cm) wide nominal, polyester substrate. Above performance based on clean water, 10 psig (0.7 bar), 77oF (25oC), negligible recovery, pH 8, 1 hour operation. Chlorine tolerance = 1,000 ppm. Flux rates based on clean water flux.

TriSep Flat Sheet Membrane

SHEET MEMBRANE MATERIALS OF CONSTRUCTION

Materials of construction for TriSep Corporation flat sheet stock RO and NF membranes consist of the following by membrane type:

Membrane Type: ACM1, ACM2, ACM3, ACM4, FULLY AROMATIC POLYAMIDE

Membrane composition:	ACM™ polyamide composite
Membrane support:	Modified polysulfone
Substrate:	Non-woven polyester

Membrane Type: X20™ POLYAMIDE UREA

Membrane composition:	X-20™ polyamide urea composite
Membrane support:	Modified polysulfone
Substrate:	Non-woven polyester

Membrane Type: XN45 AROMATIC POLYAMIDE

Membrane composition:	ANM™ polyamide composite
Membrane support:	Modified polysulfone
Substrate:	Non-woven polyester

Membrane Type: TS80 AROMATIC POLYAMIDE

Membrane composition:	ANM™ polyamide composite
Membrane support:	Modified polysulfone
Substrate:	Non-woven polyester

Membrane Type: SB50 CELLULOSE ACETATE BLEND

Membrane composition:	Cellulose acetate / triacetate blend
Membrane support:	N/A
Substrate:	Non-woven polyester

Membrane Type: UE10 AND UE50 POLYETHERSULFONE

Membrane composition:	AUM™ PES
Membrane chemistry:	Modified polysulfone
Substrate:	Non-woven polyester

Membrane Type: TM10 POLYVINYLIDENEFLUORIDE

Membrane composition:	AMM™ PVDF
Membrane chemistry:	Modified polyvinylidenefluoride
Substrate:	Non-woven polyester

TriSep Flat Sheet Membrane

MEMBRANE FLUSHING, HANDLING, & STORAGE

Handling and Storage of Flat Sheet Membrane Stock:

Use butyl or nitrile gloves when handling membrane, to prevent contact with residual organic amines and sodium metabisulfite.

IMPORTANT: TriSep roll stock flat sheet membrane includes twenty (20) linear feet of leader at no additional charge. The first twenty (20) linear feet of leader is to be discarded. We have found the first twenty (20) linear feet may be damaged in shipment, and should be discarded. Rolling of elements with the first twenty (20) feet of membrane may result in sub-spec, sub-quality final product.

Storage of Flat Sheet Membrane Stock:

IMPORTANT: TriSep flat sheet membrane stock are supplied wet, in a rolled format for ex-works shipment. For optimal storage and performance, membranes must be kept away from direct sunlight, and are best kept refrigerated at 40°F to 45°F (4°C to 7°C). This prevents biological growth and oxidation of the residual organic amines in the membrane. Not refrigerating the flat sheet membrane stock may result in accelerated darkening of the membrane.

Competitive Replacement Guide

Replacing elements from one competitor to the next can be a difficult and frustrating task. Following is a cross reference list that gives the TriSep equivalent to many competitive membrane elements currently on the market. Manufacturers frequently change models and specifications, so there is no guarantee that our listing is accurate, up to date, or that the TriSep element listed has exactly the performance of the product you are currently using. It should help guide you in determining what element has similar or equivalent performance to a competitive product.

Besides differences in flow and rejection, there are also mechanical differences from one element to another. Most variations in elements center around different permeate tube diameters and/or configurations (male versus female). There are also special element diameters (8.3" and 8.5") that some manufacturers have produced to try and minimize competition.

To address different permeate tube diameters, you must also instruct us to ship an inboard adapter. This is the piece that adapts from the first and last element in a pressure tube to the pressure tube end cap. To supply the correct adapter, we will need to know the manufacturer and possibly the model of your pressure tube.

Attached in this section is a copy of our competitive element replacement guide to help you in selecting the proper TriSep element for your element replacement needs.

COMPETITIVE REPLACEMENT GUIDE

Brackish Water Membrane Series

REPLACEMENT TRISEP MODEL	Dow / FilmTec	Hydranautics	GE / Desal	GE / Osmonics	KOCH / Fluid Systems	Toray
4040-ACM2-TSF	BW30-4040	CPA2-4040 4040-LHA-CPA2	AG4040F(F) SG4040F(F)	414-HR(PA) 414-HF(PA) 411-HR(PA) 411-HF(PA)	4040 HR 4821 HR 4820HR 4821LP	TM710 SU-710 SU-710L
8040-ACM2-TSA	BW30-365	CPA2 8040-LSY-CPA2	AG8040F SG8040F	815-HR(PA) 815-HF(PA)	8822 HR-365 8822LP 8821LP 8021LP	TM720-370 SU-720 SU-720L
8040-ACM2-UWA	BW30-400 BW30-440 SG30-400	CPA3 8040-LHY-CPA2 8040-LHY-CPA3	AG8040F400	815-HR(PA)-400	8822 HR-400 8829HR 8829LP	TM720-400 TM720-430 SU-720F SU-720LF
8340-ACM2-TSOA				811-HF(PA) 811-HF(PA)		

Low Fouling RO Membrane Series

REPLACEMENT TRISEP MODEL	Dow / FilmTec	Hydranautics	GE / Desal	GE / Osmonics	KOCH / Fluid Systems	Toray
4040-X201-TSF		LFC1-4040	Duraslick RO 4040			
8040-X201-TSA	BW30-365FR		Duraslick RO 8040			TML20-370
8040-X201-UWA	BW30-400FR	LFC1 LFC3				TML20-400

Note: TriSep Corporation replacement models may require inboard product end adaptors for connecting to housing end plate assemblies. Contact TriSep Corporation Customer Service for connection requirements and product specification sheets

COMPETITIVE REPLACEMENT GUIDE

Brackish Water Membrane Series

REPLACEMENT TRISEP MODEL	Dow / FilmTec	Hydranautics	GE / Desal	GE / Osmonics	KOCH / Fluid Systems	Toray
4040-ACM2-TSF	BW30-4040	CPA2-4040 4040-LHA-CPA2	AG4040F(F) SG4040F(F)	414-HR(PA) 414-HF(PA) 411-HR(PA) 411-HF(PA)	4040 HR 4821 HR 4820HR 4821LP	TM710 SU-710 SU-710L
8040-ACM2-TSA	BW30-365	CPA2 8040-LSY-CPA2	AG8040F SG8040F	815-HR(PA) 815-HF(PA)	8822 HR-365 8822LP 8821LP 8021LP	TM720-370 SU-720 SU-720L
8040-ACM2-UWA	BW30-400 BW30-440 SG30-400	CPA3 8040-LHY-CPA2 8040-LHY-CPA3	AG8040F400	815-HR(PA)-400	8822 HR-400 8829HR 8829LP	TM720-400 TM720-430 SU-720F SU-720LF
8340-ACM2-TSOA				811-HF(PA) 811-HF(PA)		

Low Fouling RO Membrane Series

REPLACEMENT TRISEP MODEL	Dow / FilmTec	Hydranautics	GE / Desal	GE / Osmonics	KOCH / Fluid Systems	Toray
4040-X201-TSF		LFC1-4040	Duraslick RO 4040			
8040-X201-TSA	BW30-365FR		Duraslick RO 8040			TML20-370
8040-X201-UWA	BW30-400FR	LFC1 LFC3				TML20-400

Note: TriSep Corporation replacement models may require inboard product end adaptors for connecting to housing end plate assemblies. Contact TriSep Corporation Customer Service for connection requirements and product specification sheets

COMPETITIVE REPLACEMENT GUIDE

Tape Wrap Membrane Series

REPLACEMENT TRISEP MODEL	Dow / FilmTec	Hydranautics	GE / Desal	GE / Osmonics	KOCH / Fluid Systems	Toray
4040-ACM2-TST	TW30-4040	4040-LHT-CPA2	AG4040TF SG4040TF	415-HR(PA) 415-HF(PA)	4826LP	
4040-ACM4-TST	TW30LE-4040 TW30HP-4040	4040-UHT-ESPA	AK4040TF		4820ULP-T	
4040-ACM5-TWT	LP-4040 XLE-4040				4040 ULP	

Note: TriSep Corporation replacement models may require inboard product end adaptors for connecting to housing end plate assemblies. Contact TriSep Corporation Customer Service for connection requirements and product specification sheets

COMPETITIVE REPLACEMENT GUIDE

High Rejection Brackish Water Membrane Series

REPLACEMENT TRISEP MODEL	Dow / FilmTec	Hydranautics	GE / Desal	GE / Osmonics	KOCH / Fluid Systems	Toray
4040-ACMB-SSF	SW30-4040	CPA4-4040	SE4040F SE4040FF		4820XR	SU-710R
8040-ACMB-SSA	SW30-8040	CPA4	SE8040F		8822XR-365 8822XR-400	SU-720R

Seawater Membrane Series

REPLACEMENT TRISEP MODEL	Dow / FilmTec	Hydranautics	GE / Desal	GE / Osmonics	KOCH / Fluid Systems	Toray
4040-ACMS-SSF	SW30HR-4040	SWC1-4040 SWC2-4040 4040-HSA-SWC1	AD4040F / (FF) SC4040F / (FF)		1820 SS 1820 HF	TM810 TM810L SU-810
8040-ACMS-SSA	SW30HR-380 SW30HR-320 SW30HR LE-400 SW30XLE-400 SW30-380	SWC2 SWC3+ SWC4+ 8040-HSY-SWC1 8040-HSY-SWC2	AD8040F SC8040F		2822 SS 2822 HF	TM820H-370 TM820-370 TM820-400 TM820L-370 TM820L-400 SU-820 SU-820FA SU-820L

Note: TriSep Corporation replacement models may require inboard product end adaptors for connecting to housing end plate assemblies. Contact TriSep Corporation Customer Service for connection requirements and product specification sheets

COMPETITIVE REPLACEMENT GUIDE

Cellulose Acetate RO Membrane Series

REPLACEMENT TRISEP MODEL	Dow / FilmTec	Hydranautics	GE / Desal	GE / Osmonics	KOCH / Fluid Systems	Toray
4040-SB10-TSA						
4040-SB20-TSA		CAB2-4040 4040-MSA-CAB2	CD4040F	411-HR	4221HR 4160HR	SC-6101 SC-4101 SC-4100 SC-6100
4040-SB50-TSA		CAB1-4040 4040-MSA-CAB1	CE4040F	411-SR	4221SD 4160S	SC-2101 SC-2100
4" CA NF (SB90)			CG4040F			
8040-SB10-TSA						
8040-SB20-TSA		8040-MSY-CAB2	CD8040F	815-HR	8222 HR 8221HR	SC-6201X SC-4201 SC-3200 SC-4200 SC-6200
8040-SB20-UWA					9222HR	
8040-SB50-TSA		8040-MSY-CAB1	CE8040F	815-SR	8221SD	SC-2201 SC-2200
8" CA NF (SB90)			CG8040F			
8340-SB20-TSOA			CD8340F	811-HR		
8540-SB20-TSOA		8540-MSY-CAB2				

Note: TriSep Corporation replacement models may require inboard product end adaptors for connecting to housing end plate assemblies. Contact TriSep Corporation Customer Service for connection requirements and product specification sheets

COMPETITIVE REPLACEMENT GUIDE

Nanofiltration Membrane Series

REPLACEMENT TRISEP MODEL	Dow / FilmTec	Hydranautics	GE / Desal	GE / Osmonics	KOCH / Fluid Systems	Toray
4040-XN45-TSF	NF270-4040 NF-4040 NF40-4040 NF40HF-4040 NF45-4040		DL4040F / (FF) DK4040F / (FF)	411-NF300(PA) 414-NF300(PA)	4720 SR2 4921S	SU-610
4040-TS80-TSF	NF70-4040 NF90-4040	4040-UHT-ESNA 4040-UHA-ESNA	HL4040(FF) HL4040F			SU-210
8040-XN45-TSA	NF40-8040 NF40HF-8040 NF45-8040		DL8040F DK8040F	815-NF300(PA)	8723 SR2 8921S 8929	SU-620
8040-XN45-UWA	NF-400 NF270-400 NF200-400		DL8040F DK8040F	815-NF300(PA)	8723 SR2-400 8921S 8929	SU-620F
8040-TS80-TSA	NF70-345		HL8040F		8923 S	SU-220
8040-TS80-UWA	NF70-400 NF90-400	8040-UHY-ESNA	HL8040F400		8923 S-400	

Note: TriSep Corporation replacement models may require inboard product end adaptors for connecting to housing end plate assemblies. Contact TriSep Corporation Customer Service for connection requirements and product specification sheets

COMPETITIVE REPLACEMENT GUIDE

Ultrafiltration / Microfiltration Membrane Series

REPLACEMENT TRISEP MODEL	Dow / FilmTec	Hydranautics	GE / Desal	GE / Osmonics	KOCH / Fluid Systems	Toray
4" 3.5K UF (UA60)			GK4040F			
4" 10K UF (UE10)			PW4040F		4321 UF	
4" 100K UF (UE50)		4040-TFV-P100	EW4040F	411-PT3 PS 411-PT4 PS		
4" 0.2µ MF (TM10)			JX4040F			
8" 3.5K UF (UA50)			GK8040F			
8" 10K UF (UE10)			PW8040F		8323 UF	
8" 100K UF (UE50)		8040-TFF-P100	EW8040F	815-PT3 PS 815-PT4 PS		
8" 0.2µ MF (TM10)			JX8040F			

Note: TriSep Corporation replacement models may require inboard product end adaptors for connecting to housing end plate assemblies. Contact TriSep Corporation Customer Service for connection requirements and product specification sheets

TriSep Applications Bulletins

Following is a partial list of TriSep application bulletins. Data obtained during tests or operation of actual system depend on feedwater quality, operation of the system, and other variables which may not be an accurate reflection of expected performance on other feedwater. For more detailed help on predicting membrane or chemical performance, please contact your TriSep representative.

SPIRASEP PILOT STUDY BULLETIN

Bulletin No.: SpiraSep-01

Application: Municipal sewage tertiary filtration

Membrane: SpiraSep-500 submerged, negative pressure, spiral wound membrane

Membrane Properties:	**Model:**	**8040-UB50-PVAB**
	Membrane Chemistry:	**Polyethersulfone (PES)**
	Pore Size:	**0.05 micron**
	Operating Pressures:	**1 to 10 psi vacuum**
	Clean Water Flux:	**30 gfd/psi**

Background: The SpiraSep UF technology was pilot tested for tertiary filtration of municipal sewage for the removal of turbidity, suspended solids, and viruses. The treatment schematic of the sewage plant is primary clarification, bio-filtration or "trickle-down" filtration, aeration, and secondary clarification. Feed for the SpiraSep pilot was taken directly from the secondary clarifiers.

Process:

Feedwater Chemistry

Turbidity:	**3.0 to 5.0 NTU**
TSS:	**10 to 20 ppm**

Process Parameters*

Permeate Flux:	**30 gfd**
Permeate Turbidity:	**<0.1 NTU**
Number of Elements:	**4 (420 ft2 total membrane area)**
Operating Pressure:	**1 to 5 psi vacuum**
Recovery:	**>90 %**
Backflush Frequency:	**15 minutes**
Backflush Duration:	**45 seconds**
Backflush Chlorine Dosage:	**10.0 ppm**
Aeration:	**12.0 scfm**

***Represents preliminary pilot test results as of 6/25/2004**

SPIRASEP PILOT STUDY BULLETIN

Bulletin No.: SpiraSep-02

Application: Landfill leachate

Membrane: SpiraSep-500 submerged, negative pressure, spiral wound membrane

Membrane Properties:	**Model:**	**8040-UB50-PVAB**
	Membrane Chemistry:	**Polyethersulfone (PES)**
	Pore size:	**0.05 micron**
	Operating Pressures:	**1 to 10 psi vacuum**
	Clean Water Flux:	**30 gfd/psi**

Background: The SpiraSep UF technology was pilot tested for filtration of municipal landfill leachate for the removal of turbidity, suspended solids, and viruses. The landfill cells are comprised of a mixture of ash (i.e. incinerated solid waste) and solid wastes. The treatment schematic of the plant is flocculation, sand filtration, UF filtration, and reverse osmosis.

Process:

UF Feedwater Chemistry

Turbidity:	**4.0 to 6.0 NTU**
TSS:	**8 to 20 ppm**
COD:	**160 ppm**
TOC:	**4.0 to 6.0 ppm**
Color:	**54 SCU**

Process Parameters*

Permeate Flux:	**15 gfd**
Permeate Turbidity:	**<0.1 NTU**
Number of Elements:	**4 (460 ft2 total membrane area)**
Operating Pressure:	**1 to 5 psi vacuum**
Recovery:	**>90 %**
Backflush Frequency:	**10 minutes**
Backflush Duration:	**30 seconds**
Backflush Chlorine Dosage:	**10.0 ppm**
Aeration:	**18.0 scfm**

***Represents preliminary pilot test results as of 6/25/2004**

SPIRASEP PILOT STUDY BULLETIN

Bulletin NO.: SpiraSep-03

Application: Surface water

Membrane: SpiraSep-500 submerged, negative pressure, spiral wound membrane

Membrane Properties:	**Model:**	**8040-UB50-PVAB**
	Membrane Chemistry:	**Polyethersulfone (PES)**
	Pore Size:	**0.05 micron**
	Operating Pressures:	**1 to 10 psi vacuum**
	Clean Water Flux:	**30 gfd/psi**

Background: **The SpiraSep UF technology was pilot tested for filtration of a surface water in Holland. Surface water source is a canal, with high turbidities and organic content. SpiraSep utilized an enhanced coagulation/filtration process for removal of suspended solids, organic content, and color.**

Process:

Feedwater Chemistry

Turbidity:	**12.0 -20.0 NTU**
TSS:	**10 to 20 ppm**
DOC:	**8.0-10.0 ppm**
COD:	**20.0-30.0 ppm**
BOD:	**2.0-5.0 ppm**

Process Parameters*

Permeate Flux:	**70 lmh**
Permeate Turbidity:	**<0.1 NTU**
Number of Elements:	**4 (420 ft2 total membrane area)**
Operating Pressure:	**0.11 - 0.12 bar vacuum**
Recovery:	**>90 %**
Backflush Frequency:	**15 minutes**
Backflush Duration:	**45 seconds**
Backflush Chlorine Dosage:	**10.0 ppm**
Aeration:	**2.0 - 5.0 scfm per element**
Coagulation:	**5.0 - 10.0 ppm FeCl3**

***Represents preliminary pilot test results as of 6/25/2004**

APPLICATION BULLETIN

BULLETIN NO.: X-20 / 01
TYPE: Reverse Osmosis

APPLICATION: Boiler Feedwater
CLIENT: Zero Discharge Cogeneration Plant

PRODUCTS: ***8040-X201-TSA*****:** Spiral Wound Element, X-20™ Membrane.

BACKGROUND: This plant had a history of severe biofouling. With the previous manufacturer's elements, the system needed to be cleaned every 2 to 3 days based on high Delta P's and a drop in normalized product flow. The performance of these elements had steadily declined over time.

PROCESS: City water feed with the following quality: *(NOTE: City water quality varies considerably)*

Conductivity:	1000 - 2400 µ-mho/cm
Total Hardness:	50 - 300 mg/L (as $CaCO_3$)
Silica (SiO_2):	3.0 - 6.0 mg/L
Temperature:	50 - 88°F

Pre-treatment consists of a clarifier, multimedia filter, 1.0 micron bag filters, 1.0 micron cartridge filter (nominal), sodium bisulfite feeder and UV (232 NM wavelength).

System design consists of 2 parallel trains, each train with a 6:3 array using 6M vessels. ach train is designed to produce 150 gpm of product water.

PERFORMANCE: Since the introduction of the X-20 elements, cleaning frequency has been reduced to once every 14 days. The elements have been in operation for over 1 year with no loss in flux or rejection. The X-20 membrane is showing a significant increase in silica rejection versus the previously installed standard composite membranes. Performance after 16,800 hours of operation and over 700 cleaning hours is as follows:

	Start-Up	**After 16,800 hours**
Inlet Pressure:	165 psi	170 psi
Product Flow:	150 gpm	150 gpm
System Recovery:	75%	75%
System TDS Rejection:	>99%	>99%
System Silica Rejection:	>99%	>99%
1st Stage Delta P	23 psi	24 psi
2nd Stage Delta P	15 psi	16 psi

CONCLUSION: The X-20 spiral wound elements have provided increased silica rejection. The superior low fouling performance of the X-20 membrane has decreased cleaning intervals from 2 days to 14 days.The membrane has been subjected to over 700 cleaning hours without a loss in performance. This success has allowed the plant to operate 125% under budget for the year.

APPLICATION BULLETIN

BULLETIN NO.: X-20 / 02
TYPE: Reverse Osmosis

APPLICATION: Boiler Feedwater
CLIENT: Public Utility

PRODUCTS: ***8040-X201-TSA:*** Spiral Wound Element, X-20™ Membrane.
TriPol™ 8510: Advanced Antiscalant Solution.

BACKGROUND: The system had experienced ongoing problems with biofouling and organic fouling. With competitor's membranes, the system was being cleaned monthly. Cleaning could not completely restore the element performance and resulted in the eventual failure of the elements. The system's delta P ranged from 70 to 100 psi.

PROCESS: Raw water is supplied from a shallow lake municipal source.

SDI:	6
Conductivity:	270 µ-mho/cm
Silica (SiO_2):	2.5 - 4.0 mg/L
Temperature:	50 - 80°F

Pre-treatment consists of a multimedia filter, 5.0 micron and 1.0 micron cartridge filters (nominal), sodium bisulfite feeder, and TriSep's TriPol 8510 Scale Inhibitor.

System design consists of 2 parallel trains, each with a 4:2 array using 6M vessels. Each train is designed to produce 100 gpm of product water.

PERFORMANCE: The introduction of the X-20 elements resulted in dramatic improvements in system performance. The elements have been on-line for over 7 months and were cleaned for the first time after 6 months. The cleaning restored system to start up conditions, with system delta P at only 30 psi. The X-20 membrane has exhibited superior silica rejection over the competitor's membrane. Permeate water silica concentration has dropped from 140 ppb with the competitor's elements to 8 ppb with the X-20. This corresponds to a system rejection of 99.20% running at 75% recovery and an average element rejection of 99.75%. This has resulted in reducing the regeneration rate of the demineralizer bed and increased the run lengths from 3 million gallons to 15 million gallons. The customer is adding Sodium Metabisulfite to control the free chlorine to below 0.1 ppm and allowing a residual of 1.0 ppm chloramine to the RO feed. The utility will increase the chloramine concentration to 5 to 10 ppm during the summer months.

CONCLUSIONS: TriSep's X-20 elements have significantly reduced the required cleaning frequency, and its superior silica rejection has resulted in longer run times for the demineralizers. Overall system costs have dropped due to the reduction in chemical usage and labor costs associated with cleaning.

APPLICATION BULLETIN

BULLETIN NO.: ACM / 01
TYPE: Reverse Osmosis

APPLICATION: Petrochemical Complex
LOCATION: Argentina

PRODUCTS:
***8040-ACM1-TSA*:** Spiral Wound Element, ACM™ Membrane
***TriPol™ 9000*:** Advanced Scale Inhibitor Solution

PROCESS: Brackish well water with the following average constituancy:

Total Hardness	38 mg/L (as $CaCO_3$)
Sodium (Na)	250 mg/L
Carbonate (CO_3)	8.6 mg/L (as $CaCO_3$)
Bicarbonate (HCO_3)	170 mg/L (as $CaCO_3$)
Sulfate (SO_4)	79.7 mg/L
Chloride (Cl)	228 mg/L
Nitrate (NO_3)	22.3 mg/L
Silica (SiO_2)	36 mg/L
Conductivity	1600 µS/cm
Temperature	60°C (well); 35°C (membrane feed)
pH	8.4

Pretreatment consists of cooling towers followed by media filtration, 5.0 micron cartridge filters (nominal), and chemical dosage of TriPol 9000 Scale Inhibitor.

The reverse osmosis plant is designed as a 2 stage (product staging) system, operating at 80% overall recovery with 2nd stage brine recycle to 1st stage feed, producing 12 m^3/h (76,032 gpd) of permeate for high purity requirements. Array design consists of a 1st stage of 3 tubes in a 2:1 configuration. The 2nd stage consists of 2 tubes in a 1:1 configuration. Each tube housing seven TriSep 8040-ACM1-TSA spiral wound RO elements.

PERFORMANCE:

Product Flow (1st stage; 2nd stage)	3,960 GPH (15 m^3/h); 3,168 GPH (12 m^3/h)
Concentrate Recycle (2nd stage)	792 GPH (3 m^3/h)
Overall Recovery	80%
Feed Pressure (1st stage; 2nd stage)	156 psi; 188 psi
Delta P Pressure (1st stage; 2nd stage)	46 psi; 55 psi
Product Conductivity (1st stage; 2nd stage)	20 µS/cm; 0.7 µS/cm
System Silica (SiO_2) Rejection	>99.80%
System Dissolved Solids Rejection	>99.93%

CONCLUSIONS:
1) Final permeate quality exceeds design specification.
2) Substantial cost savings over previous ion exchange system.

APPLICATION BULLETIN

BULLETIN No.: ACM / 02
TYPE: Reverse Osmosis

CLIENT: Municipal Utility Power Plant
APPLICATION: Boiler Feedwater Treatment - Silica and dissolved solids (TDS) reduction for low pressure boiler feedwater.
LOCATION: North Central United States

PRODUCT: ***4040-ACM1-TSA***: Spiral Wound Element, ACM™ Membrane

BACKGROUND: In June of 1993, FLOCEPT, INC., of Bloomington, MN., reloaded two (2) reverse osmosis systems, at a municipal utility power plant located in the north central United States, with TriSep's Advanced Composite Membrane (ACM™) RO elements for supply of low pressure boiler feedwater.

PROCESS: The feedwater quality to each reverse osmosis system ranged in conductivity from 690 - 940 micromhos/cm (approximately 350 - 480 mg/l as NaCl TDS), with average inlet silica (SiO_2) concentrations of greater than 21 mg/l.

PERFORMANCE: Permeate quality of both reverse osmosis systems employing TriSep ACM elements, has remained constant at 7 - 10 micromhos/cm (approximately 3.5 - 5 mg/l as NaCl TDS), with NON-DETECTABLE silica (SiO_2) levels reported.

TriSep's ACM elements have maintained permeate water quality, permeate water flow rates, consistent low operating pressures, contributing towards meeting boiler feedwater specifications. The TriSep ACM elements have not been cleaned and continue to perform without indications of fouling.

CONCLUSIONS: The ACM elements operate efficiently at low pressures (150 - 250 psi (10.2 - 17 bar)), yielding significantly lower passage of silica, salt, and naturally occurring low molecular weight organic compounds, than does cellulosic and other thin film type reverse osmosis membranes. This presents cost savings and operational/maintenance advantages, by reducing ion exchange resin fouling, regeneration frequencies and silica leakage, with fewer associated chemicals being used in the above application.

APPLICATION BULLETIN

BULLETIN NO.: ACM / 03
TYPE: Reverse Osmosis

CLIENT: Nevada Cogeneration Associates, Bonneville Pacific Services - Blank Mountain Plant 2

APPLICATION: Low Pressure Boiler Feedwater Treatment - Silica and dissolved solids (TDS) reduction.

LOCATION: Las Vegas, Nevada USA

PRODUCT: ***8040-ACM1-TSA***: Spiral Wound Element, ACM™ Membrane

In 1993, TriSep Corporation reloaded two (2) reverse osmosis (RO) systems, at a cogen eration power plant located in Las Vegas, Nevada, with TriSep's Advanced Composite Membrane (ACM™) RO elements for the supply of 216,000 gallons per day (GPD) of low pressure boiler feedwater.

FEED: The feedwater quality to each reverse osmosis system ranges in conductivity from 1600 - 1860 micromhos/cm (approximately 800 - 930 mg/l as NaCl TDS), with average inlet silica (SiO_2) concentrations of approximately 19 mg/l.

PERMEATE: Permeate quality of both reverse osmosis systems employing the ACM elements, remains consistent at 28 - 30 micromhos/cm (approximately 13 - 15 mg/l as NaCl TDS). Permeate silica (SiO_2) concentrations, detectable by the client to 1.5 mg/l, are consistently deter mined to be less than 1.5 mg/l.

TriSep's elements have maintained permeate water quality, permeate water flow rates, and consistent low operating pressures. The ACM membrane continues to perform, producing greater than 99% conductivity reduction (CR) quality permeate water through the system, while tolerating a standard quarterly chemical cleaning program.

CONCLUSION: Spiral wound elements, manufactured with TriSep membrane, operate efficiently at low pressures (150 - 250 psi (10.2 - 17 bar)), yielding significantly lower passage of silica, salt, and naturally occurring, low molecular weight organic compounds, than does cel lulosic and other polyamide composite RO membranes. This presents cost savings and operational/ maintenance advantages, by reducing ion exchange resin fouling, regeneration frequen cies and silica leakage with fewer associated chemicals being used.

APPLICATION BULLETIN

BULLETIN NO.: ACM / 04

TYPE: Reverse Osmosis

APPLICATION: Municipal Drinking Water

CLIENT: Town of Jupiter

LOCATION: Florida, U.S.A.

EQUIPMENT: 4040-ACM4-TSA: Spiral Wound Element, ACM™ Low Pressure Membrane.

BACKGROUND: A pilot study was done at the town of Jupiter for their planned expansion of 4 additional 1.5 MGD treatment trains to their current 6 MGD Reverse Osmosis Water Treatment Plant. The pilot test was designed to evaluate various membranes treating raw water supplied to the plant. TriSep along with two other manufacturer's participated in this pilot study.

PROCESS: Feedwater was any combination of 7 online Floridian Aquifer supply wells with varying water qualities.

Conductivity:	5,400 - 9,500 (µ-mho/cm)
Total Hardness:	783 - 1,141mg/L (as $CaCO_3$)
Bicarbonate (HCO_3):	120 mg/L (as $CaCO_3$)

Pretreatment consisted of 6 10-inch cartridge filters to remove particles larger than 5.0 microns from the raw water. Antiscalant dosed at 3 ppm. Acid injection used only during increased recovery at 5 - 10 ppm, depending on raw water pH.

The design is a 2 stage system with a 2:1 array using 6M vessels. This design simulated their existing full scale RO treatment trains array of 37:14. The elements were tested at flux rates and recoveries of 13.5 GFD / 75% recovery and 16.8 GFD / 78.5% recovery. The increased flux and recovery test was done to simulate conditions when another train was down.

PERFORMANCE: Each manufacturer's elements were tested for 13 to 16 days, treating roughly 400,000 gallons of raw water each. Comparisons done at identical operating conditions showed:

1. TriSep's ACM4 elements exhibited the lowest feed pressure requirements.
2. The highest normalized average TriSep membrane rejection was 99.40%, compared to 99.10% and 98.30% for the other two manufacturer's elements.
3. The ACM4 exhibited the lowest increase in feed pressure, 3.70%, after recovering from the increased flux test; compared to 5.10% and 13.30%.
4. The ACM4 exhibited no reduction in the normalized membrane productivity after the increased flux test; while the competitor's showed 5% and 25% declines respectively.
5. Projected system rejection with the 4040-ACM4-TSA was 96.30%. Actual system rejection was 98.50%.

CONCLUSIONS: Pilot test was very successful. The low pressure, high rejection ACM4 elements provide significant operating cost savings.

APPLICATION BULLETIN

BULLETIN NO.: ANM / TS80-01
TYPE: Nanofiltration

APPLICATION: Color removal, THM reduction.
CLIENT: Daytona Beach Pilot Plant
LOCATION: Daytona Beach, Florida, U.S.A.

PRODUCT: ***4040-TS80-TSA:*** Spiral Wound Element, ANM™ Nanofiltation Membrane

PROCESS: TriSep TS80 elements operated in a pilot plant at Daytona Beach, lorida, for 8000 hours on a test conducted by an independent testing organization. All critical process variables were logged on a daily basis along with periodic monitoring of norganic as well as various organic halide formation potentials. Raw water pre treatment consisted of acid dosing and cartridge filtration. Table 1 contains a typical feedwater analysis, while Table 2 (next page)gives typical ionic rejections observed during the course of this test.

As can be seen from Table 2, the TS80 elements gave very good inorganic ion rejections and trihalomethane formation potential (THMFP) rejections. During the course of this test, the average THMFP in the system permeate was less than 25 ppb.

The TS80 membrane also exhibited very high water flux rates. At a pressure of 100 psi, this equates to 22 GFD or 2000 GPD for a 4040-TS80-TSA element and 8000 GPD for a 8040-TS80-TSA element. The TS80 also proved to be resistant to fouling. There was no noticeable flux decline after 500 hours of operation and only a 10% flux decline after 4750 hours of operation. If we assume that the elements would be cleaned after a 10-15% loss in element flux, we can calculate an interval between cleanings of 7.3 months.

CONCLUSIONS: Based on the results of this test, the TriSep TS80 membrane is a superior mem brane for membrane softening applications requiring high inorganic and THMFP rejections at low operating pressures. The TS80 operated on this feedwater with a minimum of pretreatment and chemical cleanings.

Table 1

Daytona Beach Raw Water Analysis

Solute	Raw Water Concentration
TOXFP[1]	1120
Color (cpu)	31
NPDOC[2] (ppm)	9
TDS (ppm)	368
Na (ppm)	30
Total Hardness (ppm as CaCO3)	289
Calcium Hardness (ppm as CaCO3)	264
Cl (ppm)	29
Alkalinity (ppm as CaCO3)	295
Fe (ppb)	372
pH	6.3

Table 2
Daytona Beach Ionic Rejections

Solute	Rejection versus Operating Time		
	470 hrs	4754 hrs	8152 hrs
TOXFP1[1]	99%	97%	98%
THMFP[2]	98%	99%	98%
Color	99+%	97%	98%
NPDOC[3]	97%	99%	99%
TDS	97%	97%	96%
Na	87%	84%	83%
Total Hardness	97%	99%	98%
Calcium Hardness	99%	99%	98%
Cl	94%	93%	94%
Alkalinity	—	96%	93%
Fe	99%	96%	97%

[1]TOXFP = Total organic halide formation potential
[2]THMFP = Trihalomethane formation potential
[3]NPDOC = Non-purgable dissolved organic carbon

APPLICATION BULLETIN

BULLETIN NO.: ANM / TS80-02
TYPE: Nanofiltration

APPLICATION: Color removal, THM reduction.
CLIENT: Melbourne Pilot Plant
LOCATION: Florida, U.S.A.

PRODUCT: ***4040-TS80-TSA:*** Spiral Wound Element, ANM™ Nanofiltration Membrane

PROCESS: TriSep TS80 elements operated in a pilot plant at Melbourne, Florida, for 3800 hours on a test conducted by an independent testing organization. All critical process variables were logged on a daily basis with periodic measurement of inorganic as well as various organic halide formation potentials. Pretreatment consisted of an activated carbon filter, acid and scale inhibitor dosing. Table 1 contains a typical feedwater analysis, while Table 2 (next page) gives typical ionic rejections observed during the course of this test.

As can be seen from Table 2, the TS80 elements gave very good inorganic ion rejections and trihalomethane formation potential (THMFP) rejections. During the course of this test, the average THMFP in the system permeate was less than 25 ppb.

The TS80 membrane also exhibited very high water flux rates. Normalized to a pressure of 100 psi, this equates to 18 GFD or 1600 GPD for a 4040-TS80-TSA element and 6200 GPD for a 8040-TS80-TSA element.

CONCLUSIONS: Based on the results of this test, the TriSep TS80 membrane is a superior membrane for membrane softening applications requiring high inorganic and THMFP rejections at low operating pressures. The TS80 operated on this feedwater with a minimum of pretreatment and chemical cleanings.

Table 1
Melbourne Raw Water Analysis

Solute	Raw Water Concentration
TOXFP[1] (ppb as Cl)	7164
Color (cpu)	210
NPDOC[2] (ppm)	27
TDS (ppm)	413
Na (ppm)	54
Total Hardness (ppm as CaCO3)	147
Calcium Hardness (ppm as CaCO3)	100
Cl (ppm)	99
Alkalinity (ppm as CaCO3)	81
Fe (ppb)	263
pH	8.0

[1]TOXFP = Total organic halide formation potential
[2]NPDOC = non purgable dissolved organic carbon

Table 2
Melbourne Ionic Rejections

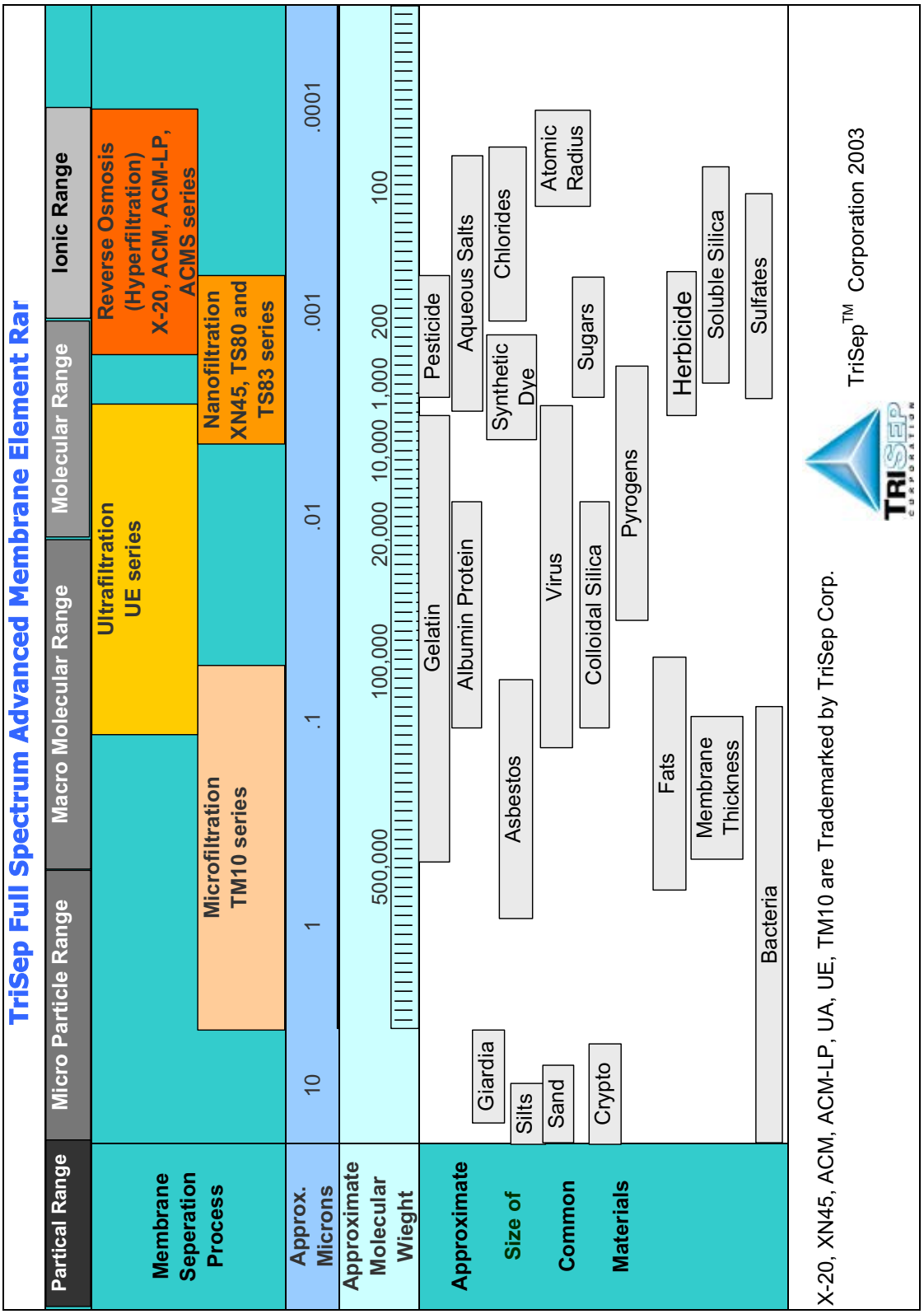
	Rejection versus Operating Time	
Solute	**300 hrs**	**3734 hrs**
TOXFP[1]	97%	98%
THMFP[2]	99%	96%
Color	BDL	BDL
NPDOC[3]	95%	BDL
TDS	94%	89%
Na	80%	73%
Total Hardness	98%	96%
Calcium Hardness	98%	97%
Cl	85%	83%
Alkalinity	93%	—
Fe	98%	—

[1]TOXFP = Total organic halide formation potential
[2]THMFP = Trihalomethane formation poetntial
[3]NPDOC = Non-purgable dissolved organic carbon

NOTES: The above listed rejections are actuals based on average feed-brine concentrations and have not been normalized. BDL means permeate concentrations were below detectabllevels.The raw data for this test is available on request.

TriSep Engineering Manual

Filtration Spectrum



TriSep Engineering Manual

Cross Flow Filtration

Cross flow filtration is different from direct or dead end filtration. In direct filtration, there is a feed stream and a filtered stream. Any material that is removed from the feed stream builds up inside the filter. The filter then needs to be replaced or back flushed to remove the accumulated sustended solids. Examples of direct filters are cartridge filters, bag filters, and sand filters.

In cross flow filtration, there is a feed stream, a purified or permeate stream, and a concentrated or brine stream. In cross flow filtration, a separation is performed and if everything is working well, no material will build up in the filter. Material that is removed by the filter ends up in the concentrate stream. These types of filters are normally operated with a significant cross flow velocity across the membrane surface to prevent fouling or scaling, hence the name.

Cross flow filtration elements come in several forms. There are hollow fine fiber based (0.1 mm diameter), capillary (1-2 mm diameter fibers), tubular (12 mm - 25 mm diameter fibers), plate and frame, and spiral wound configurations.

Spiral membrane element designs dominate the RO and NF markets due to their high packing density, flexible design, low cost, and excellent performance over a wide range of applications.

In the newly emerging back flushable UF market, capillary membranes are currently dominating the market. The SpiraSep element is the first spiral wound entry into this marketplace.

TriSep Engineering Manual

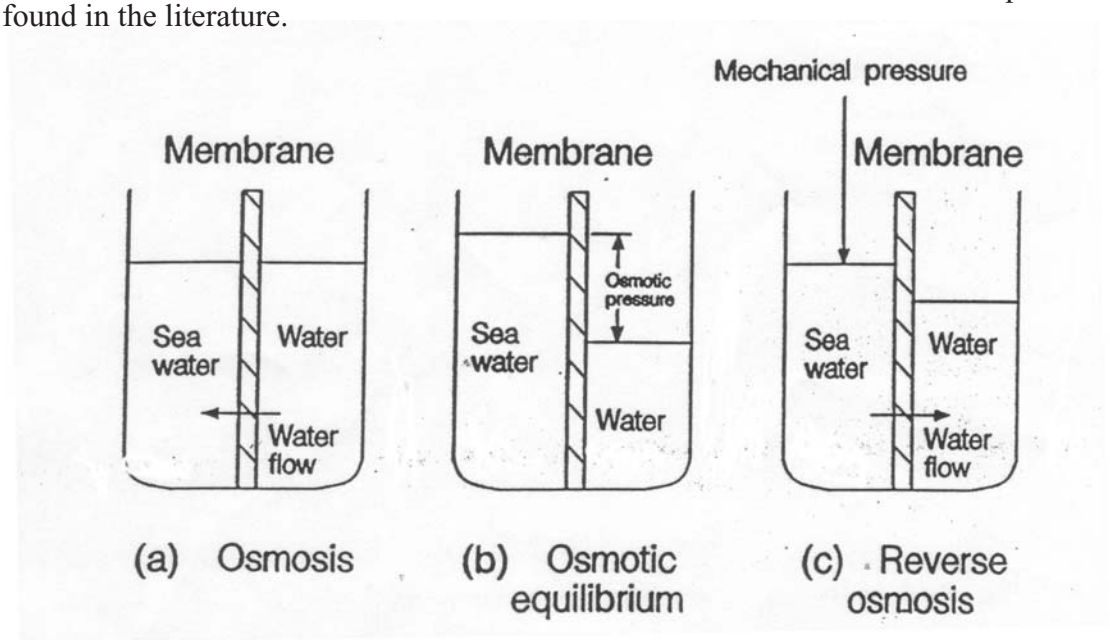
Principles of Reverse Osmosis

Osmosis is a natural process involving fluid flow across a membrane which is said to be "semipermeable". A semipermeable membrane is selective in that certain components of a solution, usually the solvent, can pass through it, while others, usually dissolved solids, cannot. The direction of solvent flow is determined by its chemical potential which is a function of pressure, temperature, and concentration of the dissolved solids. If pure water contacts both sides of a semipermeable membrane at equal pressure and tempreature, no net flow occurs across the membrane since the chemical potential is equal on both sides. If a soluble salt is added on one side of the membrane, the chemical potential of the water on that side is reduced. Osmotic flow from the pure water side to the salt solution side will occur across the membrane (Figure a, Osmotic Flow) until equilibrium of solvent chemical potential is restored.

The thermodynamic requirement for osmotic equilibrium is that chemical potential of the solvent should be the same on both sides of the membane. No such condition is imposed on the solute, since the membrane prevents its passage. Equilibrium occues when the pressure differential from the volume changes on the two sides is equal to the osmotic pressure (Figure b, Osmotic Equilibrium), a solution property which is independent of the membrane. The application of external pressure to the solution side which equals the osmotic pressure will also accomplish equilibrium. A further increase in pressure will increase the chemical potential of the water in the solution and will cause a reversal of the osmotic flow toward the pure water side (Figure c, Reverse Osmosis) now at a lower solvent chemical potential relative to the solution. This phenomenon is termed reverse osmosis and is the basis for a precess to desalinate water without phase change.

The mechanism by which osmosis-reverse osmosis occurs across a semipermeable membrane is not fully underood. However, it seems certain that the chemical nature of the membrane must be such that it will exhibit a preference for water versus dissolved salts at the surface-solution interface. This may occur by weak chemical bonding of the water to the membrane surface or the water within the membrane structure. A concentration gradient is thus formed. Pure water either at the interface or within the membrane tends to exclude the solute. Transport of the water across the membrane may be through pores physically present in the structure or by diffusion from one bonding site to another within the membrane. Both the chemical and the physical nature of the membrane determine its inherent ability to transport water and reject salt.

Since reverse osmosis membranes are tailored to transport water, it follows that dissolved compounds which are similar in chemical nature to water will also pass readily since they will interact with the membrane in a similar manner. More detailed discussion sof reverse osmosis and semipermeable membrans may be found in the literature.



TriSep Engineering Manual

Performance Variables

As a first approximation, the rate of water passage through a semipermeable membrane is defined by Equation 1.

$$Q_w = K_w (\Delta P - \Delta \pi) A / \tau \quad (1)$$

where:

Q_w = Flow rate of water through the membrane
K_w = membrane permeability coefficient for water
ΔP = hydraulic pressure differential across membrane
$\Delta \pi$ = osmotic pressure differential across membrane
A = membrane surface area
τ = membrane thickness

Similarly, the rate of salt passage is defined by Equation 2:

$$Q_s = K_s (\Delta C) A / \tau \quad (2)$$

where:

Qs = flow rate of salt through the membrane
Ks = membrane permeability coefficient for salt
ΔC = salt concentration differential across membrane

The rate of water flow through the membrane is proportional, therefore, to the pressure differential across the membrane, while the rate of salt flow is proportional to the concentraion differential and independant of the applied pressure. Thus, an increase in operating pressure will increase the water flow without changing the salt flow.

Conversion, or recovery as it is sometimes called, is defined by Equation 3.

$$Y = Q_p / Q_f \times 100 \quad (3)$$

where:

Y = % conversion or recovery
Q_p = product water flow rate
Q_f = feed water flow rate

Operation at 75% recovery means that from 100 gpm of feed water, 75 gpm of product water will be produced together with 25 gpm of concentrate or brine containing most of the dissolved solids.

The term "salt passage" is defined by Equation 4.

$$SP = C_p / C_f \times 100 \quad (4)$$

where:

SP = % salt passage
C_p = salt concentration in product stream
C_f = salt concentration in feed stream

The term "salt rejection" is 100% minus the salt passage. Salt passage increases as the applied pressure is decreased. This increase results from the lower water flow rate at deduced pressure and consequently, less dilution of the salt which continues to flow at a constant rate.

Performance Variables

Conversion or recovery affects salt passage and product flow. As conversion is increased, the salt concentration on the feed-brine side of the membrane increases, causing an increase in salt flow rate as indicated by Equation 2. In addition, the higher salt concentraion in the brine can significantly increase the osmotic pressure, thereby reducing the water flow rate according to Equation 1.

Actual water flow rate and salt rejection are always less than theoretical because of the pheneomenon of concentration polarization. As water flows through the membrane and as salts are rejected by the membrane, a boundary layer is formed near the membrane surface in which the salt concentration exceeds that in the bulk solution. This enrichment of the salt concentration is called concentration polarization. The thickness of the boundary laryer is dependent upon the stirring or streaming velocity; however, the salt in the boundary layer must return to the bulk solution by back diffusion.

Concentration polarization has several negative effects on the desalination process. Osmotic pressure will be greater at the membrane surface than in the bulk soliution, reducing the net pressure differential across the membrane ($\Delta P - \Delta \pi$) and, thereby, the water flow. Similarly, salt flow will increase with the higher localized salt concentration. In addition, the probablility of exceeding the solubility of sparingly soluble salts at the membrane surface increases, and with the possibility of precipitation causing membrane scaling. Although these boundary layer pheneomena are indepenent of membrane transport per se, their effects can be significant, particulary for membranes with high water flow per unit area (specific flux).

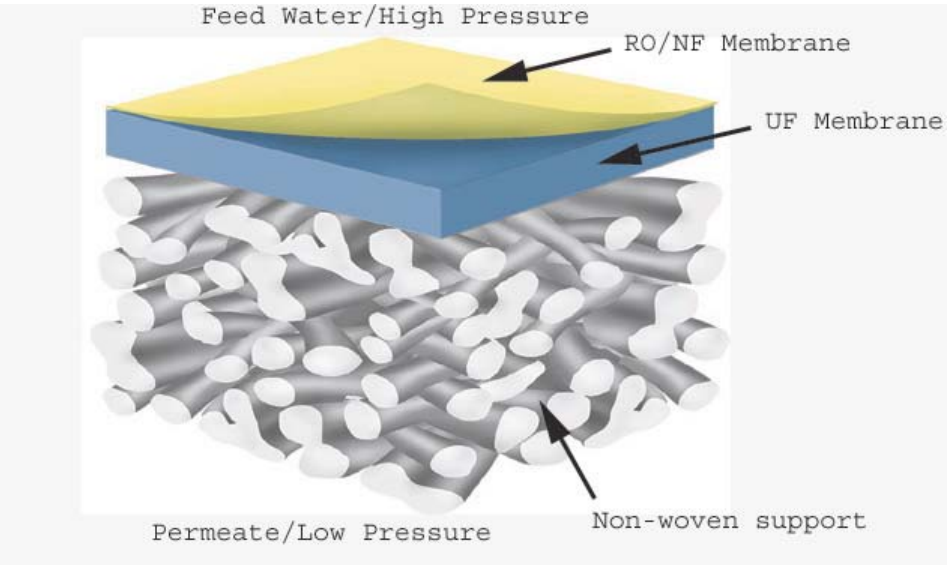
How a Membrane is Made

The membrane chosen for desalination of water by reverse osmosis must be highly permeable to water to achieve high rates of production while being highly impermeable to salts to obtain acceptable product water quality. It must also be extremely thin to maximize water flow but strong enough to withstand high pressure. Changes in the membranes transport and mechanical properties should be minimal after long exposure to high pressure. Likewise, resistance of the membrane to chemical and biological attack is necessary. For economic considerations, the membrane should lend itselt to being fabricated into shapes which offer high surface to volume ratios.

Most flat sheet membranes used in RO applications today are composite membranes. The membrane is coated or cast unto a support sheet, typically a non-woven polyester film, usually about 0.004" (0.1 mm) thick. On top of this layer, a thin UF support membrane 0.002" (0.05mm) thick, usually made from polysulfone, is applied to the support fabric. The final RO membrane, 2,000 angstroms thick, is then coated on top of the support membrane. The TriSep ACM, X-20, TS80, and XN45 membranes are made with this process.

The celluslose acetate SB series RO membranes and the UE and TM10 UF and MF membranes are assymetric membranes. This type of membrane is made in a single step. It is coated on a polyester support fabric in a single step. The surface has a much denser pore structure while the base of the membrane has a more pourous and open structure to minimize pressure drop.

Figure 3



TriSep Engineering Manual

How a Spiral is Made

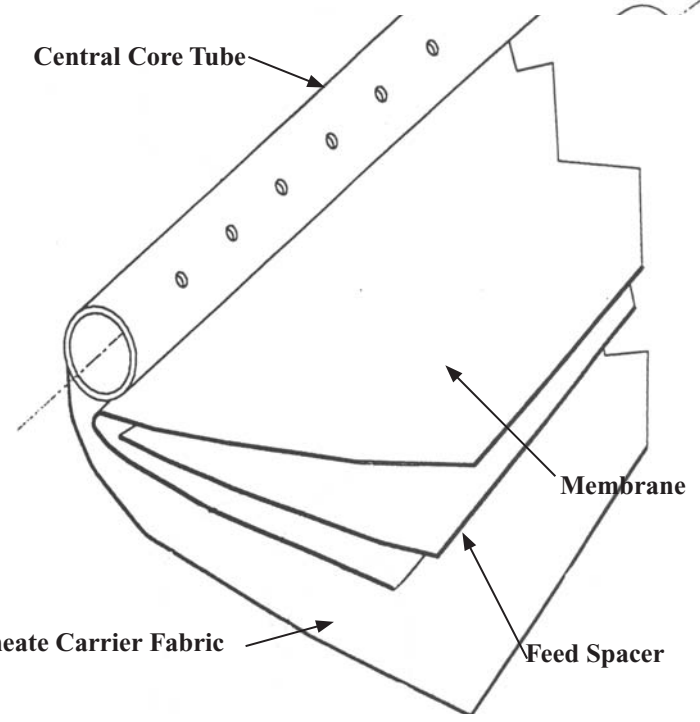
Spiral wound elements are made of three main fabrics. The membrane, permeate carrier fabric, and feed spacer. The membrane is the part of the element where the separation occurs. The membrane can be a RO, NF UF or MF type membrane. The feed spacer sits between two adjacent membrane faces and acts as a spacer and also a turbulence promoter. This function is critical to minimizing concentration polarization. The permeate carrier fabric acts as the pipe to allow the permeate to exit from the element.

The other components normally present in a spiral wound element are the permeate tube and the membrane adhesive. The permeate tube is the pipe through which the permeate can exit the element. Water under presure is forced through the membrane. It travels down the permeate carrier fabric to the permeate tube. The permeate tube has holes drilled in it to allow the permeate to enter the inside of the tube. Interconnectors with O-rings seal the feed water from the permeate water at each end.

The membrane placed in a spiral element is sealed on three sides. The only side not sealed is that adjacent to the permeate tube. The adhesive creates a sandwich of material between two back sides of the membrane and the permeate carrier fabric. The adhesive must form a leak free seal that can hold up to high pressures and possibly high temperatures.

The feed spacer material is normally a mesh or netting material made from polypropylene. This material is normally about 0.028" (0.7 mm) to 0.031" (0.8 mm) thick. It must have a relatively low pressure drop at normal operating conditions, around 1-4 psi per element. This is especially important on low pressure RO, NF, UF, and MF applications where the feed-brine differential pressure can subtract a significant amount of the available net driving pressure. Feed spacers that are thicker have lower pressure drops. Spacers that are thinner than 0.028" (0.7mm) are normally not suitable for commercial and industrial spiral wound elements due to the higher pressure drop and increased rick of feed channel plugging. Thicker feed spacers, up to 0.090" (2.3 mm) can be used for applications with high suspended solids or high recirculation flow rates.

The permeate carrier fabric must have a low pressure drop for the permeate flow while being able to withstand high pressures without compaction. The material normally used is a knit fabric that is coated with an epoxy resin to give it additional strength. This material is normally 0.010" (.25 mm) to 0.016" (0.41 mm) thick. For high pressure applications (> 600 psi (40 bar) a special permeate carrier fabric must be used. Maximum pressure for most spiral elements is around 1,200 psi (83 bar).

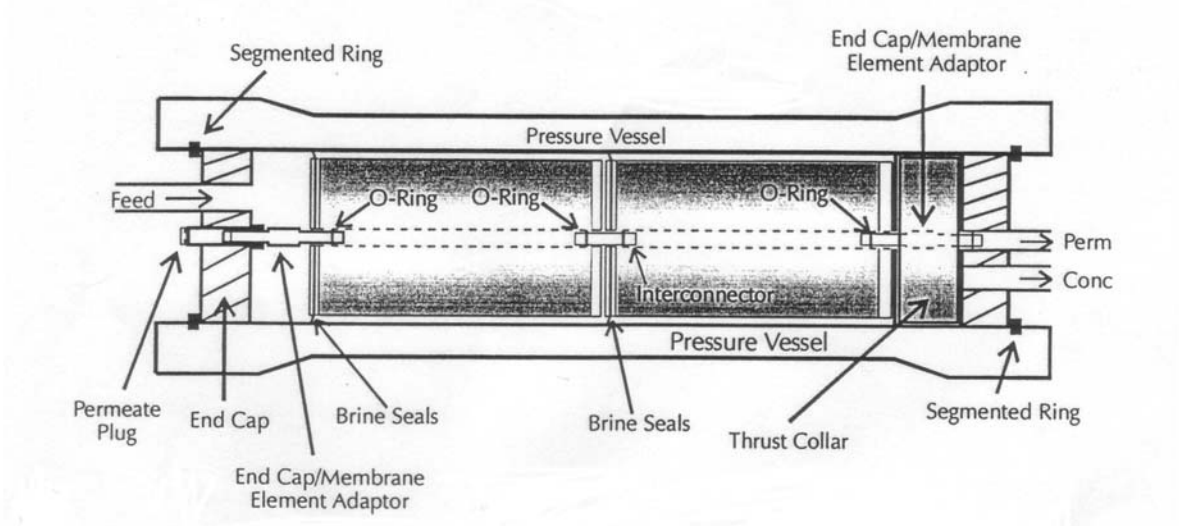


Once the element is wound, it needs some device to hold it together to keep it from unraveling. This can be done using tape, fiberglass reinforced epoxy plastic (FRP), welded or extruded netting for sanitary applications, or a hard shell such as is used for the Turboclean element. For most commericial and industrial applications that do not require sanitary construction, FRP outerwrapping is the most common method. This outerwrap must also give the element rigidity and strength to withstand the forces exhibited on the element by the feed-brine differential pressure, or delta P. On a typical 8" system, the pressure drop on a single tube can be 30 psi (bar) to 60 psi (4 bar). This equates to a force trying to compress the element stack of 1,500 lbs (685 kg) to 3,000 lbs (1,360 kg).

Spiral elements are typically loaded into a pressure tube that can withstand the feed pressure required to operate the element. To seal the outside of the element to the inside of the pressure tube, which is required to force the feed water into the elemnet rather than bypass around the outside, a seal carrier or anti telescoping device (ATD) is attached to each end of the element. This serves two purposes. One, it is a place where a brine seal can be placed to seal to the inside of the pressure tube wall, and it acts as an antitelescoping device. Telescoping happens if you fix either the center or the outside of the element and allow the other to move. The ATD must be strong enough to withstand the delta P forces mentioned above without allowing the element to telescope.

Spiral elements are normally loaded with multiple elements in a single pressure tube. This allows systems to operate at high conversions or recoveries, typically 75-90% for a RO or NF system. A typical pressure tube can hold 1-7 elements, with 6 and 7 element long tubes being the most common for large systems. To allow the permeate to exit the pressure tube, the permeate tubes of each element in a pressure tube must be connected together in such a way as to not allow feed water to enter the permeate stream. This is typically accomplished using a plastic interconneter that has O-rings on each end. At the end of the pressure tube, an inboard adapter is used to adapt the element permeate tube to the pressure tube endcap.

The ability to use different materials for the membrane, feed spacer, and permeate carrier fabric depending on the application, makes the spiral design a very flexible design. If you wish to make an element that can operate at high pressure, you can use a special permeate carrier fabric. To use a NF instead of an RO membrane, switch the membrane material. For a high solids application, use a thicker feed spacer. For high temperature applications, a special adhesive and the use of high temperature plastic parts.



QUALITY CONTROL PROCEDURE FOR THE MANUFACTURE OF TRISEP ELEMENTS

In order to assure consistent product quality, TriSep maintains a stringent Quality Control Program which insures the highest quality finished product.

This Quality Control Program encompasses all aspects of manufacturing starting with inspection of raw materials through monitoring process parameters, culminating in complete testing of 100% of the finished product.

While there are many points of inspection, four general areas are described below:

1 - Raw materials inspection
2 - Inspection of sub-assemblies
3 - Final wet testing and inspection
4 - Operation parameters.

1) RAW MATERIALS INSPECTION

TriSep maintains a Quality Control Department which inspects molded and machined parts per drawings and material receiving specifications. These parts include the permeate tubes, the molded plastic brine seal carriers, interconnectors, and the brine seals and O-rings.

Our Quality Control Department is responsible for maintaining the standards on all incoming raw material. All of our procedures and standards are designed to produce 100% compliance with our specifications. Every core tube is inspected for length and I.D. Since it determines the final length of the element and the critical O-ring sealing dimensions.

Membrane manufacture includes the use of three major sheet materials. These are the brine channel spacer, product channel materials, and membrane substrate. TriSep, in conjunction with each of the manufacturers of these materials has developed specifications which are a combination of the manufacturer's product specifications and our own. The combination of these specifications assures that the products are uniform and will consistently perform in their applications.

Depending on the material and specification in question, tests are performed on a daily or weekly lot basis. More routine functions (i.e. thickness, wale count) are performed in-house. Other testing requiring laboratory analysis is performed on a more random basis at an independent test facility.

TriSep specifies chemical grade and purity, and requires certified test reports from the manufacturer for all solvent used to produce the membrane casting solution.

Outerwrap resins and leaf adhesives are controlled by a combination of ratio checks and hardness cure tests on a daily and element basis.

QUALITY CONTROL PROCEDURE FOR THE MANUFACTURE OF TRISEP ELEMENTS

2) INSPECTION OF SUB-ASSEMBLIES

Each roll of membrane is sampled and tested under the same test conditions used for the finished membrane element. In addition, a visual inspection of the membrane is done by the casting machine operators during the preparation of the membrane leaf assembly.

Membrane testing is done in a test loop designed to duplicate element operation. Feed water concentration is controlled as are feed flow, operating pressure and temperature. Salt passage and product flows are measured to determine membrane performance.

Inspection of the membrane leaf sub-assembly includes a random check of material length (including brine channel spacer), proper spacing, and fold position.

Inspection of the product channel pack sub-assembly includes a random check of material lengths per TriSep specifications, and inspection of the product channel pack for leaf count, weld integrity, and spacing.

3) FINAL WET TESTING AND INSPECTION

The element integrity test is performed on every element prior to final acceptance . The data collected at this point is correlated with original membrane data, and calculations are made to verify uniformity and efficiency. Final element inspection includes a tolerance check to determine that the attached brine seal carriers are within the specified range. This test is followed by a cleaning and a visual check. The elements are then packaged for inventory.

Inventory control includes periodic random sampling of the elements. Certain elements are reopened, rinsed, wet tested and tolerance checked. This operation is logged by Quality Control and the elements are returned to inventory.

4) OPERATION PARAMETERS

In addition to numerous in-line Quality Control inspections of the various phases of element fabrication, TriSep maintains a rigorous control of process parameters. These controls include daily independent checks of the process variables (i.e. temperature, casting speed, adhesive ratio, etc.) by a Quality Control representative and machine operator.

Additionally, each of the instruments used in the control and testing of elements and membrane is calibrated on a routine basis.

TEMPERATURE CORRECTION FACTORS FOR TRISEP ELEMENTS

Permeate output of a membrane is partially temperature dependent. Other factors that may influence membrane permeate flow include driving pressure, osmotic pressure, differential pressure and pH. The dependency of a membrane on temperature will vary between membrane type and manufacturer. Below, are temperature correction factors for TriSep membranes to assist in estimating the effects of feedwater temperature on permeate flow rates by membrane type.

To project the estimated effects of temperature alone (all other factors constant) on permeate flow of TriSep reverse osmosis membranes, the following equation may be used. The reference temperature is 77°F (25°C).

$$TCF = e^{U(1/298 - 1/T)}$$

U = 2900 (ACM™, X-20™, XN40, and TS80 membranes)

U=2800 (SB50 and SB20 (CA) membranes)

T = °C + 273

Temperature		Temperature Correction Factor by Membrane Type	
Fahrenheit	Celsius	SB (CA)	ACM™, X-20™, XN40, and TS80
35	1.7	0.50	0.44
40	4.4	0.55	0.49
45	7.2	0.60	0.54
50	10.0	0.65	0.60
55	12.8	0.71	0.66
60	15.6	0.77	0.73
65	18.3	0.83	0.80
70	21.1	0.90	0.88
75	23.9	0.97	0.96
80	26.7	1.05	1.06
85	29.4	1.13	1.15
90	32.2	1.21	1.26
95	35.0	1.30	1.37

Typical Ionic and Organic Rejections For TriSep Membranes

Nominal % Rejection by Membrane Type

Constituent Name (SALTS)	MW	X-2OTM	ACM	ACM-LP	TS80	XN45	SB20
Sodium Fluoride(NaF)	42	99+	99+	99+	82	10	98
Sodium Cyanide(NaCN)	49	95	95	95	80	10	94
Sodium Chloride (NaCl)	58	99+	99+	99+	92	20	98
Silica (SiO2)	60	99+	99+	99+	86	50	90
Sodium bicarbonate (NaHCO3)	84	99+	99+	99+	90	30	98
Sodium nitrate (NaNO3)	85	98	98	98	82	20	90
Magnesium chloride (MgCl2)	95	99+	99+	99+	93	60	98
Calcium chloride (CACl2)	111	99+	99+	98+	95	60	98
Magnesium sulfate (MgSO4)	120	99+	99+	99+	98	95	99
Calcium Sulfate (CaSO4)	135	99+	99+	99+	98	95	99

Nominal % Rejection by Membrane Type

Constituent Name (Specific Ions)	MW	X-2OTM	ACM	ACM-LP	TS80	XN45	SB20
Sodium (Na+)	23	99+	99	98	85	20	95
Calcium (Ca++)	40	99+	99+	99+	98	60	97
Magnesium(Mg++)	24	99+	99+	99+	97	60	97
Potassium(K+)	39	98	98	98	85	20	95
Ammonium (NH4+)	18	98	98	98	70’	10	92
Chloride(Cl-)	35	99+	99+	98	90	20	95
Bicarbonate (HCO3-)	61	98	98	98	90	30	95
Sulfate (SO4-)	95	99+	99+	99+	98	95	99
Silicate (Sio2-)	60	99+	99+	99+	86	50	90
Nitrate (NO3-)	62	98	98	98	75	20	90
Fluoride(F-)	19	99+	99+	99+	84	10	75

Nominal % Rejection by Membrane Type

Constituent Name (Specific Ions)	MW	X-2OTM	ACM	ACM-LP	TS80	XN45	SB20
Sucrose	342	99.9	99.9	99.9	99	96	99.9
Lactose	360	99.9	99.9	99.9	99	95	99.9
Glucose	180	99.9	99.9	99.9	99	95	99.9
BOD	---			90-99.9			80-99
COD	---			90-99.9			80-99
TOC	---			90-99.9			80-99

System Design Parameters For TriSep Spiral Wound Elements

Maximum Recommended Average Flux Rates (GFD)

Feedwater Source	SDI	Avergae Flux (GFD)
RO/UF Permeate	<1	25 to 30
Deep well or softened	<2	18 to 22
Shallow Well	<2	15 to 18
Surface	<2	12 to 15
Surface (river,Lake)	2 to 4	8 to 14
Waste Waters	3 to 5	8 to 12

Flux Decline Coeffecients

Feedwater Source	SDI	Avergae Flux (GFD)
RO/UF Permeate	<1	-0.010 to -0.020
Well	<2	-0.020 to -0.035
Surface	2 to 4	-0.035 to -0.050

3 Year Salt Passage Increase Factor (S.P.I.F.)

Membrane Type	Membrane	3 Year S.P.I.F.
Cellulose Acetate Blend	SB20 SB50	1.5 to 2.0
Thin Film Composite (Reverse Osmosis)	X-20 ACM ACM-LP	1.1 to 1.3
Thin Film Composite (NanoFiltration)	TS80 XN45	1.1 to 1.3

TRISEP ELEMENT LOADING PROCEDURES

This document covers information for the safe loading of TriSep elements. The information is based on potential safety hazards known to TriSep and is believed to be reliable. Users should not rely upon it exclusively, as hazards unknown to TriSep can be introduced in specific applications. The information is to be accepted and utilized at user's risk. Confirmation of its validity and suitability in particular cases should be obtained independently. TriSep makes no guarantee of safety and assumes no obligation or liability in connection with this information. Please refer to the TriSep Engineering Manual for more detailed loading procedures.

PROPER EQUIPMENT:

Wear appropriate gloves, safety shoes and safety glasses for all operations discussed in this section.

CHEMICALS:
WARNING! DO NOT CONTACT FLUID INSIDE PLASTIC BAGS CONTAINING NEW ELEMENTS.
New or stored elements contain a "winterizing" solution of approximately 3% of sodium metabisulfite. This solution may cause mild eye irritation and allergic skin reaction. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling. Refer to the Material Safety Data Sheet for "winterizing" solution for details. Bags must be opened in a well ventilated area.

First Aid: ***In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. Wash skin with soap and water. Contact a physician if symptoms persist.***

Follow chemical manufacturer's labeling instructions and warning carefully for any chemical used with the TRISEP elements and/or pressure vessel system.

FLUSHING OF ELEMENTS:

Prior to operation, all new elements and stored elements containing sanitizing solution must be flushed with chlorine-free water meeting all RO Guidelines at the brine (reject) flow rates shown in Table I

Table I
RECOMMENDED FLUSHING RATES ELEMENTS[1]

Element Size	Diameter Inches	Minimum Brine Rate/Pressure Vessel gpm (lpm)	Minimum Quantity of Product / Element Gallons (liters)
2540	2.5	1.5 (1.83)	75 (284)
4040	4.0	5.0 (19.0)	145 (550)
8040	8.0	15.0 (56.8)	500 (1893)
8060	8.0	18.0 (68.2)	500 (1893)
8340	8.3	15.0 (56.8)	500 (1893)
8540	8.5	18.0 (68.2)	500 (1893)

[1] RO feedweater must meet the requirements as detailed in TriSep document "Guidelines of Operation", and must be chlorine-free.

TRISEP ELEMENT LOADING PROCEDURES

HANDLING ELEMENTS:

Do not manually lift elements and/or pressure vessels which weigh more than can be safely handled by one person. See the document “Shipping Information” for the approximate dimensions and weights for packaged TriSep elements. For shipping, the elements in sealed double plastic bags and placed in cardboard containers.

PROTECTION AGAINST OVER-PRESSURE:

Install adequate pressure controls and/or relief devices.

INSTALLING/REMOVING ELEMENTS

Only qualified personnel should install/remove elements. Do not use gas or hydraulic pressure to remove a pressure vessel end plate or element from a pressure vessel.

1. New elements are shipped in vacuum sealed three-ply bags that are packaged in individual cardboard boxes or styrofoam cartridges. Please inspect all elements for signs of physical damage that may have occurred during shipping.
2. Remove the elements from their plastic bags and stand vertically with the brine seals at the bottom. Check that each element brine seal has a light coating of Parker Super-O-Lube or glycerine.
3. Open and remove the pressure vessel end caps and check that the permeate connector O-rings are in place. Place a small amount of Parker Super-O-Lube or glycerine on the permeate connector O-ring.
4. Insure that the inside bore of the pressure vessel are clean and free of dirt, dust, or foreign objects.
5. Load elements from feed side of pressure vessel. Insert the inboard end connector to the downstream end of the first element (side opposite brine seal) and load halfway into the pressure vessel.
6. Insert the element interconnector into the feed end of the element (side with brine seal). Make sure the interconnector O-rings are lubricated with Parker Super-O-Lube or glycerine.
7. While holding the first element, connect the downstream end of the next element to the interconnector of the first element. Load with brine seal facing installer.
8. Push the element stack into the pressure vessel until half of the second element is inside the pressure tube.
9. Repeat steps 6-8 until the vessel is loaded.
10. When all the elements have been loaded into the vessel, push the stack to the downstream side of the pressure vessel until the downstream inboard adapter will connect with the downstream end cap.
11. Install the downstream end cap and spacer tube, then push the entire membrane stack as far as possible towards the downstream end cap.
12. Install the upstream inboard adapter and connect to the upstream end cap. Install the upstream end cap and connecting piping.
13. Repeat steps 3-12 for the remaining pressure vessels.
14. Start the system and run both the concentrate and permeate into the drain for 30 minutes to insure adequate flushing of the preservative solution.
15. After the system has stabilized, take a full set of performance readings.

INSTALLING/REMOVING ELEMENTS

ELEMENT DISPOSAL:

Dispose of elements by burying in accordance with locally acceptable landfill regulations. Do not incinerate.

USE OF PRODUCT WATER AND DISPOSAL OF BRINE WATER:

Check local and all applicable health regulations for standards regarding potable water and follow local and all applicable standards regarding effluent discharge.

CAUTION: ***Follow manufacturers' recommendations on containers or in product bulletins for the safe handling of all chemicals and cleaning agents used with TriSep reverse osmosis products.***

The information contained herein is based upon technical data and tests which we believe to be reliable and is intended for use by persons having technical skill at their discretion and risk. Since conditions of use are outside TriSep's control, we can assume no liability for results obtained or damages incurred through the application of the data presented. This information is not intended as a license to operate under, or a recommendation to infringe, any patent of TriSep or others covering any material or use.

ELEMENT STORAGE RECOMMENDATIONS FOR X-20™, ACM™, and ACM-LP™

MEMBRANE TYPES:

This document covers all X-20™, ACM™, and ACM-LP™ spiral wound RO membrane elements.

SHORT-TERM ELEMENT STORAGE:

For elements that will be shut down for short periods of time (less than 2-3 weeks), pretreated feedwater should be flushed through the system daily at low pressure (20-30 psi). This will minimize the growth of microbiological organisms and reduce the chance of scaling.

LONG-TERM ELEMENT STORAGE:

TriSep 8" (202 mm) and 4" (102 mm) diameter X-20™, ACM™, and ACM-LP™ elements stored in the factory shipping solution will retain the flow/salt passage performance for a period of at least twelve (12) months from date of shipment ex-works, or twelve (12) months following the addition of the sanitizing solution, if the elements remain sealed, away from direct sunlight and storage temperature must be between 32°F (0°C) - 77°F (25°C). **For extended storage times exceeding three (3) months, optimum storage temperature must be less than 60°F (15°C).** If elements are to be stored for periods greater than twelve (12) months, consult TriSep Corporation for procedures to minimize long-term effects.

For elements that have been placed in service, and will be out of service for more than 2-3 weeks, a storage solution of 2% sodium metabisulfite and 18% glycerine in RO permeate water at a pH of 6-8, should be used for a storage solution. This solution should be recirculated through the system for 30 minutes at 60 psi pressure. Feed, concentrate, and permeate valves should be closed after the pump is shut down to keep the storage solution in the pressure tubes.

FLUSHING PRIOR TO USE:

TriSep 8" and 4" diameter elements, as shipped, contain the standard aqueous solution of approximately 3% of Sodium metabisulfite and 18% glycerine. These solutions must be flushed from the elements (both concentrate and permeate) before the elements are placed in service initially or returned to service from storage. Adequate flushing can be achieved with water at a TDS up to 5000 mg/l at 225 psi (15.3 bar) at the permeate and concentrate rates listed below. Be sure that the solubility guidelines for sparingly soluble salts, maximum feed flow, maximum flux rates, and maximum pressure drop are not exceeded.

Element Diameter Inches	**Minimum Concentration Rate / Pressure Vessel** US GPM (LPM)	**Minimum Quantity of Permeate / Element US Gallons (liters)**
4	5 (19)	145 (510)
8	15 (56.8)	540 (2040)

The quality of the flush water is important. Flush water must meet the RO feedwater guidelines detailed in the TriSep document “Guidelines for Operation”. The flushing procedures given will reduce the total organic carbon (TOC) to less than 1 mg/l in the permeate.

ELEMENT STORAGE RECOMMENDATIONS FOR XN45 and TS80

MEMBRANE TYPES:

This document covers all XN45 and TS80 spiral wound NF membrane elements.

SHORT-TERM ELEMENT STORAGE:

For elements that will be shut down for short periods of time (less than 2-3 weeks), pretreated feedwater should be flushed through the system daily at low pressure (20-30 psi). This will minimize the growth of microbiological organisms and reduce the chance of scaling.

LONG-TERM ELEMENT STORAGE:

TriSep 8" (202 mm) and 4" (102 mm) diameter TS40 and TS80 elements stored in the factory shipping solution will retain the flow/salt passage performance for a period of at least twelve (12) months from date of shipment ex-works, or twelve (12) months following the addition of the sanitizing solution, if the elements remain sealed, away from direct sunlight and storage temperature must be between 32°F (0°C) - 113°F (45°C). **For extended storage times exceeding three (3) months, optimum storage temperature must be less than 60°F (15°C).** If elements are to be stored for periods greater than twelve (12) months, consult TriSep Corporation for procedures to minimize long-term effects.

For elements that have been placed in service, and will be out of service for more than 2-3 weeks, a storage solution of 2% sodium metabisulfite and 18% glycerine in RO permeate water at a pH of 6-8, should be used for a storage solution. This solution should be recirculated through the system for 30 minutes at 60 psi pressure. Feed, concentrate, and permeate valves should be closed after the pump is shut down to keep the storage solution in the pressure tubes.

FLUSHING PRIOR TO USE:

TriSep 8" and 4" diameter elements, as shipped, contain the standard aqueous solution of approximately 3% of Sodium metabisulfite and 18% glycerine. These solutions must be flushed from the elements (both concentrate and permeate) before the elements are placed in service initially or returned to service from storage. Adequate flushing can be achieved with water at a TDS up to 5000 mg/l at 100 psi (6.8 bar) at the permeate and concentrate rates listed below. Be sure that the solubility guidelines for sparingly soluble salts, maximum feed flow, maximum flux rates, and maximum pressure drop are not exceeded.

Element Diameter Inches	**Minimum Concentration Rate / Pressure Vessel** US GPM (LPM)	**Minimum Quantity of Permeate / Element US Gallons (liters)**
4	5 (19)	145 (510)
8	15 (56.8)	540 (2040)

The quality of the flush water is important. Flush water must meet the Nanofiltration feedwater guidelines detailed in the TriSep document “Guidelines for Operation”. The flushing procedures given will reduce the total organic carbon (TOC) to less than 1 mg/l in the permeate.

ELEMENT STORAGE RECOMMENDATIONS FOR SB20 and SB50

MEMBRANE TYPES:

This document covers all SB20 and SB50 spiral wound cellulose acetate (CA) blend RO membrane elements.

SHORT-TERM ELEMENT STORAGE:

For elements that will be shut down for short periods of time (less than 2-3 weeks), pretreated feedwater should be flushed through the system daily at low pressure (20-30 psi). This will minimize the growth of microbiological organisms and reduce the chance of scaling.

LONG-TERM ELEMENT STORAGE:

TRISEP 8" (20.3 cm) and 4" (10.2 cm) diameter CA elements stored in the factory shipping solution will retain the flow/salt passage performance for a period of at least twelve (12) months from date of shipment ex-works, or twelve (12) months following the addition of the sanitizing solution, if the elements remain sealed, away from direct sunlight and storage temperature guidelines are followed (between 32°F (0°C) - 104°F (40°C).**For extended storage times exceeding three (3) months, optimum storage temperature must be less than 60°F (15°C)**. If elements are to be stored for periods greater than twelve (12) months, consult TriSep Corporation for procedures to minimize long-term effects.

For elements that have been placed in service, and will be out of service for more than 2-3 weeks, a storage solution of 2% sodium metabisulfite and 18% glycerine in RO permeate water at a pH of 6-8, should be used for a storage solution. This solution should be recirculated through the system for 30 minutes at 60 psi pressure. Feed, concentrate, and permeate valves should be closed after the pump is shut down to keep the storage solution in the pressure tubes.

FLUSHING PRIOR TO USE:

TriSep 8" and 4" diameter elements, as shipped, contain the standard aqueous solution of approximately 3% of Sodium metabisulfite and 18% glycerine. These solutions must be flushed from the elements (both concentrate and permeate) before the elements are placed in service initially or returned to service from storage. Adequate flushing can be achieved with water at a TDS <5000 mg/l at 400 psi (27.2 bar) at the concentrate rates and times listed below. Be sure that the solubility guidelines for sparingly soluble salts, maximum feed flow, maximum flux rates, and maximum pressure drop are not exceeded.

Element Diameter Inches	**Minimum Concentration Rate / Pressure Vessel** US GPM (LPM)	**Minimum Quantity of Permeate / Element US Gallons (liters)**
4	5 (19)	145 (510)
8	15 (56.8)	540 (2040)

The quality of the flush water is important. Flush water must meet the RO feedwater guidelines detailed in the TriSep document “Guidelines for Operation”. The flushing procedures given will reduce the total organic carbon (TOC) to less than 1 mg/l.

TriSep Engineering Manual

TROUBLESHOOTING TRISEP ELEMENTS

INTRODUCTION

The performance of a element system is determined by the quality and quantity of product water. Salt rejection and product flow are therefore important parameters for system evaluation. In certain situations changes in the element's differential pressure (ΔP) can be used as another parameter for system evaluation. A problem exists when these factors are outside the range of protected values. Although performance may still satisfy the end-user, any unexpected change in these parameters should be investigated and corrective action taken immediately to prevent further deterioration of the system.

Many factors affect salt rejection, product flow and element ΔP. Some of these items involve changes in operating conditions. These changes can be taken into account by normalizing to a fixed set of conditions. Performance variations unexplained by operating conditions involve troubleshooting, the subject of this section.

ONLINE INVESTIGATION

Online investigation is done while the system is in operation. It involves analyzing performance trends in normalized salt rejection and product flow and correlating these trends with symptoms of known problems. The information for the online investigation is obtained from the plant operating data log and basic plant design package. The frequency, accuracy and completeness of the operating log are vital for successful troubleshooting at this level. Also critical is the accuracy of the instrumentation. It cannot be over-emphasized that before troubleshooting any plant problem, the good working order and proper calibration of meters and gauges must first be assured.

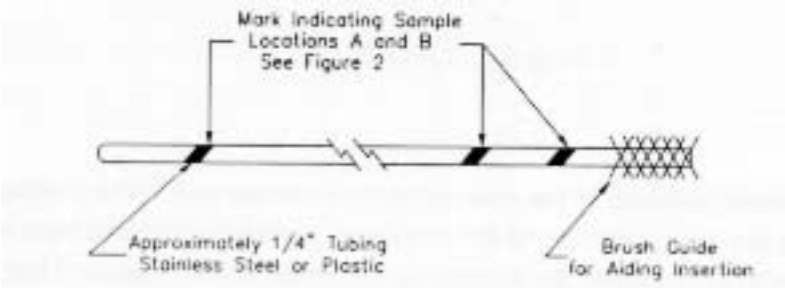


Figure 1: Product Sampling Probe

When analysis of the system indicates high salt passage for a particular vessel, product conductivity measurements are made for each element to locate the source of the problem. Measurements are made by probing the element product water tube at different locations with a plastic or stainless steel tube. A product sampling probe is illustrated in *Figure 1, Product Sampling Probe*. The probe can be marked so that the location of the marks correspond to the desired sampling locations in *Figure 2, Element Sampling Locations*. The probe is first inserted to the downstream end of the product water tube to obtain a sample for conductivity measurements. It is then withdrawn in increments to obtain a coductivity profile.

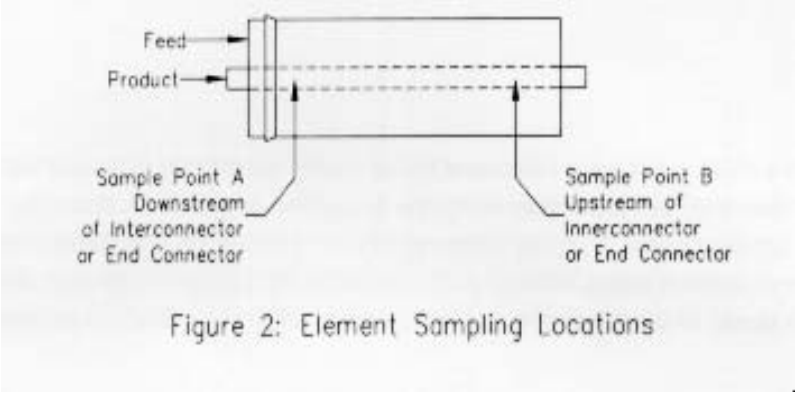
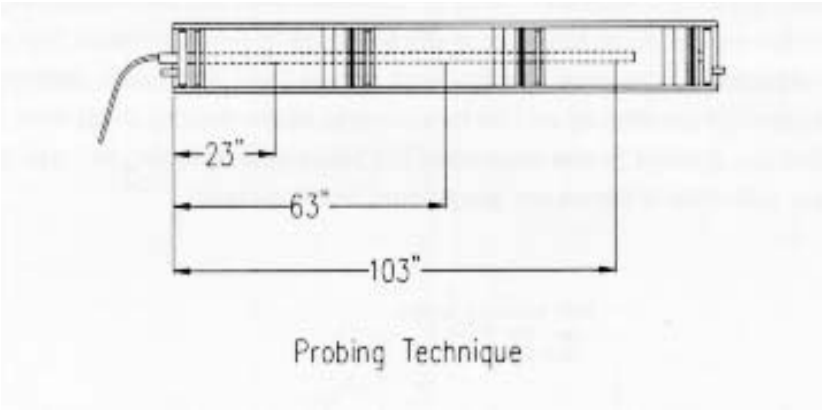


Figure 2: Element Sampling Locations

As the feedwater flows through an element, it becomes more concentrated, causing the product water concentration to increase. The conductivity of a probe sample is the average of product water produced upstream. Typically this average conductivity changes 5 to 6% from one element to the next. An unusually large deviation from this conductivity profile locates the source of the high salt passage problem. Mechanical leaks are generally indicated by a step change in the conductivity profile at “Sample Point A” of *Figure 2*. A step change in the conductivity profile at “Sample Point B” can indicate high salt passage from the element and/or a mechanical leak.



Probing Technique

The tubing is marked to show locations of the interconnectors and the end of the pressure vessel housing. By inserting and withdrawing the tube according to the markings, permeate samples from various locations within the pressure vessel housing can be obtained. By measuring the solute concentration of the samples, the location of problem areas can be determined. This procedure is illustrated in the figure “*Probing Technique*” shown above.

SHIPPING INFORMATION

DIMENSIONS AND WEIGHTS OF PACKAGED TRISEP ELEMENTS
CONTAINER DIMENSIONS - INCHES (MM)

Element Size	Quantity	Height	Length	Width	Gross Weight lb(kg)	Type of Packaging
2.5" x 40"	1	4.5 (114)	45 (1143)	4.5 (114)	7 (3)	Box
	4	9.5 (240)	46 (1168)	9.5 (240)	28 (12)	Box
4" x 40"	1	4.5 (114)	45 (1143)	4.5 (114)	14 (6)	Box
	4	9.5 (240)	46 (1168)	9.5 (240)	56 (25)	Box
	24	19 (483)	48 (1220)	40 (1016)	375 (170)	Pallet
	64	40 (1016)	48 (1220)	40 (1016)	935 (424)	Pallet
8" x 40"	1	9 (229)	45 (1143)	9 (229)	45 (20)	Box
	4	15 (381)	48 (1220)	40 (1016)	220 (100)	Pallet
	8	24 (610)	48 (1220)	40 (1016)	400 (181)	Pallet
	12	33 (838)	48 (1220)	40 (1016)	580 (263)	Pallet
	16	40 (1016)	48 (1220)	40 (1016)	750 (340)	Pallet

- Beware of hand pinch points between elements and other objects when moving elements.
- Beware of sharp edges and rough surfaces when moving elements.
- Do not stack unpackaged elements directly upon each other.

TriSep Software

The following pages contain manuals for TriSep's two software programs, Troi version 2.0 and Tron version 1.1.

Troi is used to design RO and NF systems. It requires that you input a water analysis, permeate flow rate, and system design infomration. It will then give you a prediction of the required pressures, flow rates, and permeate concentrations of the plant.

Tron is a normalization program that allows users to create normalized data for flow, rejection, and differential pressure in a graphical format. This allows operators to easily determine if systems are operating at a steady condition.

Both these programs are available at no charge either by downloading from TriSep's web site or on the TriSep CD.

TriSep Troi Design Program
Manual ver. 2.0.0

1) INTRODUCTION

Welcome to TriSep's Reverse Osmosis Implementation Windows (TROIWIN) software. TROIWIN is an easy-to-follow, straight-forward approach to helping you design the water purification system that meets your needs. Before the system can be designed and analyzed, TROIWIN must have an accurate analysis of your raw water. These can be obtained by contacting your local water district or sending a sample of your water to a reputable lab for analysis.

Just a quick note on terminology. At TriSep, we use the term pass and stage differently from some other people in the industry. In strict chemical engineering terms, a stage indicates a change of phase, such as in a distillation column. We have adopted this same terminology. So in our manual and our program, a pass indicates a feed-brine stage. For example, a 2-1 array would be a two pass system. A stage indicates a permeate stream being fed to another RO system. So a two stage system, would take the permeate from a first system and feed it to a second system to further reduce the permeate TDS.

2) WHATS NEW FOR VERSION 2.0.0

Troi version 2.0.0 has now been posted on our web site and is available for distribution. This version changes the limits of saturation and dosing for TriSep antiscalants, incorporates the new TriSEp Reverse Osmosis Normalization (TRON) software, and incorporates electronic documents for chemical spec sheets, admin documents, and some technical white papers. Some element specifications and new models have also been added to the menu. It is not a major revision, and it is not necessary for you to upgrade.

1) Antisclant saturation indexes have been increase as shown below.

Saturation Limits for TriPol Antiscalants

Max. LSI	Max CaSO4 (%)	Max SrSO4 (%)	Max BaSO4 (%)	Max CaF2 (%)	Max Silica (ppm)	Max Al (ppm)	Max Fe + Mn	
8010	1.0	150	200	200	200	100	0.1	0.1
8510	2.0	400	1,200	12,000	8,000	100	0.5	0.5
9010	2.6	300	800	10,000	10,000	100	0.3	0.3
9510	2.6	400	1,200	12,000	10,000	200	4.0	4.0

2) 4040-ACM5-TSF, 8040-ACM5-TSA, and 8040-ACM5-UWA elements have been added to the list of element selections.
3) The new version of TRON, TriSep's normalization software that allows operators to normalize flow, rejection, and delta P over time in a graphical format is now linked to the Troi main menu. A separate manual fro TRON is included.
4) Chemical spec sheets for antiscalants and cleaning chemicals have been added to the main menu.
5) Administrative documents such as our standard warranty, terms and conditions, etc. have been added to the main menu.
6) Operating pH ranges were increased for ACM, X-20, TS80, and XN45 product lines from 4-11 to 2-11. For short term cleaning, it has been increased to 1-12 if the temperature does not exceed 40°C. Maximum exposure should not exceed 500 hours for a pH > 11.0 and < 11.9.

We are always working to improve our software and will plan to have a new version available in the next 6 months. Keep checking the web site for updates.

3) INSTALLATION

The hardware requirements to run TROIWIN are an IBM PC compatible type computer, 486 or equivalent, Windows 95, 98, NT, 2000, or XP a hard disk with about 10 megabytes of free space, a CD, a printer, and 16 megabytes of memory. A color monitor is desirable.

To install the TROIWIN software onto a hard disk:

Place the TROIWIN CD into your drive.

At the Windows Desktop, click on Start, then click on Run, and type in d:/setup where d: is your CD drive. Your CD drive may have a different drive setting than d:, it may be e: or some other letter. If you are unsure of the drive letter for your CD, click on Browse then double click on My Computer and look for the drive with the CD symbol. Double click on your CD to open the disk, and then search for the file named Setup, click on it, then click Open, then click OK. The setup installation program should then start.

The first screen will ask you if you want to continue or exit. The next screen will allow you to continue the installation, with the default settings copying the files into the folder c:\Program Files\TROI. If you wish to copy the files into a different directory, you may change the default by clicking on Change Directory. If you wish to exit the Setup program, click on Exit or hit F3. The installation process should take about a minute, and give you a message that the installation is complete and was successful.

TROIWIN is now installed on your hard disk under folder c:\Program Files\TROI.

NETWORK INSTALLATION OF DATABASE

TROI needs to be individually installed on each work-station, but the database can now be shared on the network. Copy the Romain.mdb, Romain.ini, Elements.dat and Elements.mdb onto a shared network folder. Then on each work-station create a database.ini file with notepad, pointing to the database folder path.

For example, you have a shared folder DataTroi on the network and its mapped to drive M:. Then you would just type in the M:\DataTroi in the database.ini file.

A UNC path is preferred and the syntax of that would be \\servername\foldername
For example, if the name of the server is MyServer and the folder name is DataTroi
Then the path would be \\MyServer\DataTroi

To start the TroiWin software once it is installed: Click on Start, Programs,
Troi For Windows Version 2.0.0. You can also place a copy on your desktop by right clicking your mouse in the desktop area and then click on New and then click on Shortcut and a pop up window will appear. You can type in the above listed folder location or click on Browse and find the above listed folder then select the file TROI.exe. Click on the Next button and then you can input a name for the shortcut. Click on Finish and you should have a shortcut on your desktop.

4) USER'S GUIDE

Before you run TroiWin software, there are a few things you need to know:

The program is written in Visual Basic and we have tried to stay with the standard Windows methodology in operating programs. The selections to perform tasks can be accomplished by selecting the drop down menus at the top of the screen or by clicking on the toolbar icons.

Menu selections may be made by left clicking the mouse button when the mouse pointer is over the particular menu selection, or by depressing the "Alt" key while typing in the underlined letter of the selection you want to make, i.e. "Alt F" would drop down the file menu. Hovering the mouse pointer over any of the toolbar icons will display a brief description of what that button does, i.e. "New" for creating a new analysis file.

The upper right hand corner of each screen has the standard windows icons for minimizing, maximizing, and exiting each particular program screen. If you have any comments or suggestions or bugs that you have identified, please send your comments by e-mail to info@trisep.com.

To move from one data field to the next, use the tab key, and not the enter key.

Menu Selection:

Menu selections may be made by left clicking the mouse button when the mouse pointer is over the particular menu selection, or by depressing the "Alt" key while typing in the underlined letter of the selection you want to make, i.e. "Alt F" would drop down the file menu. Hovering the mouse pointer over any of the toolbar icons will display a brief description of what that button does, i.e. "New" for creating a new analysis file.

Main Menu:

Notice the blue bar along the top of the screen. This is the title bar and gives the name of the screen that you are in. In the main screen, this bar says "TriSep Reverse Osmosis Implementation (TROI) v. 2.0.0". The v. 2.0.0 indicates the revision level of the program you are using. You can check our web site to make sure that you have the most current version of the software at trisep.com/download.htm.

The main menu has four selections available, File, Calculations, Units, and Help.

File:

There are six options in File, whose functions are self-explanatory: "New Analysis", "Open Analysis", "Delete Analysis", "Add Custom Model", "Print", and "Exit". The "Add Custom Model" is new for version 2.0.0.

Calculations:

There is currently only one selection under Calculation, and that allows you to perform the system design calculation. This can not be done unless a water analysis has been input, balanced, and saved.

Units:

This is a toggle switch that allows you to set the units you want to use in the calculations and units you wish to use in the print out. It defaults to U.S. units which will use degrees F for temperature, gallons per day (gpd) and gallons per minute (gpm) for

flow rates, and pounds per square inch (psi) for pressures, and gallons per square foot per day (gfd) for flux rates.

If you select metric units, it will use degrees C for temperature, cubic meters per hour (m3/hr) for flow rates, bar for pressures, and liters per square meter per hour (lmh) for flux rates.

The program will remember the last setting you used, so check this before you start a new design. As an example, if you set the units toggle to metric, exit the program, and then start the program again, the toggle will still be set to metric.

Help:

Currently, the help menu only displays the version of the program.

Main Toolbar:

The main toolbar selections are Exit, New, Open, Design Calculation, and Delete. These correspond to the menu selections listed above.

File:

New Analysis:

Select this option to input a new water analysis. You will be prompted for a file code. This file code is a unique, alphanumeric filed up to 50 characters long, under which the file is saved. Choose the file code carefully because a file code cannot be changed. A duplicate file code entered here will result in an error message and a prompt for another file code. To exit at this point, click on the Exit toolbar to return to the TROIWIN main menu.

Once a valid file code is entered the raw water information is entered. The feedwater temperature can be entered as either °C or °F, by clicking on the “C” radio button for °C or the “F” radio button for °F.

All of the fields below pH are for reference purposes only and are not currently used by the program calculations. These fields can be left empty.

The cations and anions can be input as part per million (ppm) which is equivalent to milligrams per liter (mg/l), milliequavalents (meq), or ppm as calcium carbonate (CaCO3). All ions will be saved as ppm when the water analysis is balanced and saved.

Once you have finished inputting all of the data on this screen, click on the “Calculate” button to check if the analysis is balanced. If the analysis is not balanced within 1%, a message box will pop on the screen asking if you want to automatically balance the analysis, edit it manually, or cancel. If you click on yes, the program will automatically balance the water analysis by either adding sodium (Na) or chloride (Cl) to the water analysis depending on whether the analysis requires cations or anions to balance. If you click on “No”, you can manually adjust the analysis and then recalculate.

Note: The values of pH, Temp, and HCO3 will affect the values of CO2 and CO3. So if pH, Temp, and HCO3 are changed, this will affect the anion total.

In addition to balancing the cations and anions, the calculate button also calculates saturation indices, the total dissolved solids (TDS), and the feedwater osmotic pressure in either psi or bar. We have added calcium fluoride saturation indexes to version 2.0.0. We have also modified the calculation for silica saturation to include temperature and pH in the calculation.

Open Analysis:

When this option is selected, you will be prompted to select a file from a drop down list of entered analysis". Click on the analysis you wish to edit, and then click on OK. Alternatively, you can double click on the analysis that you want to edit. This will open the analysis and allow you to edit any of the data.

Once you have finished inputting all of the data on this screen, click on the "Calculate" button to check if the analysis is balanced. If the analysis is not balanced within 1%, a message box will pop on the screen asking if you want to automatically balance the analysis, edit it manually, or cancel. If you click on yes, the program will automatically balance the water analysis by either adding sodium (Na+) or chloride (Cl-) to the water analysis depending on whether the analysis requires cations or anions to balance. If you click on "No", you can manually adjust the analysis and then recalculate.

Note: The values of pH, Temp, and HCO3 will affect the values of CO2 and CO3. So if pH, Temp, and HCO3 are changed, this will affect the anion total.

Delete Analysis:

Once a water analysis file is deleted, it is permanently removed from your list of files on record in your database. Click on the file that you want to delete then click OK.

Print:

This will allow you to print out a projection that has previously been calculated and saved. It is not necessary to recalculate the design before printing it. The program will prompt you to select the projection that you want to print. Click on the appropriate file, then click on OK.

Exit:

Select this option when you are finished using Trisep's Reverse Osmosis Implementation Software and wish to close the program.

Calculations:

Design Calculation, Single Stage System:

Here is where you get to design your own membrane separation plant. First, it will ask you to select a project that you have previously input or a water analysis that you have to input. Once you have made this selection, click OK and the main design window pops up.

The first field, "Projection By", allows you to input your name for future reference. The next field, allows you to specify the system design recovery. This field is required. The recovery is defined as the ratio of permeate flow to feed flow expressed as a percentage. Feed temperature and feed pH defaults to what was input in the water analysis, but can be modified at this point. If the pH is lowered, acid will be dosed to the feed water analysis to adjust the pH to the desired level. The feed pH can also be increased in version 2.0.0 using 30% caustic soda. Both of these will effect the CO2, HCO3-, and CO3-concentrations in the feedwater analysis. You can select either hydrochloric acid (HCl) or sulfuric acid (H2SO4) as the acid, or caustic soda as a base, to use for adjusting the pH. If you use H2SO4, the sulfate ion concentration will also be adjusted in the feedwater. If you select HCl, the chloride ion will be adjusted in the feedwater. If you use caustic soda, the sodium level will be adjusted.

The next field allows you to input the required permeate flow rate. In addition, you can specify a recirculation flow rate (Recirc. Flow), which allows a portion of the concentrate to be fed back to the feed of the system. This is sometimes desirable to increase the feed flow rate to a system without changing the system recovery. You can also specify a blend flow rate, which blends some feedwater with the permeate water. This increases the TDS of the permeate water and allows you to increase the capacity of a

system without adding membrane area at the expense of permeate quality.

The temperature units can be selected as either °C or °F from the radio button next to the feedwater temperature. The permeate flow, recirculation flow, and blend flow can be selected as either gallons per minute (gpm), gallons per day (gpd), or cubic meters per hour (m3/hr).

The last three fields that can be entered on the top section of the screen, allow you to adjust the system performance with age. This allows some empirical method to account for possible degradation in membrane permeate flow, which could be caused by fouling, and degradation of element rejection, which could be caused by wear and tear of the membrane elements. The age is input in years, and the flux decline coefficient (Flux Decl) is a decimal value which corresponds to an inverse exponential decline, with most of the decline occurring in the beginning of the time period, slowly leveling off to a constant level. A value of 0.025 would correspond to a 20% flux decline over 3 years. Larger numbers correspond to higher flux declines. The salt passage increase factor (SPIF) allows you to take into account decreases in element rejection. A factor of 2 would correspond to the salt passage doubling in three years. Higher numbers would result in more dramatic decreases in element rejections. We normally recommend a value of 2.0 for cellulose acetate elements and 1.3 for polyamide elements.

The only thing left to do to complete the system design is to select the element model you wish to use, and determine the array of the system. You can also specify permeate back pressures to help in balancing membrane fluxes between passes. We have also added interpass concentrate boost pressure. This allows a system designer to add a pump or turbocharger between passes to allow for increasing the feed pressure to a second pass.

There are two ways to select an element. Click on the “Select” button or double click in the box under the “Model” heading. The latter is required if you want to select different elements for different passes. When you perform either of the above, the element selection window pops up. This window allows you to select the element model you wish to use. Specification sheets for individual elements may be printed by clicking on the “Print Spec Sheets” button. Custom model numbers are at the bottom of the list with an “*” at the beginning of the model number to indicate that this is not a standard TriSep model number. A view of the sheet is displayed to the screen which can then be printed or saved in several different file formats. Elements are separated by diameter. Click on the radio button of the diameter you wish to use. Then select the appropriate element and input the number of elements per pressure tube. The maximum number of elements per pressure tube is 7. Click OK to select the element.

Now input the array for the system. This is done by specifying the number of tubes per pass. A maximum of 4 passes are allowed. You can type in the number of tubes per pass or click on the up and down arrows to increment or decrement the number of tubes by one.

The last two fields that you can input is for the permeate backpressure. Depending on the units toggle switch, you must input in psi or bar. This allows you to balance the permeate flux rates in each pass. This is useful on high osmotic pressure feed streams, or when using very high flux membrane elements. You may also enter a concentrate boost pressure for inter-pass boosting. This is sometimes used for high osmotic pressure feeds and is a more energy efficient method of balancing permeate fluxes.

Once all of the required data fields have been input, you can click on the Calculate button and do the system design calculation. If you have left required fields blank, it will prompt you to fill in the fields. When the

system has calculated properly, the middle section of the screen will be filled in. The View and Print buttons will also change from a grayed out button to the active color button. This indicates that the button is now available for use.

The view button allows a quick look at additional calculated values. The view button displays all of the raw, feed, permeate, and concentrate concentrations in ppm and CaCO3. In addition, the TDS and pH’s are displayed. Below these fields, the saturation indices are displayed followed by the osmotic pressures. Lastly, recommended antiscalent model and dosages are given, along with dosage of acid or caustic if needed.

There are now two print-outs. The projection print-out and the individual element print out. The projection print-out gives details on the system design and the feed, brine, and permeate water analysis. The individual element print-out gives details on the permeate flow, TDS, Beta, flux, and net driving pressure for each element in a system.

The Print button allows you to print the entire projection. To view the print out on the screen, select File, Print Preview. This is a two page report that can be viewed on the screen, sent to a printer, or saved as a file. You can also print the individual element report from the File menu, either in preview or directly to the printer. It may take several seconds to load the report generator. To get to the second page of the report, click on the right arrow button at the top of the screen. To get back to the first page, click on the left arrow button. To scroll through the report, click in the scroll bars on the right hand side of the screen or drag the status bar down the page. To send the output to a printer, click on the printer icon at the top of the page. A print window will then pop up indicating the default printer that the report will be sent to. If this is not the printer you wish the output to go to, exit the report by clicking on the "X" at the upper right corner of the screen, and click on File, Printer Setup to select your desired printer. This pops up the standard windows printer selection window to allow you to select any printer that is installed on your system. If the printer is correct, you can specify to print all the pages, or a range of pages, the number of copies you want to print, and whether the pages are collated or not. When you have made these selections, click OK to begin the printing process.

If you wish to save the print out to a file for transmission by e-mail or to edit it in a text editor, the best way is to purchase Adobe Acrobat and print it to a PDF file. If you do not have this program, click on the inbox button, which looks like an envelope with a red arrow pointing into it. This will bring up the export window, which allows you to specify the type of file you wish to save the report in. Depending on the way your system is configured, you can select a variety of formats, including Excel, Word, ASCII, and other formats. We have found that using Rich Text Format seems to work the best for importing into Microsoft Word. None of these formats will save the lines that are present on the printout that separates the raw, feed, permeate, and

concentrate ions. You can also specify a destination which would normally be a Disk File. Once you have made these selections, the Choose Export File window will pop up. This allows you to name the file and specify a folder to save it.

You can also specify the magnification that is used to view the file. Click on the down arrow next to the 100% box, and select the desired magnification.

When you are finished, click on the X in the upper right hand corner of the screen to return to the Design Calculation window.

Two Stage System Calculation:

TroiWin version 2.0.0 allows two stage system design, i.e. permeate staged. The operation is very similar to the single stage design with a couple of limitations. To create a two stage design, click on the "2-Stage" button or click on File, the Create Two Pass System from the drop down menu. The "2 Stage" button then becomes gray indicating it is not available for selection. Also when the "2 Stage" button is selected, the "Stage 2" tab turns from gray to normal indicating that this project is a two stage system. The Recirc. and Blend features are not functional when using the two stage feature. To design the second stage system, click on the "Stage 2" tab and input the permeate flow required for the second stage. The first input is a check box to indicate if you wish to adjust the second stage pH. If you check this box, it allows you to adjust the pH on the feed to the second stage. If this box is un-checked, the feed pH to the second stage defaults to the permeate pH from the first stage. The second stage permeate flow must be less than 95% of the first stage permeate flow. Once the permeate flow is input, the recovery is automatically calculated since the permeate flow from the first stage is set which is equal to the feed flow to the second stage. Also note that the temperature is grayed out and entry is not allowed. Select the element type and array. When the "Calculate" button is pressed, the two stage system is automatically calculated. The concentrate from the second stage is recycled back to feed the first stage. This will be indicated as a recirc. flow rate in the first stage system. The feed to the first stage is then a blend of the second stage concentrate and the raw feed. The first stage recovery is actually the overall two stage system recovery since the concentrate from the second stage is recycled. The program will indicate the stage recovery for the first stage on the print out.

The ionic analysis for the raw, feed, brine, and permeate can be seen individually by clicking on the "View" button. The second stage analysis can be seen by clicking on the "View Second Stage" button. Clicking on the "Print" button will print both the first

and the second stage analysis. To preview the print out, click on File, then Print Preview from the drop down menu for either the projection preview or the individual element preview. This will take a few seconds to open the report writer, and will create two reports. To view the first stage report, minimize or close the second stage report or click on the first analysis on your windows tool bar at the bottom of your screen. These previews can be printed and saved as described above in the single stage section. When you print an analysis from the preview screen, it will only print the analysis that is currently being displayed. You must print both the first and the second stage analysis individually from this screen.

Ionic Rejections:

One last feature allows you to modify the individual ionic rejections of certain classes of membranes. Click on the "Supplement" menu selection and then select "Modify Ion Salt Parameter Limits". This window allows modification of the individual ion rejections relative to sodium and chloride, which are normally set to 1. Do not use this feature unless you fully understand the impacts of these changes. To reset the values to their defaults, click on "Reset Ion Salt Parameter Limits". When a change is in effect, a message "Ionic Rejections" is displayed in the upper right hand corner of the calculation window.

5) Engineering Considerations for Spiral Wound Membrane Systems:

When designing a SWMS system, two factors are very important to insuring a reliable design, membrane flux and the element "Beta Factor". Both of these values are listed on the screen displays and on the print-outs.

Flux:

The membrane flux is the amount of product water made per unit area of membrane in a given period of time. It is normally expressed in units of gallons per square foot per day (GFD) or liters per square meter per hour (LMH). For a given element which has a given area, the higher the flux the higher the permeate water productivity. The overall system flux can then be controlled by varying the pressure or the number of modules used to build the system. The overall system flux is displayed on the calculation window.

Higher water fluxes can result in higher fouling rates. Table 2 gives some guidelines for fluxes that should be used under varying feedwater conditions. In general, feed waters with high fouling potentials should use low membrane fluxes to minimize membrane fouling rates. The type of membrane used for a particular application may also affect the fouling rate. The X-20 membranes generally exhibit lower fouling rates on surface and waste waters than standard composite membranes. For further information, please refer to the "Guidelines for Operation" in the TRISEP Engineering Manual.

Table 2
Flux Guidelines for SWMS Elements

Feedwater Source	Suggested Flux(GFD)
RO/UF Permeate	22-28
Deep Wells	18-22
Shallow Wells	16-18
Surface Waters	12-16
Waste Waters	8-12

Beta Factor:
The "Beta Factor" is a measure of the relationship between the feed water velocity traveling parallel to the membrane and the permeate water traveling perpendicular or into the membrane. This number is also related to the individual element recovery. For most large systems, the "Beta Factor" should be less than 1.20. This equates to an individual 40" element recovery of approximately 20%. Lower beta factors indicate lower element recoveries. For a given system recovery, increasing the path length of the system
array (i.e. the equivalent number of elements in series) decreases the "Beta Factor". Table 3 gives guidelines for the number of elements in series required to achieve acceptable "Beta Factors" at some typical system recoveries.

Table 3
Element Path Length versus System Recovery

Recovery %	Path Length
50	6
75	12
88	18

Note: Path length is defined as the number of 40" elements in series needed to define the array. Balanced designs are easily obtained by tapering the number of pressure tubes per pass. For six element long tubes, approximately 50% of the feedwater is converted to permeate water in each pass. Therefore, the second pass should have half as many tubes in parallel as the first pass. A 50% recovery system would require one pass of six element long tubes, i.e. all the tubes could be plumbed in parallel. For a 75% recovery system, a two pass design would be required, i.e. 8 tubes in the first pass feeding 4 tubes in the second pass, resulting in a 12 element path length. For an 87.5% recovery system, a three pass design would be required, i.e. 8 tubes in the first pass feeding 4 tubes in the second pass feeding 2 tubes in the third pass, resulting in an 18 element path length.

Saturation Indexes:

Sulfate Scales:

The saturation values for the sulfates are expressed as a percentage of the ion product (IP) divided by the solubility product (Ksp). A value less than 100% indicates a solution that is not saturated, while a value greater than 100% indicates some degree of supersaturation. Acrylic acid antiscalent can be used to control sulfate scaling. The program lists saturation indices for calcium, strontium, and barium sulfate scales.

Calcium Carbonate Scale:

Sodium hexametaphosphate (SHMP), acrylic acids, and/or acidification can be used to control CaCO3 scaling. At low TDS's (less than 15,000 ppm), the Langelier Saturation Index (LSI) can be used to indicate saturation. At higher TDS levels, the Stiff and Davis Saturation Index (S and DSI) gives a more accurate representation of the solubility of CaCO3. The indexes are set up so that negative values indicate a solution that is not saturated while positive values indicate some degree of supersaturation.

Calcium Flouride Scale:

In version 2.0.0 calcium flouride scale calculation have been added. A value less than 100% indicates a solution that is not saturated, while a value greater than 100% indicates some degree of supersaturation. Acrylic acid antiscalent can be used to control calcium flouride scaling.

Silica Scale:

Silica scaling in actual RO systems is dependent on a number of factors. The equilibrium value is dependent on the feedwater temperature and pH. In actual practice, due to the relatively short residence time in a typical RO system, the kinetics of the precipitation reaction are normally the limiting factor rather than the equilibrium value. The kinetics of the silica precipitation reaction are catalyzed by the presence of trivalent metal ions. When operating systems near the maximum silica saturation's, the presence and concentration of trivalent metal ions should be evaluated. Plants designed and operated at or near the maximum specified saturation levels may require special system process features, i.e. low pressure feed water flushes upon system shutdown. In version 2.0.0, the silica saturation index takes into account pH and temperature.

Maximum Allowable Saturation Indexes

Scale	Max. Saturation without scale inhibitor	Max. Saturation[1] with scale inhibitor
CaCO3	< 0	+ 2.6
CaSO4	<100%	<400%
SrSO4	<100%	<1,200%
BaSO4	<100%	<12,000%
CaF2	<100%	<10,000%
Silica	<100%	<200%

[1] Effectiveness of scale inhibitors, dosing requirements, and feed water chemistry affect maximum saturation indexes. Contact chemical company for specific details.

6) CUSTOM ELEMENT MODEL NUMBERS

Starting the Program

New to version 2.0.0, is the ability to add custom model numbers. These can be competitors models to allow users to only have one program that they require to compare different element types. It can also be used to create custom model that are not on the standard TriSep list.

TriSep Corporation does not assume any liability for any custom elements that are designed by third parties.

To input a custom model number, go to the main start-up screen, and click on File, Add Custom Model. This brings up the ROMAIN edit screen. From this screen, you have six buttons on the toolbar. The first is to exit the program, the second is to cancel an input, the third is to save changes, the fourth is to add a new custom element, the fifth is to delete a custom element, and the sixth is to copy a standard element to a custom element.

On the left hand side of the screen, are two list of elements sorted by element diameter. If there is a "+" to the left of the diameter, this indicates that the list can be expanded and that there are additional elements to view. As a default, there are no custom elements, but only the TriSep standard elements.

To view the properties of an element, lets look at the 8040-X201-TSA element. Left click on the "+" next to the 7.9 on the TriSep elements. This will expand the list and show you all the TriSep standard elements. Click on the 8040-X201-TSA model and the fields to the right will be populated. Now you should see four pages of data for each element.

Explanation of the Fields

The data on page one on the right hand side outlined in a box are used in the element calculations. In addition, the spec. rejection and spec. flow at the bottom of the page are used in the calculations. The rest of the data is used in the element specification sheet which can be printed for each element.

The differential pressure drop across each element is calculated by the following formula:

Delta P = Delta P Coeff. * (Fbar) ^ Delta P Exponent
Where Delta P = pressure drop in psi,
Delta P Coeff = empirical value entered into program
Fbar = average feed brine flow rate in gpm, and
Delta P Exponent = empirical value entered into program.

The leak factor assumes a certain by-pass leakage for each element. A value of 0.001 is equal to a 0.1% leakage.

Active area is the area in each element. NaCl rejection is the rejection of sodium chloride for each element. Calc. A value is used in permeate flow calculations. This value is calculated automatically after you have input the permeate flow, area, and net driving pressure for each element.

The Temp. Factor is used to correct for variations in permeate flow with temperature. The membrane type selects the specific ionic rejections for each type of membrane. These can be seen in the calculation section under Modify Ionic Rejections. NDP is the net driving pressure in psi at the test conditions for the permeate flow and rejection.

The remainder of the values on pages 2-4 are self explanatory and are not used in any calculations, but only in the printed specification sheet.

Inputing a Custom Element

There are two ways to input a custom element. First, you can start from scratch and click on the Add Element button. I would not recommend this to the casual user. There are many fields to input and it is easier to copy the structure and data from an existing model. To do this, select a standard TriSep element that is close to the new element you wish to create. Then click on the Copy Element button. This will ask you for a new model number and part number. Please note that model numbers must be less than 15 characters in length. You can leave the part number blank, but it will require a model number.

Once a copy has been created, you can modify the required fields to suit your purposes. After you have modified the element, you can then select the element in the calculation portion of the
program under the Select Element button. Custom elements will be listed at the bottom of the element list, below all the standard TriSep elements, and will be marked with an "*" at the beginning of the model number to indicate that this is a custom model.

To delete a custom element, highlight it, then click on the Delete button.

7) SHARING THE DATABASES ON A NETWORK

TROI needs to be individually installed on each work-station, but the database can now be shared on the network. Copy the Romain.mdb, Romain.ini, Elements.dat and Elements.mdb onto a shared network folder. Then on each work-station create a database.ini file with notepad, pointing to the database folder path.

For example, you have a shared folder DataTroi on the network and its mapped to drive M:. Then you would just type in the M:\DataTroi in the database.ini file.

A UNC path is preferred and the syntax of that would be \\servername\foldername
For example, if the name of the server is MyServer and the folder name is DataTroi
Then the path would be \\MyServer\DataTroi.

To start the TroiWin software once it is installed: Click on Start, Programs,
Troi For Windows Version 2.0.0. You can also place a copy on your desktop by right clicking your mouse in the desktop area and then click on New and then click on Shortcut and a pop up window will appear. You can type in the above listed folder location or click on Browse and find the above listed folder then select the file TROI.exe. Click on the Next button and then you can input a name for the shortcut. Click on Finish and you should have a shortcut on your desktop.

8) DISCLAIMER:

We at TriSep have put a lot of time and energy into making TROIWIN a user friendly program for our customers that is as accurate as possible. The output from this program should not be used for warranty purposes and is accurate to +/- 10%. TriSep Corporation assumes no liability for any errors or costs that may result from the use of this program. TROIWIN has been extensively tested by our in house engineers and we feel that most of the “bugs” have been removed. However, if you experience a problem with your particular copy or hardware, please let us know so that we can remedy it for future revisions by sending an e-mail to info@trisep.com. Any comments that you may want to make to improve the software will be considered for future modifications. Thank you for considering TriSep in your membrane selection process.

TriSep Tron Normalization Program
Manual ver. 1.1.0

1) INTRODUCTION

Welcome to TriSep's Reverse Osmosis Normalization (TRON) software. This program is designed to help membrane operators monitor their reverse osmosis (RO) and nanofiltration (NF) systems by normalizing permeate flow, rejection, and delta P coefficients to account for changes in feed water and system operation.

The complexity of RO and NF systems coupled with the many changing process and operating variables, makes it difficult for operators to detect problems. Problems can develop quickly or slowly over time. The ability for an operator to diagnose and remedy problems at an early stage is a key to minimizing costly membrane element replacement. Our experience shows that systems that are monitored through the use of graphical normalized data, experience fewer problems and enjoy longer membrane life.

Normalizing RO and NF data requires the use of many mathematical equations to take into account changes in temperature, flow, pressure, and feed water quality. TRON is designed to make normalizing data a simple task. The Windows based software has a simple set-up screen to input your specific system variables such as array, number of elements per tube, units of measure, and variables to convert conductivity to TDS and osmotic pressure.

Individual data points are input into a spreadsheet type matrix. The program calculates the normalized values, which are displayed in a graphical format. Multiple RO systems can be input into the database.

2) INSTALLATION

The hardware requirements to run TRON are an IBM PC compatible type computer, 486 or equivalent, Windows 95, 98, NT, 2000, or XP a hard disk with about 10 megabytes of free space, a CD, a printer, and 64 megabytes of memory. A color monitor is desirable.

To install the TROIN software onto a hard disk:

Place the TROIWIN \ TRON CD into your drive.

Once the CD is inserted it will automatically bring up a Menu screen. Click on the menu TRON for Windows Ver 1.1. This will automatically start the setup program.

In case the Cd does not autostart at the Winows Desktop, click on Start and then on Run and type in d:\normalization\setup.exe where d: is your CD drive. Your CD drive may have a different drive designation, that is it could be assigned to e: or s: or any other letter. If unsure of your drive letter right click on Start and then on Explore. This will bring up a window with all your drives. Look for the one with a CD Symbol, or the one called CD drive. Click on the + sign on the left of it, then click on the normalization folder in the right hand pane, and scroll through the files and find setup.exe. Click on that to start installation of the program. It will take a couple of minutes to install the program. Once installed it will give a message that the installation is complete and successful.

TRON is now installed on your hard disk under folder c:\Normalization.

NETWORK INSTALLATION OF DATABASE

TRON can be installed from a workstation directly on the network. For other workstations to access the software, a shortcut pointing to the program on the network will have to be created and placed on each users desktop, as well as certain files need to be copied under the users system directory. The list of files are:

TriSep Tron Normalization Program
Manual ver. 1.1.0

3) USER'S GUIDE

TRON follows the standard Windows methodology in operating programs. The selections to perform tasks can be accomplished by selecting the drop down menus at the top of the screen or by clicking on the toolbar icons.

Menu Selection:

Menu selections may be made by left clicking the mouse button when the mouse pointer is over the particular menu selection, or by depressing the "Alt" key while typing in the underlined letter of the selection you want to make, i.e. "Alt F" would drop down the file menu. Hovering the mouse pointer over any of the toolbar icons will display a brief description of what that button does, i.e. "Add project" for creating a new Project.

Main Menu:

Notice the blue bar along the top of the screen. This is the title bar and gives the name of the screen that you are in. In the main screen, this bar says "Normalization Program ".

The main menu has five selections available, File, Print, Units, Window and Help.

File:

There are six options in File, whose functions are self-explanatory: "Add Project", "Edit Project", "Delete Project", "View Project ", "Export to Excel", and "Exit".

Print:

There are three selections, "All data", "Input Data", "Calculated Data". "All data" will print the entire project i.e., data which is input as well as calculated by the program. "Input data" prints only the data the user is required to input, and "Calculated data" prints only the fields calculated by the program.

Units:

This is used to set the default units you want to every time you start a new project. These units are set by first selecting the units you want, for Pressure, Flow, Flux and Temperature from their respective drop down boxes. You can either select Units and Default from the menu or Click on the Units icon in the toolbar. A screen with checkboxes next to the different units pops up. Check the boxes whose units you want to set as default. Next time when you add a project the default units will be displayed in the respective drop down boxes.

The program will remember the last setting you used, so check this before you start a new project .
As an example, if you set the Pressure units = 'bar', flow units = m3/hr, flux units to 'lmh' and temperature = 'C', the next time you start the program and add a new project, the units will be populated with what you had set through the Units option. .

Help:

Currently, the help menu only displays the version of the program.

TriSep Tron Normalization Program
Manual ver. 1.1.0

Main Toolbar:

The main toolbar selections are Add Project, Edit Project, Delete Project, View Projects, Export to Excel, Print Whole Project, Print Input Details Print Calculated Fields, Units, Recalculate, Graph, Exit and Help. All except Recalculate and Graph correspond to the menus above.

Recalculate is used if you change any input variables on the Project, the records in the grid below will be recalculated to reflect the new calculations.

Graph is used to provide a graphical view of the data entered on the Grid.

File:

Add Project:

Select this option to input a Project. You begin by entering the Project code and Name. You proceed to select the units for Pressure, Flow, Flux and Temperature from their respective drop down boxes . If you have already set the units using the Units option, you can jump to the Brine Stage, depending on what stage you select, the input boxes for the Vessels and Elems/ Vessels will be displayed.

Conductivity is populated with a default value of 0.5000 and osmotic pressure is populated with 0.0100. Both these can be changed by the user. These determine for the program the conversion from conductivity to TDS, i.e. a value of 0.5 assumes that a conductivity of 1000 mmhos would equal a TDS of 500. This value can be customized to the particular feed water you have. The osmotic pressure value converts TDS to osmotic pressure. A value of 0.01 would convert a TDS of 1000 ppm to an osmotic pressure of 10 psi.

The date format has two options DMY to display date in the dd/mm/yy format and MDY to display date mm/dd/yy format.

There are two check boxes for how delta P is input. One is Delta P and the other for InterStage pressure, both can be left unchecked, or either one of them can be checked. When the Delta P box is checked, one has to input the Delat P in the grid below for the different stages and the Interstage will be calculated automatically. In case the Interstage pressure box is checked, one has to input the Interstage values in the grid below for the different stages and Delta P will be automatically calculated. If your system is equipped with Delta P gauges, you want to check Delta P. If you have interstage pressure gauges, check Interstage. If you have neither, leave both unchecked. We strongly recommend that you have the capability to monitor the Delta P of all stages independently.

The System start date and the Start NDP are input. This can be whatever you would like. Normally the start date would be when you replace your elements. The start NDP can be 200 psi or the start-up NDP. The last thing is to input the system array. Enter the Stage 1 Vessels and Stage 1 Elem/Vessels, depending on how many stages you have selected under the Brine Stages dropdown.

Click on the Add button to start entering the detailed data points on the grid. Every time you want to add a set of data to the grid, you will need to click on the Add button. You can proceed in the grid by using the Enter

Key or the tab key. A message will popup if a field which requires input or if the input needs to be within a range of values.

Once all the values required by the user have been input, the temperature correction factor, NDP, osmotic pressure, Delta P, and the normalized flow and rejection will be calculated.

You can make changes to any user input values and recalculate the values in the grid by clicking on the recalculate icon on the toolbar.

View Projects::

When this option is selected, you will be prompted to select a project from a drop down list of entered projects. Click on the project you wish to edit, and then click on OK. Alternatively, you can double click on the project that you want to edit. This will open the project and allow you to edit any of the data. Double clicking will not work to select the first project on the list. Simply highlight this project and close the window to select.

Once you have finished inputting all of the data on this screen, click on the "ReCalculate" button .

Delete Analysis:

Once a Project is deleted the detail data records of the project are deleted and permanently removed from your list of files on record in your table. Click on the project that you want to delete then click OK.

To delete a detail point, position or click on the record you want to delete and then click on the delete button below the grid. This will delete only that particular data point and not the entire project.

Print:

This will allow you to print out a project that has previously been calculated and saved. It is not necessary to recalculate the design before printing it. To print a particular project, select it from View projects and then click on of the print options.

Exit:

Select this option when you are finished using Trisep's Reverse Osmosis Normalization Software and wish to close the program.

4) DISCLAIMER:

We at TriSep have put much time and energy into making TRON a user friendly program for our customers that is as accurate as possible. The output from this program should not be used for warranty purposes and is only as accurate as the input data. As with any program, certain simplifying assumptions have been made which under certain circumstances may result in calculated values that are not accurate. TriSep Corporation assumes no liability for any errors or costs that may result from the use of this program. TRON has been extensively tested by our in house engineers and we feel that most of the "bugs" have been removed. However, if you experience a problem with your particular copy or hardware, please let us know so that we can remedy it for future revisions by sending an e-mail to info@trisep.com. Any comments that you may want to make to improve the software will be considered for future modifications. Thank you for considering TriSep in your membrane selection process.

Administrative Documents

The following pages contains severeal adminstrative documents such as our standard warranty and terms and conditions.

TriSep Corporation

TERMS AND CONDITIONS OF SALE

SELLER provides all data in good faith and believes the information and data contained herein to be accurate and useful. It is the user's responsibility to determine the appropriateness of SELLER's products for the user's specific end uses.

1. PRICES AND PAYMENT:

Terms of payment on open accounts only, are net 30 days from the date of invoice. This agreement is subject to credit approval. Retention is NOT allowed. Interest will be charged on past due accounts. Interest charges will be calculated on the unpaid balance at 1.25% per month (15% per annum) or the maximum rate allowed by law, whichever is more. Unless specifically included as a separate item, or required by contract, prices quoted do not include any city, county, state or federal taxes, or transportation of SELLER's material or service.

2. WARRANTIES:

SELLER warrants that the material will conform to the description contained in the applicable published specifications and "Standard Guarantee for Spiral Wound Products". SELLER makes no warranty, express or implied, of merchantability or of fitness for a particular end use. SELLER's liability for breach of warranty is limited solely to the supply or repair or replacement of element materials and SELLER shall not be held liable for consequential or incidental damages resulting to CUSTOMER or others from the furnishing or use of materials said to be defective.

SELLER's maximum total liability for all causes including any breach of warranty or failure to deliver conforming goods shall not exceed the value of the contract

3. PREVAILING TERMS AND CONDITIONS:

Specific provisions provided by SELLER may supersede these terms and conditions. However, should any of these terms and conditions be contrary to or inconsistent with any terms and conditions contained in any purchase order form or other document between SELLER and CUSTOMER which is prepared by CUSTOMER and whenever executed, the provisions hereof shall be controlling and shall supersede the conflicting terms and conditions which are contained in such other document.

4. TITLE AND RISK OF LOSS:

Title to and risk of loss of the goods herein described shall pass to CUSTOMER upon delivery of said goods to a carrier at SELLERS plant. Title to and risk of loss of said goods shall pass to CUSTOMER in no other way, notwithstanding any agreement to the contrary, including but not by the way of limitation, any agreement to pay freight, express, or other transportation of insurance charges.

5. TAXES, DUTIES, AND CLEARANCE EXPENSES:

CUSTOMER assumes full responsibility including reporting and payment of any and all sales or use taxes, import duties, or other expenses relating to clearance of the goods herein described at destination, or any and all other charges of like nature which may be imposed upon such goods.

6. ACCEPTANCE OF GOODS:

CUSTOMER shall inspect all goods immediately upon their delivery to the destination stated in the agreement and shall within ten (10) days provide written notice to SELLER at its principal place of business of any claim that the goods do not conform to the terms of the agreement.

7. PATENT INFRINGEMENT:

Except for goods manufactured by SELLER based on specification of drawings furnished by CUSTOMER, SELLER shall defend at its expense any suit, action or proceedings brought against CUSTOMER based upon any claim that the equipment covered by this order infringes any United States patent which has been issued as of the date of the order and pay any damages and costs awarded therein against CUSTOMER, but not to exceed the amount therefore paid to SELLER by CUSTOMER hereunder, if promptly notified by CUSTOMER in writing of such Claim and given authority, information and assistance by CUSTOMER, at SELLER'S expense, to conduct such defense.

8. EXCUSABLE DELAYS:

SELLER shall not be in default for failure to deliver or delay in delivery arising out of causes beyond its control and without its negligence, including but not limited to Acts of God or the public enemy; acts of the Government in either its sovereign or contractual capacity; fires; floods; epidemics; quarantine restrictions; strikes; shortages of materials or supplies; labor disputes; freight embargoes; delays in transit; consignments lost or damaged by freight agent(s); and unusually severe weather.

9. DEFAULT AND VENUE:

In the event CUSTOMER cancels all or any portion of this contract following the date of acceptance by SELLER, CUSTOMER shall be obligated to pay for all fabricated and/or purchase of components and all other non-recoverable costs pertaining to the project. In the event suit is necessary to enforce payment by CUSTOMER, whether as a result of cancellation or as a result of nonpayment, CUSTOMER agrees to pay all actual attorney's fees, out-of-pocket costs and actual Court costs incurred by SELLER including all out-of-pocket costs and actual attorney's fees in enforcing any judgment. In such event SELLER shall have the exclusive right to institute legal proceedings in either any Court having jurisdiction where the CUSTOMER's materials are installed, the place of residence of the CUSTOMER, or in any Court of competent jurisdiction in the County of Santa Barbara, State of California. In the event CUSTOMER institutes legal proceedings against SELLER for whatever reason, the Superior Court of the County of Santa Barbara shall have exclusive jurisdiction.

10. ASSIGNMENT:

CUSTOMER may not assign this Agreement, or any portion thereof without the express prior written consent of SELLER.

STANDARD WARRANTY
FOR
SPIRAL WOUND ELEMENTS
3 YEAR STANDARD WARRANTY

GENERAL

TriSep provides all data in good faith and believes the information and data contained herein to be accurate and useful. However, since any assistance furnished by TriSep with reference to the proper use and disposal of its products is provided without charge, and since use conditions and disposal are not within its control, TriSep assumes no obligation or liability for such assistance and does not guarantee results from use of such products or other information herein. TriSep assumes no liability for results obtained or damages incurred through the application of the presented information and data. It is the user's responsibility to determine the appropriateness of TriSep's products for the user's specific end uses.

The total system operation performance is out of the control of TriSep Corporation personnel and we are not "on-site" to monitor the proper operation of our products in the systems. TriSep's product performance is affected by such operational variables including, but not limited to, pretreatment, operators and training, system breakdowns, feedwater changes, system components and component changes and other possible variables.

This warranty applies to all sales of spiral wound elements on or after December 1, 1999

1.0 MODELS

TriSep X-20, ACM, CA, XN40, TS80, UE50 and TM10 membrane elements.

1.1 APPLICATIONS

The following warranty applies to TriSep spiral wound elements used in "water" applications. "Non-water" applications such as chemical processing, food processing, or wastewater treatment are not covered by the performance warranty in section 4.3.

2.0 TYPE AND LENGTH OF WARRANTIES

2.1 "Water" Applications

	X-20, ACM, CA, XN40	UE50, TM10
A. Initial Performance	24 hours	24 hours
B. Materials and Workmanship	12 months	12 months
C. Extended Element Performance	36 months	Contact TriSep

2.2 "Non-Water" Applications

	All elements
A. Initial Performance	24 hours
B. Materials and Workmanship	12 months
C. Extended Element Performance	Contact TriSep

0 WARRANTY START DATE

Warranties for extended element performance commence on the date of plant start-up or 3 months after initial shipment date from TriSep's facility, whichever occurs first.

4.0 WARRANTIES AND LIABILITIES: SPIRAL WOUND PRODUCTS

4.1: Materials and Workmanship:

TriSep warrants that its spiral element(s) will be free of mechanical defects, as determined by TriSep, due to faulty materials or errors in manufacturing workmanship for a period up to twelve (12) months after the Warranty Start Date. Claims made under this portion of TriSep's warranty must specify the alleged defect in materials of construction or manufacturing workmanship on which such a claim is based. All claims must be documented by the customer for TriSep processing.

4.1.1: TriSep Liability:

TriSep will repair or replace, at no charge, any element which is found by TriSep to be mechanically defective, due to errors in manufacturing or faulty material, as specified in 4.1 above.

4.2: Initial Performance:

TriSep warrants for a period up to the Warranty Start Date per Paragraph 3 that the individual element(s) will have 85% of the initial minimum product flow specified and the initial minimum salt rejection as specified by TriSep in its published product specifications when such elements are tested under specified Standard Test Conditions. The test period for determining minimum product flow shall be limited to no more than 24 consecutive hours.

4.2.1: TriSep Liability:

TriSep reserves the right to repair or replace such element(s) as TriSep determines to be necessary to correct any deficiencies, as specified in 4.2 above.

4.3: Three-year Element Performance:

The three-year performance warranties set forth in 4.3.1 start on the Warranty Start Date, apply to individual element(s) only and incorporate by reference all Conditions of Warranties described in paragraphs 5.1 to 5.5.

4.3.1: X-20, ACM, CA, TS80, XN40 Element Performance:

For a period of three (3) years the minimum product water flow for X-20, ACM, CA, TS80, and XN40 elements under Standard Test Conditions will be at least 70 percent of the TriSep specified initial minimum flow. The maximum overall salt passage X-20, ACM, CA, TS80, and XN40 element(s), under Standard Test Conditions and pressure required to give the initial specified flow, will not be more than 2 times the TriSep initial maximum level. Standard Test Conditions, and the specified product water flow and salt passage for X-20, ACM, CA, TS80, and XN40 element are set forth in product specification sheets provided by TriSep.

4.3.5 Periodic Cleanings

Periodic cleanings of the membranes will be required to maintain this performance. TriSep will not be responsible for any costs associated with these element and/or system cleanings. Membrane cleaning protocols are to be approved by TriSep. Required frequency of cleaning will be determined during operation of the system, and may vary with time of year, feedwater temperature, feedwater contaminants, and microbial

STANDARD WARRANTY
FOR
SPIRAL WOUND ELEMENTS
3 YEAR STANDARD WARRANTY

challenge level. Other variables not mentioned above may also effect the required cleaning frequency.

If TriSep determines that replacement is required under this warranty, TriSep will credit the Customer 1/36 of the original purchase price of the element(s), per Terms and Conditions of Sale, for each unexpired month of the warranty period. This credit will be toward the purchase of TriSep replacement element(s) at the then current selling price set by TriSep.

5.0 CONDITIONS OF WARRANTIES

5.1: Limitation of Warranties:

5.1.1: Occurrence of any of the following as determined by TriSep shall void all warranties hereunder:

(a) Operation of the elements that deviates from the "Guidelines for Operation of Spiral Wound Elements" attached.

(b) Fouling and/or Scaling of the elements that cause system and/or membrane element failures and/or damage and/or loss of element performance.

(c) Physical abuse or misuse of element(s);

(c) Faulty installation of element(s);

(d) Alteration of any parts originally supplied by TriSep with element(s);

5.2: Standard Guidelines:

All element Warranties are conditioned upon TriSep's determination that shipping, storage, system design, installation, operation and maintenance of elements are in accordance with all Guidelines specified by TriSep in the attached Guidelines for Operation. Any reviews of system design or inspections of facilities made by TriSep are intended to assist in detection of system faults to subsequently cite matters which were not discovered in such reviews or inspections as violations of Guidelines, voiding warranties hereunder:

5.3: Additional Equipment:

TriSep assumes no liability for any additional equipment that may be deemed necessary after plant operation has begun, including materials, equipment, and labor required to install additional elements or pressure vessels.

5.4: Warranty Maintenance:

To maintain the Warranty described herein, plant operating records from initial start-up date of claim must be maintained and made available to TriSep upon request. Documentation must be provided in the detail as specified in 5.5: Below in order to: a) Verify uninterrupted compliance with Guidelines; and b) establish liability (TriSep's or Customer's) for element(s) replaced or repaired under warranty.

5.5: Notification and Verification of Performance Deficiency:

All claims filed hereunder shall be made in writing within Thirty (30) days of identifying a deficiency in warranted performance and shall present a detailed analysis of the system and individual element data showing the performance deficiency, and must include:

(a) The serial number(s) of the element(s) involved, and

(b) The individual element(s) documented operating data, documented system operating data or defect in materials or workmanship upon which the claim is based. Operating data must include: permeate and brine flow, salt passage, operating pressure, pressure drop, feedwater temperature, pH, TDS, SDI, conversion, and elapsed time since start-up (hours). TriSep reserves the right to require additional data as necessary to validate the claims filed.

After receipt of the notice, TriSep will promptly undertake such investigations as, in TriSep's opinion, are necessary to verify whether a deficiency exists and to establish liability for remedy of any deficiency. The Customer may, in course of these investigations, be requested to return element(s) to TriSep for examination. TriSep may make reasonable tests and inspections on end-user's or on the Customer's premises.

TriSep will have the right to specify reasonable remedies other than replacement, repair or addition of element(s) to restore performance to TriSep specified levels.

TriSep's Returned Goods Authorization (RGA) Procedure must be followed for return of element(s). Element(s) shipped to TriSep for warranty examination must be shipped freight prepaid. Unless specifically agreed to in writing by TriSep prior to shipment, all collect and/or COD deliveries will be refused by TriSep. If the Customer desires replacement element(s) to replace those alleged to be defective or those returned to TriSep for warranty examination, Customer is responsible for providing any needed replacements until warranty examination is complete. Element(s) examined as part of a warranty claim which are found by TriSep to be performing as warranted will be returned to the Customer freight collect, with appropriate charges (minimum US$100.00) made for TriSep handling, inspection, testing or analytical services, as described in TriSep's RGA Procedure.

Replacement, by the Customer, of element(s) under Extended Element Performance warranties will be at the then current selling price, per TriSep's Standard Terms and Conditions, plus handling charge for each returned element. If in connection with any TriSep inspection and testing of products and/or system on the Customer's or end-user's premises a claim under the Extended element performance warranty is determined by TriSep to be invalid, the Customer shall pay to TriSep a minimum fee of $450 per day, plus all direct expenses incurred by TriSep employee(s) conducting such inspection/testing.

The RGA Procedure is part of TriSep's RGA (Return Goods Authorization procedure).

NO OTHER WARRANTIES, EXPRESS OR IMPLIED ARE MADE IN CONNECTION WITH THE SALE OF THESE PRODUCTS, INCLUDING NO WARRANTIES OF FITNESS FOR ANY PARTICULAR USE OR MERCHANTABILITY OF THESE PRODUCTS. THE REMEDY HEREBY PROVIDED SHALL BE THE EXCLUSIVE AND SOLE REMEDY OF CUSTOMER, AND IN NO EVENT SHALL TRISEP BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER OR NOT CAUSED BY OR RESULTING FROM TriSep's NEGLIGENCE.

STANDARD WARRANTY
FOR
SPIRAL WOUND ELEMENTS
3 YEAR STANDARD WARRANTY

GUIDELINES FOR OPERATION

TriSep provides all data in good faith and believes the information and data contained herein to be accurate and useful. It is the user's responsibility to determine the appropriateness of TriSep's products for the user's specific end uses.

X-20™, ACM™, TS80™ , CA, XN40™ , UE50 ™ AND TM10™ RO/NF/UF/MF Membrane Guidelines

SUSPENDED SOLIDS

· Turbidity of element RO feed must be <1.0 for all elements, except for X-20 turbidity must be less than 2.0, measured upstream of the micron filters, preferably <1.0. Operation at turbidities higher than 1.0 may require more frequent membrane cleanings and may reduce membrane life.

· The system array, recovery and instrumentation and the design parameters and components of the system in which the elements(s) are employed shall be consistent with sound engineering practice. TriSep reserves the right to review system design.

BIOLOGICAL MATTERS

· Biological activity inside the element must be controlled during operation so that system water quality and quantity are not affected.

CHLORINE/BROMINE

· The total free chlorine and bromine content of all water entering the X-20™, ACM ™ , TS80™ , element(s) must be < 0.1 mg/l. The total free chlorine and bromine content of all water entering CA, XN40™ , UE50™, and
TM10™ element(s) must be < 1.0 mg/l. Total free chlorine tolerance for the X-20 and ACM membranes are 1000 ppm-hrs, when exposed at concentrations less than 1 ppm in the absence of trivalent metals ions on the surface of the membrane. The presence of trivalent metal ions, such as ferric hydroxide, may reduce the oxidation tolerance substantially of all membranes.

MISCELLANEOUS CHEMICALS

· Chemicals which form a water-immisible phase in the RO feed or brine must not enter the element.

· Use of cationic polyelectrolytic compounds in elements is not permitted unless prior written approval is given by TriSep

· All water entering the element must be free of strong oxidants such as H_2O_2, O_3, $KMnO_4$, CH_3CO_3H.

· Impurities present in chemicals added to the RO feed water must not affect the element performance .

· Feedwater shall contain no colloidal sulfur.

· Membrane damage caused by chemical compounds (e.g. surfactants, solvents, soluble oils, free oils, lipids, and high molecular weight natural polymers) shall nullify and void the warranty.

· Failure to maintain the elements in a clean condition, unfouled by particulate matter, precipitates, suspended material, or biological growth shall nullify and void the warranty.

pH

· The pH in the element must be >4.0 for continuous operation. The maximum allowable exposure time during operation and cleaning for solutions with a pH between 2 to 4 is 150 hours over the life of the elements. Elements must not be exposed to pH <2.0.

· For continuous operation the pH in the elements must be < 11.0 up to 40°C and < 10.0 up to 45°C. The maximum total allowable exposure time during operation and cleaning is 500 hours over the life of the element for solutions with pH 11.0 to 11.9 up to 40°C and with pH 10.0 to 10.9 up to 45°C. Elements must not be exposed to pH >11.9.

SOLUBILITY LIMITS

· The Langelier Saturation Index (LSI) of the brackish water brine stream must be negative except where an approved Antiscalant is used. When an approved Antiscalant is used, the pressure vessels must be flushed within 15 minutes after shutdown to remove the supersaturated salt solutions. Recovery ratio shall be consistent with concentration of sparingly soluble salts. Membrane scaling caused by failure of the chemical dosing system (e.g. Ca, Ba, or Sr salts) shall nullify and void the warranty.

· IP_b < Ksp for $CaSO_4$, $BaSO_4$, $SrSO_4$, and CaF_2 where IP_b is the ion product of brine stream, Ksp is the solubility product

· IP_b $CaSO_4$ < 1.0 x 10-3 or 2.5 x (Ksp) whichever is larger if TriPol 8510 or TriPol 9010 is used, where IPb is the ion product of brine stream, Ksp is the solubility product.

· IP_b $BaSO_4$ < 70 x (Ksp) if TriPol 8510 or TriPol 9010 is used, where IPb is the ion product of brine stream, Ksp is the solubility product.

· IP_b $SrSO_4$ < 8 (Ksp) if TriPol 8510 or TriPol 9010 is used, where IPb is the ion product of brine stream, Ksp is the solubility product.

· IP_b CaF_2 < (Ksp) if TriPol 8510 or TriPol 9010 is used, where IPb is ion product of brine stream, Ksp is the solubility product.

· The brine silica shall be less than 150 mg/l at 25°C, unless an antiscalent approved by TriSep is used.

STANDARD WARRANTY
FOR
SPIRAL WOUND ELEMENTS
3 YEAR STANDARD WARRANTY

GUIDELINES FOR OPERATION

DESIGN

· Modifications of any TriSep element, and/or component supplied by TriSep are not permitted unless approved by TriSep in writing.
· In systems having 10 or more pressure vessels, provisions must be made to permit installation and operation of at least 10% additional pressure vessels calculated to meet design capacity.
· A thrust ring must be used on the last element in a pressure vessel.
· The pre-treatment system must be designed to prevent irreversible organic and/or inorganic fouling of the membrane.
· Cleaning shall be initiated at 10% to 15% normalized product flow decline, a 15% to 20% increase in normalized system delta P, or a 20% decline in normalized salt passage.

OPERATING CONDITIONS : TEMPERATURE AND PRESSURE

· The product pressure must never exceed the feed or brine pressure.
· The maximum temperature for operation of the element is 45°C. For operation outside this limit consult TriSep.
· In all stages the ratio of the brine flow to the product flow must be at least 5.0 per element.
· At all times e.g. operation, cleaning, flushing and post-treatment, the maximum pressure drop per pressure vessel is 60 psi or 15 psi per element, whichever is less as determined from routine monitoring on a representative sampling of pressure tubes per stage and per train.
· The elements shall not be exposed to pressure greater than 1000 psi for seawater elements, and 600 psi for brackish water elements.

OPERATING CONDITIONS- FLOW RATES

Model No.	Min. Brine l/min (gpm)	Max. Feed l/min (gpm)
4”	19.0 (5.0)	75.6 (20.0)
8”	57 (15.0)	303 (80.0)
8.5”	57 (15.0)	322 (85.0)

· The average gallons per square foot of membrane area per day (GFD) per element must not exceed 20 if the turbidity is less than 0.1, or 18 if the turbidity is equal to 0.1 but less than 0.3, or 15 if the turbidity is equal to 0.3 but less than or equal to 0.5, or 12 if the turbidity is equal to 0.5 but less than or equal to 1.0, or 10 if the turbidity is equal to 1.0 but less than or equal to 2.0. Operation at turbidities > 0.3 may result in increased cleaning frequencies. When the feedwater is RO permeate, elements may operate at flux rates up to 30 gfd. Turbidities may not be a good indicator of organic fouling potential.

FLUSHING

· Flush water must be of good quality (meeting Guidelines) and of low TDS (<2000 ppm).
· The product side must be open to atmosphere when flushing or adding water to the element.
· When scale inhibitor is used, the element must be flushed at shutdown within 15 minutes to remove the Antiscalant and the supersaturated salt solution.

SHIPPING, HANDLING AND STORAGE

· When not in operation the membrane must be kept saturated with good quality feedwater (meeting Guidelines) and having a low TDS (<2000 mg/l) at all times.
· The as-shipped elements must be kept sealed in its original double plastic bag, in a cool,dry place, out of direct sunlight, until required for installation.

STORAGE

Min. Storage Temp. without Glycerine	Min. Storage Temp. w/ 40 wt. % Glycerine	Maximum Storage Temp.
0°C (32°F)	-15°C (5°F)	30°C (86°F)

· Only glycerin may be used as a freeze protection agent. If used, the concentration must be 20 wt %.
· 2 - 3 wt. % sodium metabisulfite or TriSep approved biocide must be used for storage, shipping or continuous element shutdowns in excess of 5 days to prevent biological growth

Spare Parts

The following tables contain a listing of spare parts that are available for TriSep membrane elements. These include inboard adapters, used to adapt the first and last element within a pressure tube to the pressure tube end cap, interconnectors, used to connect two element permeate tubes together, and brine seals and O-rings for the elements.

Most TriSep elements come standard with brine seals, interconnectors, and interconnector O-rings. The exceptions are that all Turboclean elements come without a brine seal since they are sanitary elements and do not require one. And 2.5" and 3.8" diameter elements are not supplied with interconnectors. These must be purchased separately.

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Parts List and Pricing
Inboard Adpaters

4040 Series - 4 INCH DIAMETER ELEMENTS

Part Number	Element Models	Drawing #	Pressure Tube Manufacturer	Pressure Tube Model	Adapter Material	Adapter Price	Comments
1124012	4040-xxxx-xx**A**	T-10233	Codeline/ASI/Structural/Pentair	4B	PVC	$18.30	Snap ring end cap, won't work with direct connect
1124080	4040-xxxx-xx**A**	T-10338	Codeline/ASI/Structural/Pentair	U4B, U4S	PVC	$13.63	3 piece ring end cap, U4S to 1000 psi
1124271	4040-xxxx-xx**A**	T-10807-2,-1	Codeline/ASI/Structural/Pentair	40A	PVC	$55.95	Side port, spiralox ring, 2 adapters, feed & brine[1]
1124104	4040-xxxx-xx**A**	T-10368	Environmental Products	Type 1	PVC	$16.73	
1124106	4040-xxxx-xx**A**	T-10376	Environmental Products	Type 2	PVC	$16.65	
1124091	4040-xxxx-xx**A**	T-10356	Fluid Systems		PVC	$28.50	Model Number 4XXSL00
1124231	4040-xxxx-xx**A**	T-10715	Nitto Denko		PVC	$28.15	
1124015	4040-xxxx-xx**A**	T-10219	Osmonics	Type 1, SS	PVC	$28.15	0.775" OD snout
1124050	4040-xxxx-xx**A**	T-10290	Osmonics	Type 2, SS	PVC	$34.01	0.845" OD snout, SS tube
1124017	4040-xxxx-xx**A**	T-10222	Spaulding		PVC	$16.91	
1123050	4040-xxxx-xx**A**	T-10281	Toray		PVC	$34.01	
1124328	4040-xxxx-xx**A**	T-11403	SNIM		PVC	$29.56	
1124084	4040-xxxx-xx**F**	T-10418-1	Codeline/ASI/Structural/Pentair	4B	PVC	$25.17	Filmtec style core tube, not needed with direct connect
1124093	4040-xxxx-xx**F**	T-10362-1	Osmonics	Type 1	PVC	$30.14	Filmtec style core tube
1124364	4040-xxxx-xx**F**		Protec/Beakart		PVC	$25.10	
1124084	4040-xxxx-xx**T**	T-10418-1	Codeline/ASI/Structural/Pentair	4B	PVC	$25.17	Filmtec style core tube, not needed with direct connect
1124093	4040-xxxx-xx**T**	T-10362-1	Osmonics	Type 1	PVC	$30.14	Filmtec style core tube
1124257	4040-xxxx-xx**G**	T-10322-3	Codeline/ASI/Structural/Pentair	4B	Polysulfone	$37.53	0.62" I.D.
1124225	4040-xxxx-xx**H**	T-10415-3	Codeline/ASI/Structural/Pentair	4B	Polysulfone	$29.20	0.835" I.D.
1124256	4040-xxxx-xx**S**	T-10322-2	Codeline/ASI/Structural/Pentair	4B	Acetal	$29.86	0.62" I.D.
1124260	4040-xxxx-xx**G**	T-10808-2	Osmonics	Type 1	Polysulfone	$33.08	0.775" OD snout, 0.62" I.D. Core Tube
1124212	4040-xxxx-xx**H**	T-10603	Osmonics	Type 1	Polysulfone	$36.95	0.775" OD snout, 0.835" I.D. Core Tube
1124259	4040-xxxx-xx**S**	T-10808-1	Osmonics	Type 1	Acetal	$28.62	0.775" OD snout, 0.62" I.D. Core Tube
1124267	4040-xxxx-xx**FG**	T-10418-3	Codeline/ASI/Structural/Pentair	4B	Polysulfone	$35.66	Filmtec style core tube, Turboclean High Temp.
1124266	4040-xxxx-xx**FS**	T-10418-2	Codeline/ASI/Structural/Pentair	4B	Acetal	$30.49	Filmtec style core tube, Turboclean
1124265	4040-xxxx-xx**FG**	T-10362-3	Osmonics	Type 1	Polysulfone	$37.77	Filmtec style core tube, Turboclean High Temp.
1124264	4040-xxxx-xx**FS**	T-10362-2	Osmonics	Type 1	Acetal	$32.61	Filmtec style core tube, Turboclean
1124079	4040-xxxx-xx**DA**	T-10322-1	Codeline/ASI/Structural/Pentair	4B	PVC	$15.81	DuPont/Desal style core tube

Rev. 1-20-05

Parts List and Pricing
Inboard Adpaters

8040 Series - 8 INCH DIAMETER ELEMENTS

Part Number	Element Models	Drawing #	Pressure Tube Manufacturer	Pressure Tube Model	Adapter Material	Adapter Price	Comments
1124011	8040-xxxx-xx**A**	T-10187-1	Codeline/ASI/Structural/Pentair	80A, 80E, E8/SP	PVC	$32.37	
1124285	8040-xxxx-xx**A**	T-10187-3	Codeline/ASI/Structural/Pentair	80A, 80E, E8/SP	304SS	$232.18	
1124096	8040-xxxx-xx**A**	T-10363	Cogema		PVC	$28.92	
1124013	8040-xxxx-xx**A**	T-10257	Envirogenics		PVC	$26.32	
1124011	8040-xxxx-xx**A**	T-10187-1	Filmtec	PVE-8	PVC	$32.37	Made by ASI
1124018	8040-xxxx-xx**A**	T-10188	Fluid Systems/UOP		PVC	$28.85	
1124338	8040-xxxx-xx**A**	T-11419	Fluid Systems Old Style	86FRPC	PVC	$42.22	
1124296	8040-xxxx-xx**A**	T-10949	Jeddah Sewage Plant		PVC	$46.92	
1124014	8040-xxxx-xx**A**	T-10118	Hydranautics	Hydraclam	PVC	$28.85	External clam shell closure
1124011	8040-xxxx-xx**A**	T-10187-1	Hydranautics	Hydracode	PVC	$32.37	Side entry, made by ASI
1124113	8040-xxxx-xx**A**	T-10390	Knappe		PVC	$19.35	
1124232	8040-xxxx-xx**A**	T-10708-1	Nitto Denko		PVC	$39.88	
1124024	8040-xxxx-xx**A**	T-10708-3	Nitto Denko		PVC	$33.73	Solid adapter plug
1124046	8040-xxxx-xx**A**	T-10251	Osmonics		PVC	$82.71	SS pressure tube, kit contains 2 0124016 and 1124270
1124306	8040-xxxx-xx**A**	T-11116	Osmonics #2		PVC	$32.37	Has 3/8" shoulder.
1124356	8040-xxxx-xx**A**		Osmonics #2 Kit		PVC	$32.37	0124016 + 0124355
1124355	8040-xxxx-xx**A**	T-11447	Osmonics #2 Bushing		PVC	$32.37	
1124131	8040-xxxx-xx**A**	T-10389	Phoenix		PVC	$35.14	
1124263	8040-xxxx-xx**A**	T-10787	Spaulding		PVC	$34.11	
1124021	8040-xxxx-xx**A**	T-10333	Samarec		PVC	$31.90	
1124023	8040-xxxx-xx**A**	T-10284	Toray		PVC	$31.55	Studded end caps
1124095	8040-xxxx-xx**A**	T-10361	Total Minerals		PVC	$79.76	
1124089	8040-xxxx-xx**A**	T-11365	PMT/Village Marine		PVC	$35.19	
1124309	8040-xxxx-xx**A**	T-10942	Esmil/Osmo Tube		PVC	$32.37	Osmo tube customized by Esmil
1124321	8040-xxxx-xx**A**	T-11271-1	Protec		PVC	$35.19	
1124307	8040-xxxx-xx**A**	T-10187-2	Codeline/ASI/Structural/Pentair	80A, 80E, E8/SP	Polysulfone	$121.98	
1123056	8040-xxxx-xx**DA**	T-10317-1	Codeline/ASI/Structural/Pentair	80A, 80E, E8/SP	PVC	$27.26	Desal/Dupont Core Tube
1124283	8040-xxxx-xx**DA**	T-10317-4	Codeline/ASI/Structural/Pentair	80A, 80E, E8/SP	304SS	$225.15	Desal/Dupont Core Tube
1124090	8040-xxxx-xx**DA**	T-10272	Hydranautics	Hydraclam	PVC	$28.90	Desal/Dupont Core Tube
1124172	8040-xxxx-xx**DA**	T-10722	Osmonics		PVC	$25.26	Desal/Dupont Core Tube

Parts List and Pricing
Inboard Adpaters

8040 Series - 8 INCH DIAMETER ELEMENTS

Part Number	Element Models	Drawing #	Pressure Tube Manufacturer	Pressure Tube Model	Adapter Material	Adapter Price	Comments
1124278	8040-xxxx-xx**FS**	T-10849-2	Codeline/ASI/Structural/Pentair	80A, 80E, E8/SP	PVC	$38.49	Filmtec Core Tube
1124040	8040-xxxx-xx**FS**	T-10820-3	Hydranautics	Hydraclam	PVC	$38.49	Filmtec Core Tube
1124290	8040-xxxx-xx**FS**	T-10881-1	Osmonics		PVC	$34.30	Filmtec Core Tube
1124314	8040-xxxx-xx**FS**	T-11367-1	Knappe		PVC	$35.19	Filmtec Core Tube
1124278	8040-xxxx-xx**FA**	T-10849-2	Codeline/ASI/Structural/Pentair	80A, 80E, E8/SP	PVC	$38.49	Filmtec Core Tube
1124040	8040-xxxx-xx**FA**	T-10820-3	Hydranautics	Hydraclam	PVC	$38.49	Filmtec Core Tube
1124290	8040-xxxx-xx**FA**	T-10881-1	Osmonics		PVC	$34.30	Filmtec Core Tube
1124305	8040-xxxx-xx**FA**		Hydranautics	Hydraclam	PVC	$105.56	Kit with IC, 2 spacer, IA for HWS and TS in same tube
1124314	8040-xxxx-xx**FA**	T-11367-1	Knappe		PVC	$35.19	Filmtec Core Tube
1124279	8040-xxxx-xx**FG**	T-10849-1	Codeline/ASI/Structural/Pentair	80A, 80E, E8/SP	Polysulfone	$123.39	Filmtec Core Tube
1124031	8040-xxxx-xx**FG**	T-10820-1	Hydranautics	Hydraclam	Polysulfone	$93.83	Filmtec Core Tube
1124315	8040-xxxx-xx**FG**	T-11367-2	Knappe		Polysulfone	$124.33	Filmtec Core Tube
1124218	8040-xxxx-xx**G**	T-10317-3	Old Style Codeline	80A, 80E, E8/SP	Polysulfone	$123.39	Desal/Dupont Core Tube
1124218	8040-xxxx-xx**H**	T-10317-3	Codeline/ASI/Structural/Pentair	80A, 80E, E8/SP	Polysulfone	$123.39	Desal/Dupont Core Tube
1123056	8040-xxxx-xx**S**	T-10317-1	Old Style Codeline	80A, 80E, E8/SP	PVC	$32.84	Desal/Dupont Core Tube
1124090	8040-xxxx-xx**S**	T-10272	Old Style Hydranautics	Hydraclam	PVC	$28.90	Desal/Dupont Core Tube
1124172	8040-xxxx-xx**S**	T-10722	Old Style Osmonics		PVC	$25.26	Desal Core Tube,Can't use with welded inboard adapter
							<u>Core Tube Adapter Sleeves</u>
1124298	8040-xxxx-xx**FG**	T-10881-2	Osmonics		Polysulfone	$117.29	Filmtec Core Tube

Rev. 1-20-05

Parts List and Pricing
Inboard Adpaters

8340 Series - 8.3 INCH DIAMETER ELEMENTS

Part Number	Element Models	Drawing #	Pressure Tube Manufacturer	Pressure Tube Model	Adapter Material	Adapter Price	Comments
1124046	8340-xxxx-xx**A**	T-10251	Osmonics		PVC	$82.71	SS pressure tube, kit contains 2 0124016 and 1124270
1124172	8340-xxxx-xx**S**	T-10722	Old Style Osmonics		PVC	$25.26	Desal Core Tube,Can't use with welded inboard adapter
1124313	8336-xxxx-xx**FG**	T-11354-1	Custom		Polysulfone	$220.50	Filmtec/Turboclean Core Tube

8540 Series - 8.5 INCH DIAMETER ELEMENTS

Part Number	Element Models	Drawing #	Pressure Tube Manufacturer	Pressure Tube Model	Adapter Material	Adapter Price	Comments
1124014	8540-xxxx-xx**A**	T-10118	Hydranautics	Hydraclam	PVC	$28.85	External clam shell closure

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Parts List and Pricing
Interconnectors, Plugs, Dummy Elements

3840 Series - 3.8 INCH DIAMETER ELEMENTS

art Numb	Element Models	Drawing #	Description	Dimensions Core Tube	I.C. Material	I.C. Price	Comments
1124199	3840-xxxx-xx**G**	T-10769-2	Desal Sanitary	0.835" I.D.	Polysulfone	$19.66	ATD/Interconnector
1123069	3840-xxxx-xx**G**	T-10843-2	Desal Sanitary	0.835" I.D.	Polysulfone	$19.66	ATD/Solid 1/2 Connector

4040 Series - 4 INCH DIAMETER ELEMENTS

art Numb	Element Models	Drawing #	Description	Dimensions Core Tube	I.C. Material	I.C. Price	Comments
1124019	4040-xxxx-xx**A**	T-10065-3	TriSep Style	0.75" I.D.	Noryl	$7.08	Interconnector
1124159	4040-xxxx-xx**A**	T-10065-2	TriSep Style	0.75" I.D.	Polysulfone	$23.46	Interconnector
1124008	4040-xxxx-xx**A**	T-10221	TriSep Style	0.75" I.D.	PVC	$14.94	End Plug
1324021	4040-xxxx-xx**A**	T-10220	TriSep Style	0.75" I.D.	PVC	$25.22	Interconnector, Solid Plug
1124052	4040-xxxx-xx**DA**	SDP-100011-1	DuPont/Desal style	0.625" I.D.	PVC	$12.22	Interconnector
1124056	4040-xxxx-xx**DA**	SDP-100011-2	DuPont/Desal style	0.625" I.D.	PVC	$18.77	End Plug
1124094	4040-xxxx-xx**F**	T-10806-4	Filmtec Style	0.75" O.D.	Noryl	$9.85	Interconnector
1124157	4040-xxxx-xx**F**		Filmtec Style	0.75" O.D.	PVC	$43.58	Dummy Element
1124269	4040-xxxx-xx**FG**	T-10806-3	Filmtec Style, Turbo High Temp.	0.75" O.D.	Polysulfone	$17.52	Interconnector
1124094	4040-xxxx-xx**FS**	T-10806-1	Filmtec Style, Turboclean	0.75" O.D.	Noryl	$6.36	Interconnector
1124262	4040-xxxx-xx**G**	T-10777-1	Turbo High Temp.	0.625" I.D.	Polysulfone	$36.95	Interconnector
1124147	4040-xxxx-xx**H**	T-10416	High Temp.	0.835" I.D.	Polysulfone	$36.95	Interconnector
1124250	4040-xxxx-xx**OA**	T-10763	Osmonics Style	0.83" I.D.	PVC	$13.25	Interconnector
1124261	4040-xxxx-xx**S**	T-10777-2	Turboclean	0.625" I.D.	Noryl	$28.15	Interconnector
1124094	4040-xxxx-xx**T**	T-10806-4	Filmtec Style	0.75" O.D.	PVC	$9.85	Interconnector

Parts List and Pricing
Interconnectors, Plugs, Dummy Elements

8040 Series - 8 INCH DIAMETER ELEMENTS

art Numb	Element Models	Drawing #	Description	Dimensions Core Tube	I.C. Material	I.C. Price	Comments
1124020	8040-xxxx-xx**A**	T-10238-1	TriSep Style	1.50" I.D.	Noryl	$5.79	Interconnector
1124022	8040-xxxx-xx**A**	T-10838	TriSep Style	1.50" I.D.	PVC	$17.12	Interconnector
1124284	8040-xxxx-xx**A**	T-10238-3	TriSep Style	1.50" I.D.	304SS	$114.36	Interconnector
1124226	8040-xxxx-xx**A**	T-10150-1	TriSep Style	1.50" I.D.	PVC	$30.49	Interconnector, Solid Plug
1124009	8040-xxxx-xx**A**	T-10150-3	TriSep Style	1.50" I.D.	PVC	$21.53	End Plug
1124105	8040-xxxx-xx**A**		TriSep Style	1.50" I.D.	FRP/ABS	$70.37	Dummy Element, 8040
1124275	8040-xxxx-**SxA**	T-10838	TriSep Style, Seawater	1.50" I.D.	PVC	$17.12	Interconnector
1123082	8040-xxxx-**SxFA**	T-10780-5	Filmtec Style Seawater	1.12" I.D.	Noryl	$25.52	Interconnector
1124032	8040-xxxx-xx**DA**	T-10834-1	DuPont/Desal style	1.18" I.D.	PVC	$33.80	Interconnector
1124282	8040-xxxx-xx**DA**	T-10834-3	DuPont/Desal style	1.18" I.D.	304SS	$134.30	Interconnector
1124055	8040-xxxx-xx**DA**	T-10929-1	DuPont/Desal style	1.18" I.D.	PVC	$36.15	End Plug
1124180	8040-xxxx-xx**FA**	T-10780-2	Filmtec Style	1.12" I.D.	Noryl	$7.04	Interconnector
1124280	8040-xxxx-xx**FA**	T-10850-2	Filmtec Style	1.12" I.D.	Noryl	$28.38	End Plug
1124061	8040-xxxx-xx**FA**		Filmtec Style	1.12" I.D.	FRP/ABS	$70.37	Dummy Element, 8040
1124179	8040-xxxx-xx**FG**	T-10780-1	Filmtec style	1.12" I.D.	Polysulfone	$46.02	Interconnector
1124281	8040-xxxx-xx**FG**	T-10850-1	Filmtec style	1.12" I.D.	Polysulfone	$68.03	End Plug
1124180	8040-xxxx-xx**FS**	T-10780-2	Turboclean	1.12" I.D.	Noryl	$7.04	Interconnector
1124280	8040-xxxx-xx**FS**	T-10850-2	Turboclean	1.12" I.D.	Noryl	$28.38	End Plug
1124105	8040-xxxx-xx**FS**		Turboclean	1.12" I.D.	FRP/ABS	$105.02	Dummy Element, 8020
1124153	8040-xxxx-xx**G**	T-10834-2	Old style Turbo High Temp.	1.18" I.D.	Polysulfone	$51.51	Interconnector
1124217	8040-xxxx-xx**G**	T-10929-2	Old Style Turbo High Temp.	1.18" I.D.	Polysulfone	$47.95	End Plug
1124153	8040-xxxx-xx**H**	T-10834-2	High Temp.	1.18" I.D.	Polysulfone	$51.51	Interconnector
1124217	8040-xxxx-xx**H**	T-10929-2	High Temp.	1.18" I.D.	Polysulfone	$47.95	End Plug
1124163	8040-xxxx-xx**OA**	T-10831-2	Osmonics Style	1.13" I.D.	PVC	$25.57	Interconnector
1124162	8040-xxxx-xx**OA**	T-10831-1	Osmonics Style	1.13" I.D.	Polysulfone	$46.02	Interconnector
1123070	8040-xxxx-xx**OA**	T-10841-1	Osmonics Style	1.13" I.D.	PVC	$29.49	End Plug
1124032	8040-xxxx-xx**S**	T-10834-1	Old StyleTurboclean	1.18" I.D.	PVC	$33.22	Interconnector
1124055	8040-xxxx-xx**S**	T-10929-1	Old StyleTurboclean	1.18" I.D.	PVC	$36.15	End Plug
1124219	8040-xxxx-xx**TA**	T-10634	Toray style	32 mm O.D.	PVC	$15.13	Interconnector
1124293	8040-xxxx-xx**FA**	T-10882-1	8040-xxxx-xx**DA**	1.18" - 1.12"	PVC	$22.82	Dupont/Desal to Filmtec IC
1124294	8040-xxxx-xx**FA**	T-10882-2	8040-xxxx-xx**DA**	1.18" - 1.12"	Polysulfone	$35.19	Dupont/Desal to Filmtec IC
1124087	8040-xxxx-xx**A**	T-10350	8040-xxxx-xx**DA**	1.50" - 1.18"	PVC	$31.32	I.C. TriSep - Desal/Dupont
1124300	8040-xxxx-xx**A**	T-10945	HWS element	1.50" - 1.50 OD	PVC	$34.27	I.C. TriSep - TS/HWS
1124322	8040-xxxx-xx**A**	T-11275	Koch/Fluid Systems Element	1.50" - 1.25"	PVC	$35.19	I.C. TriSep - TS/Koch
1124016	8040-xxxx-xx**A**	T-10251	8040-xxxx-xx**OA**	1.50" - 1.19"	PVC	$30.28	I.C. TriSep - TS/Osmo

Rev. 1-20-05

Parts List and Pricing
Interconnectors, Plugs, Dummy Elements

8340 Series - 8.3 INCH DIAMETER ELEMENTS

art Numbe	Element Models	Drawing #	Description	Dimensions Core Tube	I.C. Material	I.C. Price	Comments
1124020	8340-xxxx-xx**A**	T-10238-1	TriSep Style	1.50" I.D.	Noryl	$5.79	Interconnector
1124022	8340-xxxx-xx**A**	T-10838	TriSep Style	1.50" I.D.	PVC	$17.12	Interconnector
1124226	8340-xxxx-xx**A**	T-10150-1	TriSep Style	1.50" I.D.	PVC	$30.49	Interconnector, Solid Plug
1124009	8340-xxxx-xx**A**	T-10150-3	TriSep Style	1.50" I.D.	PVC	$21.53	End Plug
1124179	8340-xxxx-xx**FG**	T-10780-1	Filmtec style	1.12" I.D.	Polysulfone	$46.02	Interconnector
1124281	8340-xxxx-xx**FG**	T-10850-1	Filmtec style	1.12" I.D.	Polysulfone	$68.03	End Plug
1124180	8340-xxxx-xx**FS**	T-10780-2	Turboclean	1.12" I.D.	Noryl	$7.04	Interconnector
1124280	8340-xxxx-xx**FS**	T-10850-2	Turboclean	1.12" I.D.		$28.38	End Plug
1124153	8340-xxxx-xx**G**	T-10834-2	Old Style Turbo High Temp.	1.18" I.D.	Polysulfone	$51.51	Interconnector
1124217	8340-xxxx-xx**G**	T-10929-2	Old Style Turbo High Temp.	1.18" I.D.	Polysulfone	$47.95	End Plug
1124153	8340-xxxx-xx**H**	T-10834-2	High Temp.	1.18" I.D.	Polysulfone	$51.51	Interconnector
1124217	8340-xxxx-xx**H**	T-10929-2	High Temp.	1.18" I.D.	Polysulfone	$47.95	End Plug
1124032	8340-xxxx-xx**S**	T-10834-1	Old Style Turboclean	1.18" I.D.	PVC	$33.80	Interconnector
1124055	8340-xxxx-xx**S**	T-10929-1	Old Style Turboclean	1.18" I.D.	PVC	$36.15	End Plug
1124163	8340-xxxx-xx**OA**	T-10831-2	Osmonics Style	1.13" I.D.	PVC	$25.57	Interconnector

8540 Series - 8.5 INCH DIAMETER ELEMENTS

art Numbe	Element Models	Drawing #	Description	Dimensions Core Tube	I.C. Material	I.C. Price	Comments
1124020	8540-xxxx-xx**A**	T-10238-1	TriSep Style	1.50" I.D.	Noryl	$5.79	Interconnector
1124022	8540-xxxx-xx**A**	T-10838	TriSep Style	1.50" I.D.	PVC	$14.27	Interconnector
1124226	8540-xxxx-xx**A**	T-10150-1	TriSep Style	1.50" I.D.	PVC	$25.41	Interconnector, Solid Plug
1124009	8540-xxxx-xx**A**	T-10150-3	TriSep Style	1.50" I.D.	PVC	$17.95	End Plug

Parts List and Pricing
Brine Seals and I.C. O-Rings

2540 Series - 2.58 INCH DIAMETER ELEMENTS

Part Number	Element Models	Seal Type	Seal Material	Seal Price	Comments
1123000	2540-xxxx-xxx	Brine Seal	EPR	$2.09	Filmtec Core Tube
1423061	2540-xxxx-xxx	I.C. O-Ring	EPR	$0.12	Filmtec Style Core Tube

3840 Series - 3.8 INCH DIAMETER ELEMENTS

Part Number	Element Models	Seal Type	Seal Material	Seal Price	Comments
1124255	3840-xxxx-xx**S**	Lip Seal	EPR	$4.40	0.835" I.D. Core Tube
1124255	3840-xxxx-xx**G**	Lip Seal	EPR	$4.40	0.835" I.D. Core Tube

Rev. 1-20-05

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Parts List and Pricing
Brine Seals and I.C. O-Rings

4040 Series - 4 INCH DIAMETER ELEMENTS

Part Number	Element Models	Seal Type	Seal Material	Seal Price	Comments
1123001	4040-xxxx-xx**A**	Brine Seal	EPR	$2.09	TriSep Core Tube
1123001	4040-xxxx-xx**DA**	Brine Seal	EPR	$2.09	Desal/Dupont Core Tube
1123001	4040-xxxx-xx**F**	Brine Seal	EPR	$2.09	Filmtec Core Tube
1123001	4040-xxxx-xx**H**	Brine Seal	EPR	$2.09	High Temperature
1123001	4040-xxxx-xx**OA**	Brine Seal	EPR	$2.09	Osmonics Core Tube
1123001	4040-xxxx-xx**T**	Brine Seal	EPR	$2.09	Filmtec Style Core Tube
1123021	4040-xxxx-xx**A**	I.C. O-Ring	EPR	$0.12	TriSep Core Tube
1123035	4040-xxxx-xx**DA**	I.C. O-Ring	EPR	$0.08	Desal/Dupont Core Tube
1423061	4040-xxxx-xx**F**	I.C. O-Ring	EPR	$0.12	Filmtec Style Core Tube
1423061	4040-xxxx-xx**FG**	I.C. O-Ring	EPR	$0.12	Filmtec Style, Turbo High Temp.
1423061	4040-xxxx-xx**FS**	I.C. O-Ring	EPR	$0.12	Filmtec Style, Turboclean
1123035	4040-xxxx-xx**G**	I.C. O-Ring	EPR	$0.08	0.625" Turboclean, H.T.
1123059	4040-xxxx-xx**H**	I.C. O-Ring	EPR	$0.12	0.835" High Temperature
1123035	4040-xxxx-xx**S**	I.C. O-Ring	EPR	$0.08	0.625" Turboclean
1423061	4040-xxxx-xx**T**	I.C. O-Ring	EPR	$0.16	Filmtec Style Core Tube
1124249	Osmo Element	I.C. O-Ring	EPR	$0.16	Osmo core tube
1124119	4040-xxxx-xx**A**	Seal Kit	EPR	$4.74	2 brine seals, 8 O-rings
1124124	4040-xxxx-xxF	Seal Kit	EPR	$4.74	2 brine seals, 8 O-rings

Rev. 1-20-05

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Parts List and Pricing
Brine Seals and I.C. O-Rings

8040 Series - 8 INCH DIAMETER ELEMENTS

Part Number	Element Models	Seal Type	Seal Material	Seal Price	Comments
1123002	8040-xxxx-xx**A**	Brine Seal	EPR	$5.86	TriSep Core Tube
1123002	8040-xxxx-xx**DA**	Brine Seal	EPR	$5.86	Desal/Dupont Core Tube
1123002	8040-xxxx-xx**FA**	Brine Seal	EPR	$5.86	Filmtec core tube
1123002	8040-xxxx-xx**H**	Brine Seal	EPR	$5.86	High Temperature
1123002	8040-xxxx-xx**TA**	Brine Seal	EPR	$5.86	Toray Style Core Tube
1124007	8040-xxxx-xx**A**	I.C. O-Ring	EPR	$0.21	TriSep Core Tube
1123079	8040-xxxx-xx**DA**	I.C. O-Ring	EPR	$0.21	Desal/Dupont Core Tube
1123064	8040-xxxx-xx**FA**	I.C. O-Ring	EPR	$0.21	Filmtec Core Tube
1123064	8040-xxxx-xx**FG**	I.C. O-Ring	EPR	$0.21	New High Temp. Turboclean FT CT
1123064	8040-xxxx-xx**FS**	I.C. O-Ring	EPR	$0.21	New Turboclean FT CT
1123079	8040-xxxx-xx**S**	I.C. O-Ring	EPR	$0.21	Old Style Turboclean
1123079	8040-xxxx-xx**G**	I.C. O-Ring	EPR	$0.21	Old Style High Temp. Turboclean
1123079	8040-xxxx-xx**H**	I.C. O-Ring	EPR	$0.21	High Temperature
1123039	8040-xxxx-xx**OA**	I.C. O-Ring	EPR	$0.09	Osmonics Style Core Tube
1323019	8040-xxxx-xx**TA**	I.C. O-Ring	EPR	$1.08	Toray Style Core Tube
1123009	1124021	I.A. O-Ring	EPR	$0.21	Samarec to TSA O-ring
1123037	1124018	I.A. O-Ring	EPR	$0.21	TSA to FS tube
1124098	1124095	I.A. O-Ring	EPR	$0.21	TSA to Total Minerals Tube
1124233	1124230	Sleeve O-Ring	EPR	$0.21	TSA-FT Bushing O-ring
1124297	1124296	I.A. O-Ring	EPR	$0.21	TSA-Jeddah Sewage Plant PT
1123078	SpiraSep	Core Tube	EPR	$0.21	SpiraSep 8" core tube
1123074	SpiraSep	ATD	EPR	$1.47	SpiraSep 8" ATD
1123058	8040-xxxx-xx**A**	I.C. O-Ring	EPR	$1.47	TSA to Koch element I.C. O-ring
1124120	8040-xxxx-xx**A**	Seal kit	EPR	$12.39	2 brine seals, 8 O-rings
1124133	8040-xxxx-xx**FA**	Seal kit	EPR	$12.39	2 brine seals, 8 O-rings

Rev. 1-20-05

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Parts List and Pricing
Brine Seals and I.C. O-Rings

8340 Series - 8.3 INCH DIAMETER ELEMENTS

Part Number	Element Models	Seal Type	Seal Material	Seal Price	Comments
1123002	8340-xxxx-xx**A**	Brine Seal	EPR	$5.86	TriSep Core Tube
1123002	8340-xxxx-xx**H**	Brine Seal	EPR	$5.86	High Temperature
1124007	8340-xxxx-xx**A**	I.C. O-Ring	EPR	$0.21	TriSep Core Tube
1123064	8340-xxxx-xx**FG**	I.C. O-Ring	EPR	$0.21	New High Temp. Turboclean FT CT
1123064	8340-xxxx-xx**FS**	I.C. O-Ring	EPR	$0.21	New Turboclean FT CT
1123079	8340-xxxx-xx**S**	I.C. O-Ring	EPR	$0.21	Old Style Turboclean
1123079	8340-xxxx-xx**G**	I.C. O-Ring	EPR	$0.21	Old Style High Temp. Turboclean
1123039	8340-xxxx-xx**OA**	I.C. O-Ring	EPR	$0.09	Osmonics Style Core Tube
1123079	8340-xxxx-xx**H**	I.C. O-Ring	EPR	$0.21	High Temperature
1123068	8237-xxxx-xxx	I.C. O-Ring	EPR	$0.21	

8540 Series - 8.5 INCH DIAMETER ELEMENTS

Part Number	Element Models	Seal Type	Seal Material	Seal Price	Comments
1123003	8540-xxxx-xx**A**	Brine Seal	EPR	$6.80	TriSep Core Tube
1124007	8540-xxxx-xx**A**	I.C. O-Ring	EPR	$0.21	TriSep Core Tube
1124134	8540-xxxx-xx**FA**	Seal Kit	EPR	$14.92	2 brine seals, 8 O-rings

All Model Numbers

Part Number	Element Models	Description	Seal Material	Seal Price	Comments
1235016	All	O-Ring Lube	All	$33.50	Parker Super-O-Lube

Rev. 1-20-05