# Product Specification

April 15, 2007

CSM

SAEHAN INDUSTRIES

CSM® Customer Satisfaction Membrane

# CSM Brackish Water RO Membrane Elements

| | |
|---|---|
| **RE8040-BN** | 8” in diameter X 40” in length, Normal grade RO membrane element with thick feed spacer for brackish water |
| **RE8040-BN300** | 8” X 40”, Normal grade RO membrane element with thick feed spacer, 300 $ft^2$ membrane area for brackish water |
| **RE8040-BE** | 8” X 40”, High productivity RO membrane element with 400 $ft^2$ membrane area for brackish water |
| **RE8040-BE440** | 8” X 40”, High productivity RO membrane element with 440 $ft^2$ membrane area for brackish water |
| **RE8040-BR** | 8” X 40”, High rejection RO membrane element with extended area for higher TDS than 2,000 mg/L |
| **RE4040-BN** | 4” X 40”, Normal grade RO membrane element with thick feed spacer for brackish water |
| **RE4040-BE** | 4” X 40”, High productivity RO membrane element with extended area for brackish water |
| **RE4021-BE** | 4” X 21”, High productivity RO membrane element with extended area for brackish water |
| **RE2540-BN** | 2.5” X 40”, Normal grade RO membrane element with thick feed spacer for brackish water |

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-BN

*Normal grade RO membrane element with a thick feed spacer for brackish water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 10,000 GPD (37.9 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 365 $ft^2$ (33.9 $m^2$) |

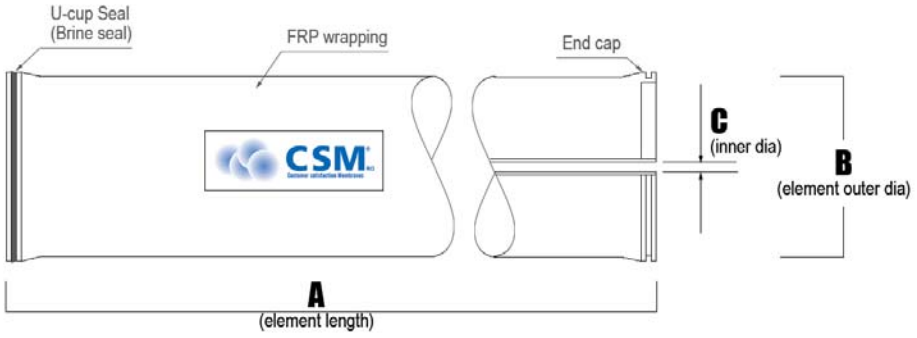
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%
3. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
4. Effective membrane area may vary within 3 %.
5. Thicker Feed spacer (32 mil) is used.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |

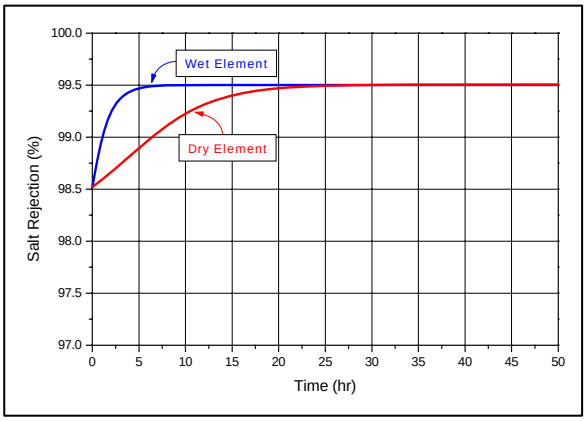



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM Brackish water high rejection membrane elements are used most widely because of their ability to sustain excellent performance.
- CSM membrane elements have a high chemical durability which prevents declining of their performance after CIP.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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PRODUCT SPECIFICATION SHEET

CSM®

Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-BN300

*Normal grade RO membrane element with a thick feed spacer for brackish water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 9,000 GPD (34.1 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 300 $ft^2$ (27.9 $m^2$) |

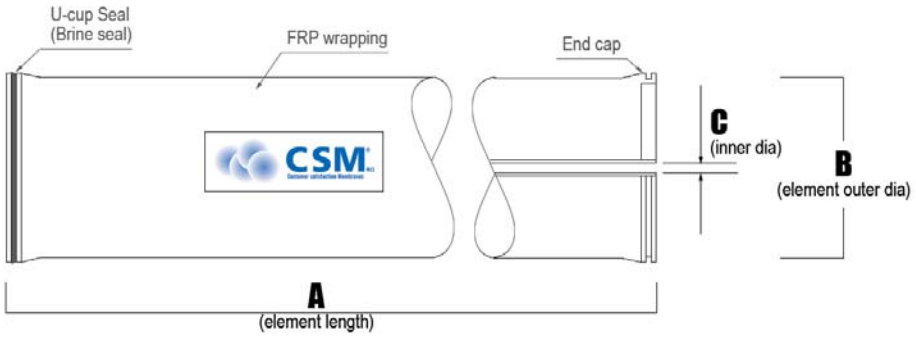
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%
3. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
4. Effective membrane area may vary within 3 %.
5. Thicker Feed spacer (46 mil) is used.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |

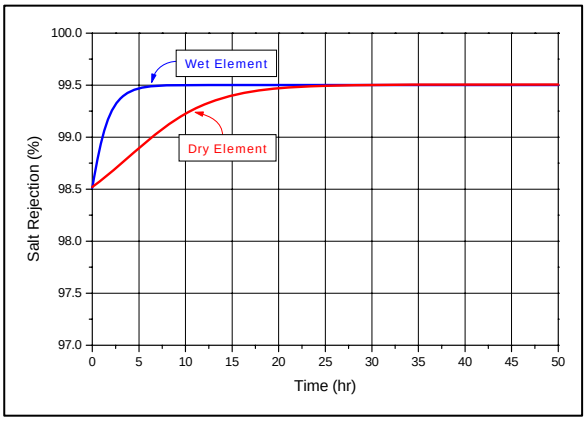



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. a pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM Brackish water high rejection membrane elements are used most widely because of their ability to sustain excellent performance. CSM membrane elements have a high chemical durability which prevents declining of their performance after CIP.
- The thicker feed spacer (46 mil) of CSM BN300 element enables element to treat a feed water containing a high load of colloidal particles.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# RE8040-BE

*High productivity RO membrane element with extended area for brackish water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 11,000 GPD (41.6 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

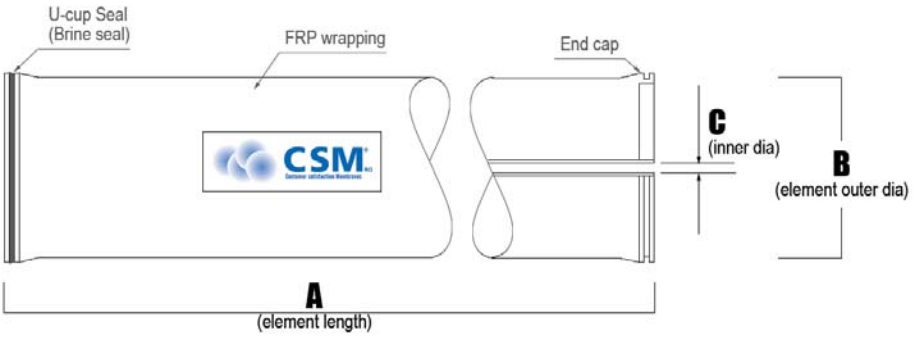
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%
3. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
4. Effective membrane area may vary within 3 %.
5. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |

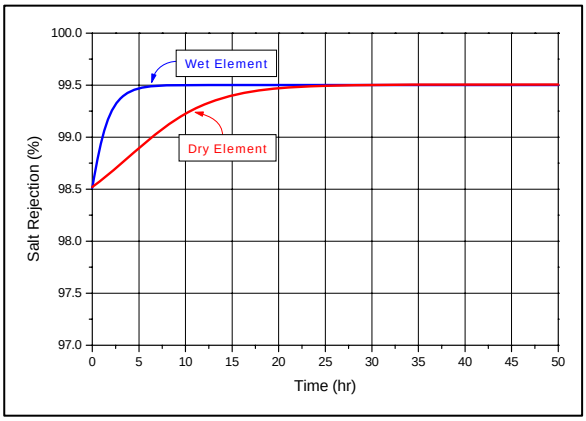



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM Brackish water high rejection membrane elements are used most widely because of their ability to sustain excellent performance.
- CSM membrane elements have a high chemical durability which prevents declining of their performance after CIP.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# RE8040-BE440

*High productivity RO membrane element with high extended area for brackish water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 12,000 GPD (45.4 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 440 $ft^2$ (40.9 $m^2$) |

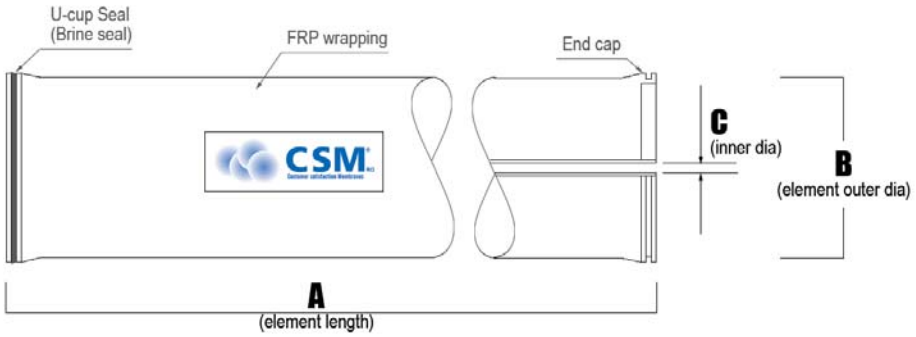
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%
3. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
4. Effective membrane area may vary within 3 %.
5. Central tube inner diameter is 1.5 inches which is not same to regular element.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.5 inch (38 mm) |

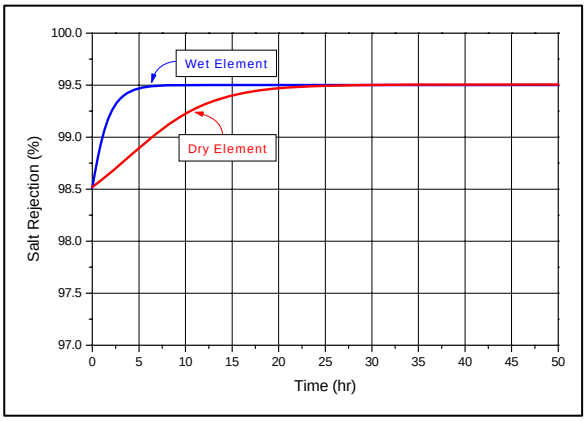



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM BE440 is made of the same high rejection membrane as BN and BE but produces more permeate flow due to its extended membrane area. For the same amount of product water, BE440 can be operated at a lower pressure and fouled less than the regular BE and BN
- CSM membrane elements have a high chemical durability which prevents declining of their performance after CIP.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
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- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

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|---|---|
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| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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Email wankk@saehan.co.kr
Website http://www.saehancsm.com

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CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-BR

*Ultra-high salt rejection RO membrane element with extended area for higher TDS than 2,000 mg/L*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 5,500 GPD (20.8 $m^3$/day) |
| Stabilized Salt Rejection : | 99.7 % |
| Effective Membrane Area : | 380 $ft^2$ (35.3 $m^2$) |

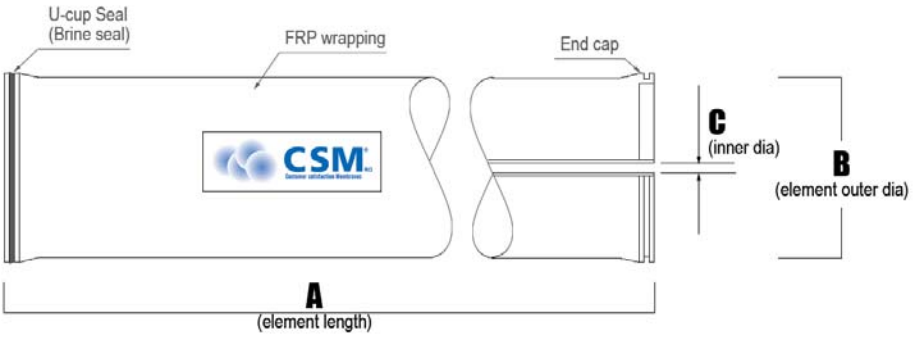
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.4 %
3. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
4. Effective membrane area may vary within 3 %.
5. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |

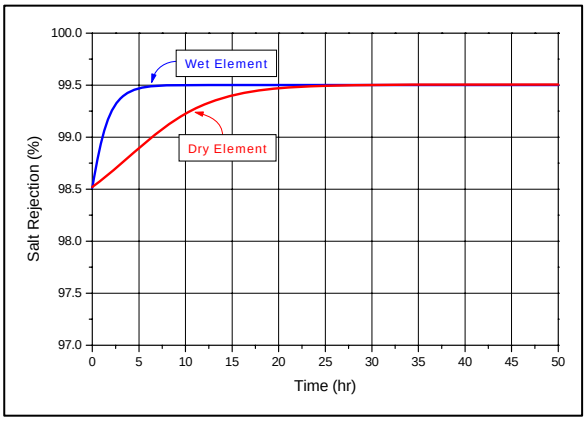



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM BR is a brackish water ultra high rejection membrane element used for the desalination of highly brackish water with TDS higher than 2,000 mg/L
- CSM membrane elements have a high chemical durability which prevents declining of their performance after CIP.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4040-BN

*Normal grade RO membrane element with a thick feed spacer for brackish water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 2,000 GPD (7.6 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 75 $ft^2$ (7.0 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

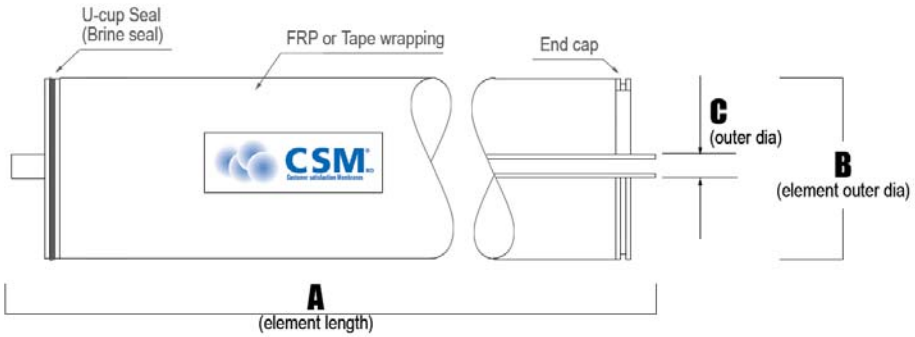
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 4.0 inch (102 mm)

C = 0.75 inch (19.1 mm)

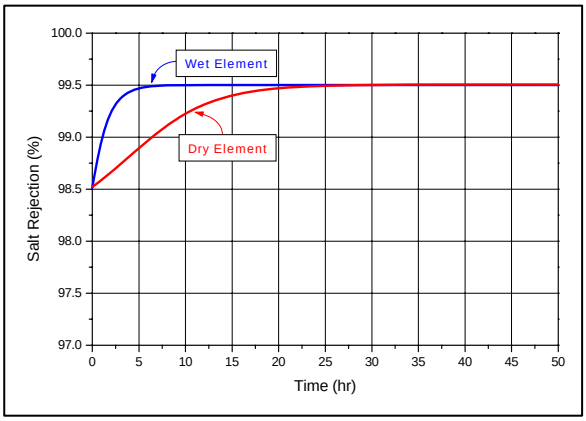



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 4.0-inch (102 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM Brackish water high rejection membrane elements are used most widely because of their ability to sustain excellent performance.
- CSM membrane elements have a high chemical durability which prevents declining of their performance after CIP.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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Website http://www.saehancsm.com

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4040-BE

*High productivity RO membrane element with extended area for brackish water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 2,400 GPD (9.1 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 85 $ft^2$ (7.9 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

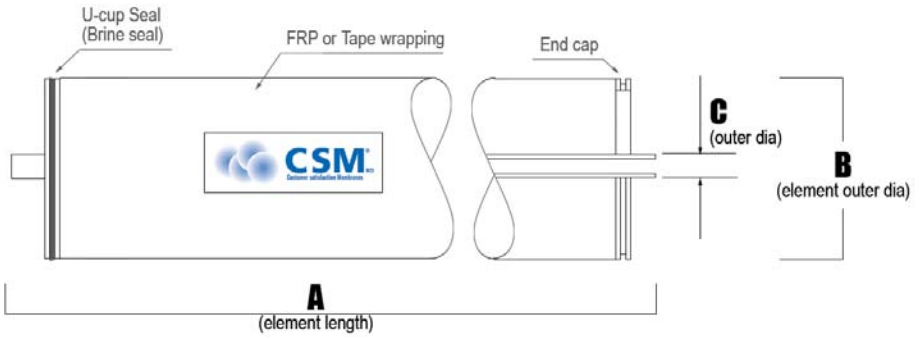
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 4.0 inch (102 mm)

C = 0.75 inch (19.1 mm)

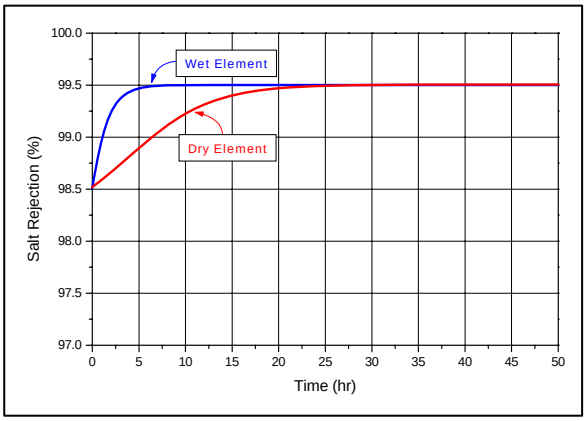



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 4.0-inch (102 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM Brackish water high rejection membrane elements are used most widely because of their ability to sustain excellent performance.
- CSM membrane elements have a high chemical durability which prevents declining of their performance after CIP.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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Website http://www.saehancsm.com

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4021-BE

*High productivity RO membrane element with extended area for brackish water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 1,050 GPD (4.0 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 35 $ft^2$ (3.3 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

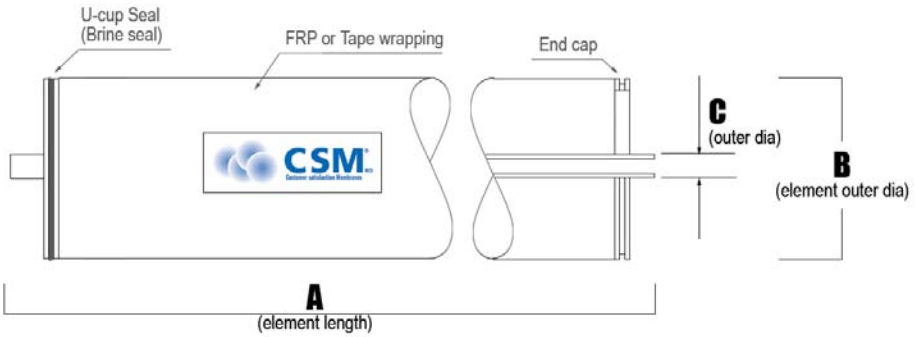
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 21 inch (533 mm)

B = 4.0 inch (102 mm)

C = 0.75 inch (19.1 mm)

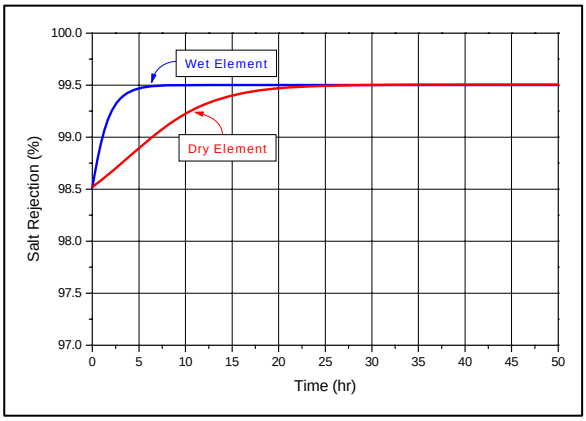



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 4.0-inch (102 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM Brackish water high rejection membrane elements are used most widely because of their ability to sustain excellent performance.
- CSM membrane elements have a high chemical durability which prevents declining of their performance after CIP.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE2540-BN

*Normal grade RO membrane element with a thick feed spacer for brackish water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 600 GPD (2.3 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 24 $ft^2$ (2.5 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

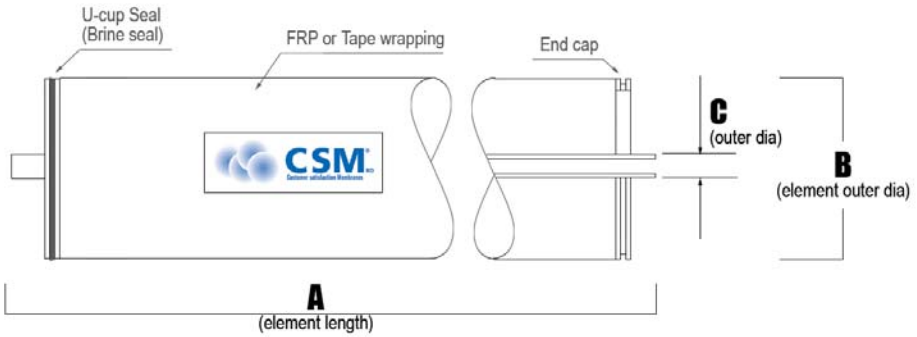
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 2.5 inch (64 mm)

C = 0.75 inch (19.1 mm)

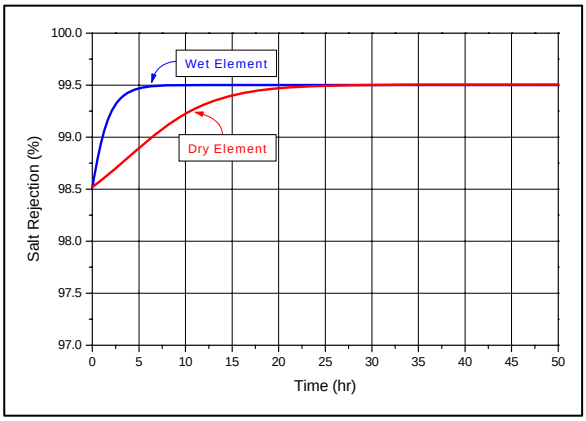



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM Brackish water high rejection membrane elements are used most widely because of their ability to sustain excellent performance.
- CSM membrane elements have a high chemical durability which prevents declining of their performance after CIP.

## The Stabilization of salt rejection Characteristics

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2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
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- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 6 gpm (1.36 $m^3$/hr) |
| Min. Concentrate flow rate | 1 gpm (0.23 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

SAEHAN INDUSTRIES

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Website http://www.saehancsm.com

CSM® Customer Satisfaction Membrane

# CSM Tap Water RO Membrane Elements

| | |
|---|---|
| **RE4040-TE** | 4” in diameter X 40” in length, Normal grade RO membrane element with extended area for tap water and/or low TDS water |
| **RE4021-TE** | 4” X 21”, Normal grade RO membrane element with extended area for tap water and/or low TDS water |
| **RE2540-TE** | 2.5” X 40”, Normal grade RO membrane element with extended area for tap water and/or low TDS water |
| **RE2521-TE** | 2.5” X 21”, Normal grade RO membrane element with extended area for tap water and/or low TDS water |
| **RE4040-TL** | 4” X 40”, Low pressure RO membrane element for tap water and/or low TDS water |
| **RE4021-TL** | 4” X 21”, Low pressure RO membrane element for tap water and/or low TDS water |
| **RE2540-TL** | 2.5” X 40”, Low pressure RO membrane element for tap water and/or low TDS water |
| **RE2521-TL** | 2.5” X 21”, Low pressure RO membrane element for tap water and/or low TDS water |

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4040-TE

*Normal grade RO membrane element with extended area for tap water and/or low TDS water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 2,400 GPD (9.1 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 85 $ft^2$ (7.9 $m^2$) |

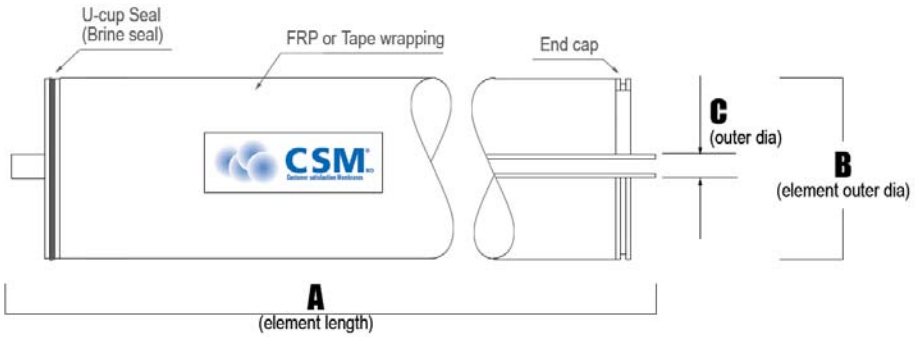
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 4.0 inch (102 mm) |
| C = | 0.75 inch (19.1 mm) |




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- High rejection CSM tap water elements can be useful in purifying tap water further in case that it is not of high quality.
- CSM TE elements are suitable for treatment of small systems

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4021-TE

*Normal grade RO membrane element with extended area for tap water and/or low TDS water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 1,050 GPD (4.0 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 35 $ft^2$ (3.3 $m^2$) |

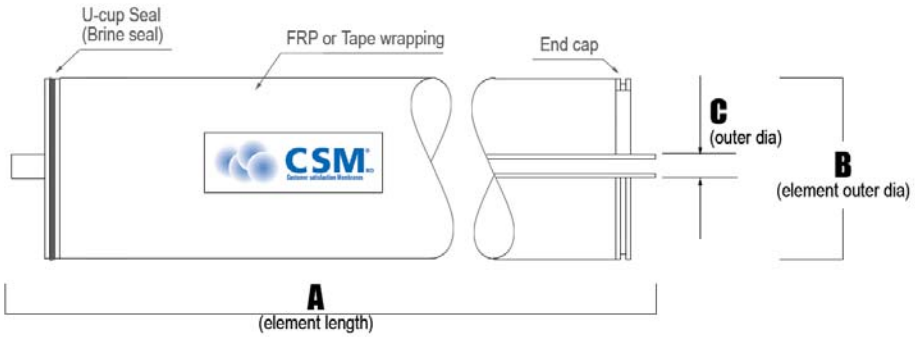
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 21 inch (533 mm) |
| B = | 4.0 inch (102 mm) |
| C = | 0.75 inch (19.1 mm) |




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- High rejection CSM tap water elements can be useful in purifying tap water further in case that it is not of high quality.
- CSM TE elements are suitable for treatment of small systems

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# RE2540-TE

*Normal grade RO membrane element with extended area for tap water and/or low TDS water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 800 GPD (3.0 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 27 $ft^2$ (2.5 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

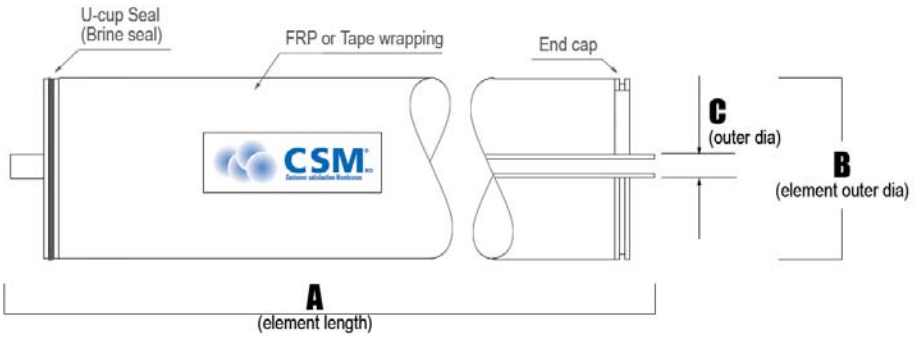
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 2.5 inch (64 mm)

C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- High rejection CSM tap water elements can be useful in purifying tap water further in case that it is not of high quality.
- CSM TE elements are suitable for treatment of small systems

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 6 gpm (1.36 $m^3$/hr) |
| Min. Concentrate flow rate | 1 gpm (0.23 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# RE2521-TE

*Normal grade RO membrane element with extended area for tap water and/or low TDS water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 300 GPD (1.1 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 12 $ft^2$ (1.1 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

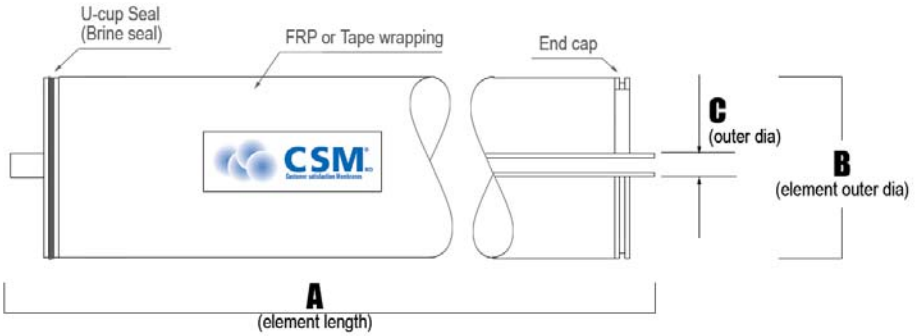
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

A = 21 inch (533 mm)

B = 2.5 inch (64 mm)

C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- High rejection CSM tap water elements can be useful in purifying tap water further in case that it is not of high quality.
- CSM TE elements are suitable for treatment of small systems

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 6 gpm (1.36 $m^3$/hr) |
| Min. Concentrate flow rate | 1 gpm (0.23 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# RE4040-TL

*Normal grade RO membrane element with extended area for tap water and/or low TDS water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 2,600 GPD (9.8 $m^3$/day) |
| Stabilized Salt Rejection : | 99.0 % |
| Effective Membrane Area : | 85 $ft^2$ (7.9 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 1,500 mg/L NaCl solution at 150 psig (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

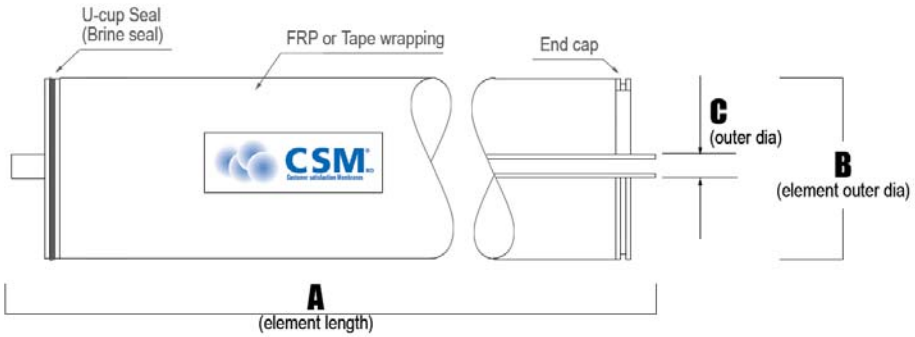
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 4.0 inch (102 mm)

C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- High rejection CSM tap water membrane elements can be useful when tap water is not safe enough to drink without further purification.
- CSM low pressure TL elements have capabilities in salt rejection and flux similar to the regular brackish water membrane under low pressure condition to reduce the energy cost.
- CSM low pressure TL elements are helpful in saving electricity as well as capital costs for pumps, plumbing and pressure vessels in small systems.

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4021-TL

*Normal grade RO membrane element with extended area for tap water and/or low TDS water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 1,050 GPD (4.0 $m^3$/day) |
| Stabilized Salt Rejection : | 99.0 % |
| Effective Membrane Area : | 35 $ft^2$ (3.3 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 1,500 mg/L NaCl solution at 150 psig (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

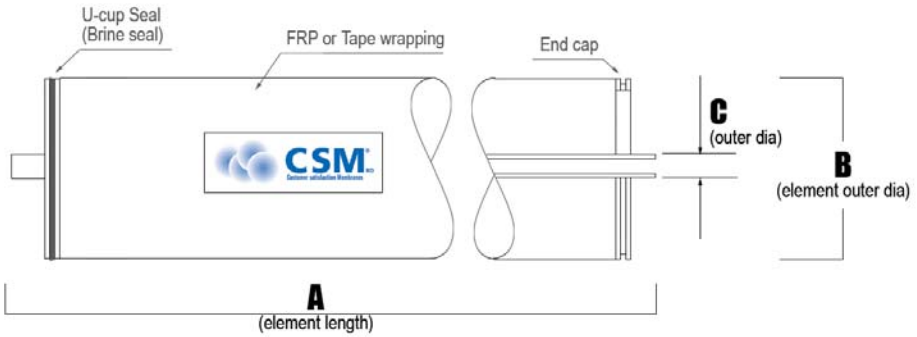
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

A = 21 inch (533 mm)

B = 4.0 inch (102 mm)

C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- High rejection CSM tap water membrane elements can be useful when tap water is not safe enough to drink without further purification.
- CSM low pressure TL elements have capabilities in salt rejection and flux similar to the regular brackish water membrane under low pressure condition to reduce the energy cost.
- CSM low pressure TL elements are helpful in saving electricity as well as capital costs for pumps, plumbing and pressure vessels in small systems

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# RE2540-TL

*Normal grade RO membrane element with extended area for tap water and/or low TDS water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 850 GPD (3.2 $m^3$/day) |
| Stabilized Salt Rejection : | 99.0 % |
| Effective Membrane Area : | 27 $ft^2$ (2.5 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 1,500 mg/L NaCl solution at 150 psig (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

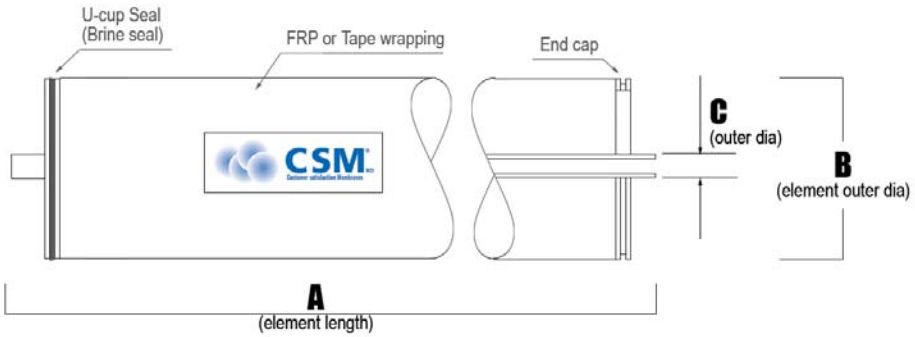
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 2.5 inch (64 mm)

C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- High rejection CSM tap water membrane elements can be useful when tap water is not safe enough to drink without further purification.
- CSM low pressure TL elements have capabilities in salt rejection and flux similar to the regular brackish water membrane under low pressure condition to reduce the energy cost.
- CSM low pressure TL elements are helpful in saving electricity as well as capital costs for pumps, plumbing and pressure vessels in small systems

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 6 gpm (1.36 $m^3$/hr) |
| Min. Concentrate flow rate | 1 gpm (0.23 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# RE2521-TL

*Normal grade RO membrane element with extended area for tap water and/or brackish water with low TDS*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 300 GPD (1.1 $m^3$/day) |
| Stabilized Salt Rejection : | 99.0 % |
| Effective Membrane Area : | 12 $ft^2$ (1.1 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 1,500 mg/L NaCl solution at 150 psig (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

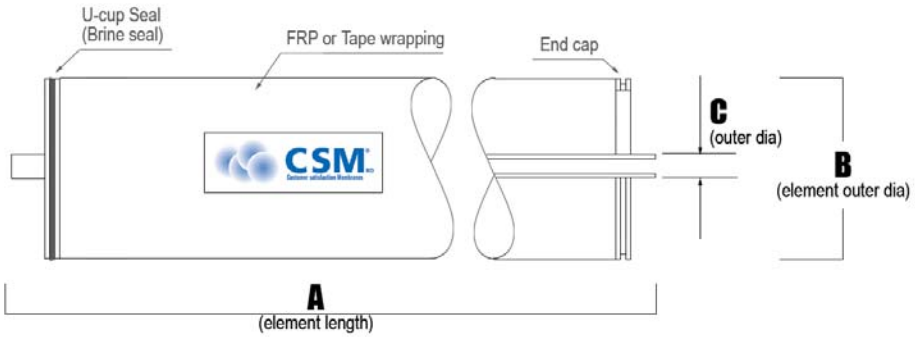
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

A = 21 inch (533 mm)

B = 2.5 inch (64 mm)

C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- High rejection CSM tap water membrane elements can be useful when tap water is not safe enough to drink without further purification.
- CSM low pressure TL elements have capabilities in salt rejection and flux similar to the regular brackish water membrane under low pressure condition to reduce the energy cost.
- CSM low pressure TL elements are helpful in saving electricity as well as capital costs for pumps, plumbing and pressure vessels in small systems

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 6 gpm (1.36 $m^3$/hr) |
| Min. Concentrate flow rate | 1 gpm (0.23 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

# CSM Low Pressure RO Membrane Elements

| | |
|---|---|
| **RE8040-BLN440** | 8” in diameter X 40” in length, Normal low pressure grade RO membrane element with 440 $ft^2$ membrane area for brackish water |
| **RE8040-BLN** | 8” X 40”, Normal low pressure grade RO membrane element for brackish water |
| **RE8040-BLR** | 8” X 40”, Low pressure RO membrane element with high salt rejection for brackish water |
| **RE8040-BLF** | 8” X 40”, Ultra-low pressure RO membrane element for low TDS water |
| **RE16040-BLR** | 16” X 40”, Low pressure RO membrane element with high salt rejection for brackish water |
| **RE4040-BLN** | 4” X 40”, Normal low pressure grade RO membrane element for brackish water |
| **RE4040-BLR** | 4” X 40”, Low pressure RO membrane element with high salt rejection for brackish water |
| **RE4040-BLF** | 4” X 40”, Ultra-low pressure RO membrane element for low TDS water |

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# RE8040-BLN440

*Normal low pressure grade RO membrane element with high extended area for brackish water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 13,000 GPD (49.2 $m^3$/day) |
| Stabilized Salt Rejection : | 99.0 % |
| Effective Membrane Area : | 440 $ft^2$ (40.9 $m^2$) |

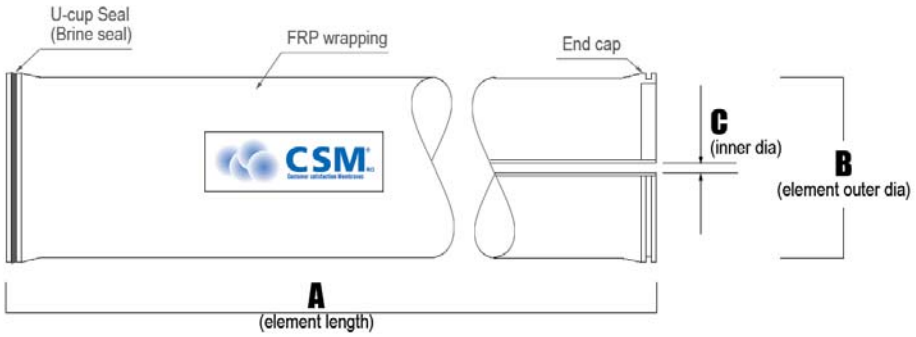
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 1,500 mg/L NaCl solution at 150 psig (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 98.5%
3. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
4. Effective membrane area may vary within 3 %.
5. Central tube inner diameter is 1.5 inches which is larger than 1.12 inch of the regular element.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.5 inch (38 mm) |



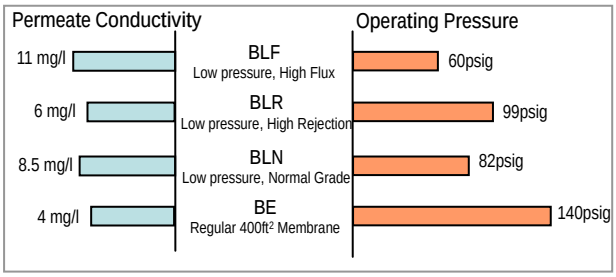

1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM low pressure BLN440 element is made of the same high flux membrane as the regular low pressure membrane (BLN).
- CSM BLN440 produce more permeate flow than BLN because it has more membrane area. The high flux BLN440 element can save energy cost and capital costs for a high pressure pump, plumbing and pressure vessels.
- Salt rejection and specific permeate flux of BLN440 are between BLR and BLF products.

## Product Characteristics Comparison

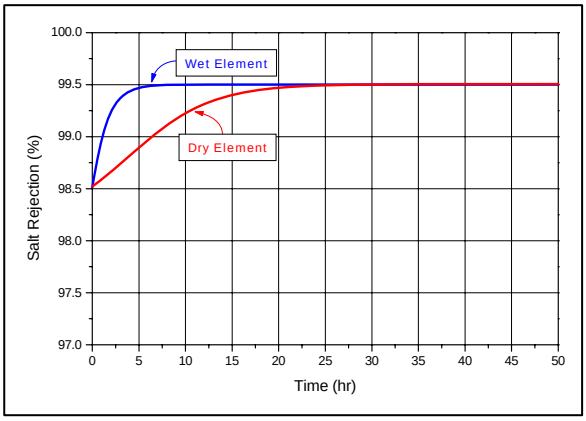
Comparison of CSM low pressure membranes with respect to permeate TDS and operating pressure under the same feed water condition (500 mg/l NaCl) and permeate flux (15 gfd) at 25℃ (recovery 15 %)




## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# RE8040-BLN

*Normal low pressure grade RO membrane element for brackish water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 12,000 GPD (45.4 $m^3$/day) |
| Stabilized Salt Rejection : | 99.2 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

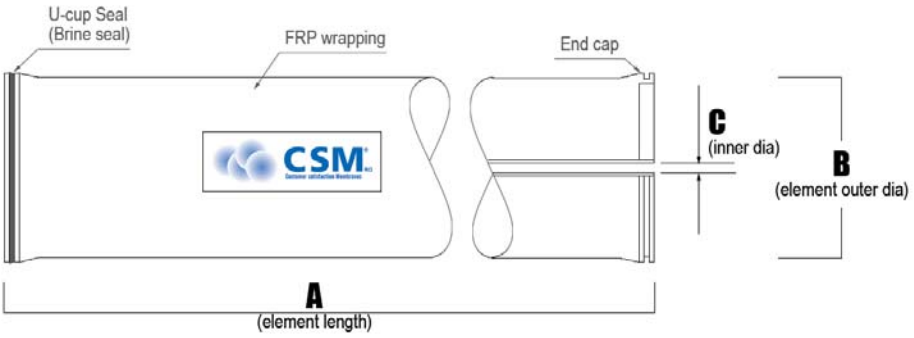
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 1,500 mg/L NaCl solution at 150 psig (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%
3. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
4. Effective membrane area may vary within 3 %.
5. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |



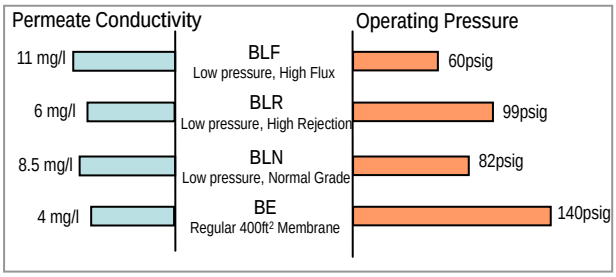

1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM low pressure BLN elements have similar capabilities to the brackish water membrane at low pressure condition, which can reduce the energy cost and capital costs for the high pressure pumps, plumbing and the pressure vessels.
- Salt rejection and specific permeate flux of BLN are between BLR and BLF products.

## Product Characteristics Comparison

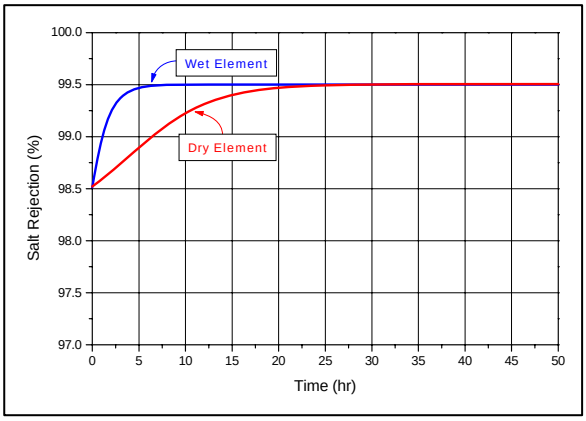
Comparison of CSM low pressure membranes with respect to permeate TDS and operating pressure under the same feed water condition (500 mg/l NaCl) and permeate flux (15 gfd) at 25℃ (recovery 15 %)




## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-BLR

*Low pressure RO membrane element with high salt rejection for brackish water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 9,000 GPD (34.0 $m^3$/day) |
| Stabilized Salt Rejection : | 99.6 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

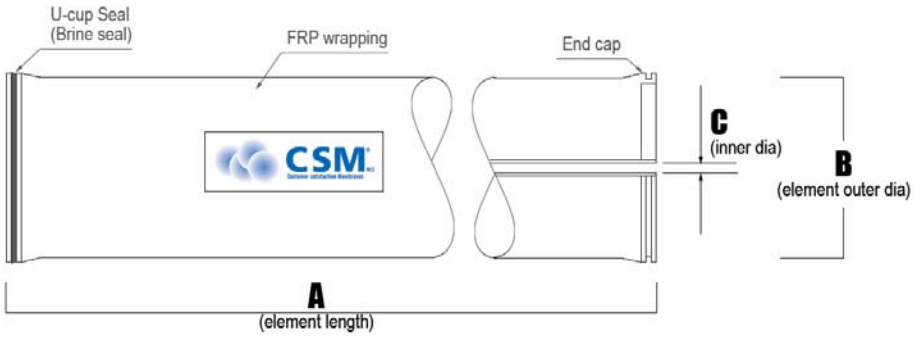
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 1,500 mg/L NaCl solution at 150 psig (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.5%
3. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
4. Effective membrane area may vary within 3 %.
5. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

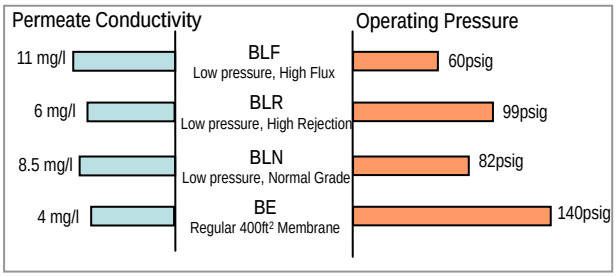
- CSM BLR element shows higher salt rejection and higher permeate flow at a lower pressure than regular brackish water membrane. It can produce higher quality of water using less energy and less capital cost for the high pressure pumps, plumbing and the pressure vessels than the regular membrane.
- More useful for high TDS feed water or for higher permeate quality.

# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

## Product Characteristics Comparison

Comparison of CSM low pressure membranes with respect to permeate TDS and operating pressure under the same feed water condition (500 mg/l NaCl) and permeate flux (15 gfd) at 25℃ (recovery 15 %)




## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.
-

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.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CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-BLF

*Ultra-low pressure RO membrane element for low TDS water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 11,500 GPD (43.5 $m^3$/day) |
| Stabilized Salt Rejection : | 99.2 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 500 mg/L NaCl solution at 100 psig (0.7 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%
3. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
4. Effective membrane area may vary within 3 %.
5. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

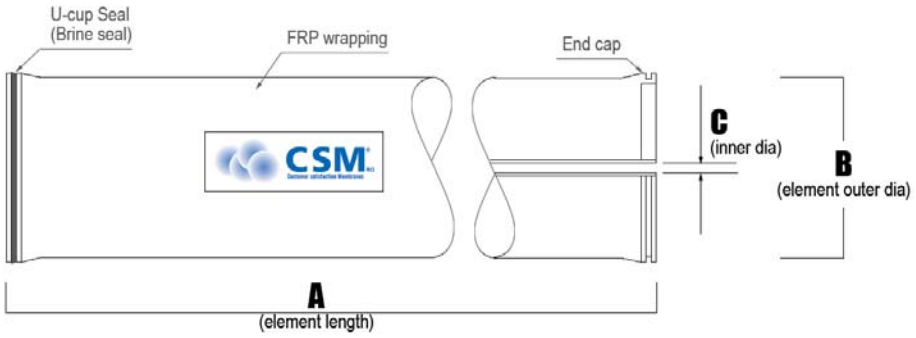
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 8.0 inch (203 mm)

C = 1.12 inch (28 mm)



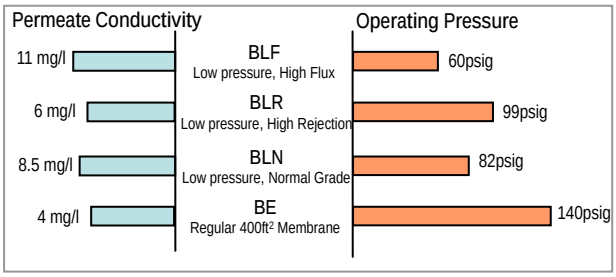

1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM ultra-low pressure BLF element produces high permeate flow at a very low pressure, which can reduce energy cost and capital costs for a high pressure pump, plumbing and pressure vessels.
- More useful when feed water TDS is low and high permeate quality is not required.

## Product Characteristics Comparison

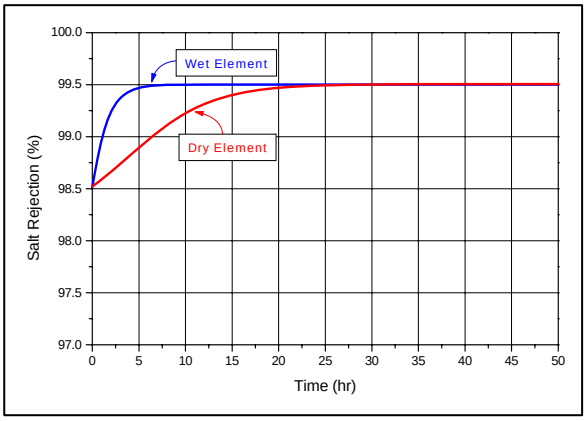
Comparison of CSM low pressure membranes with respect to permeate TDS and operating pressure under the same feed water condition (500 mg/l NaCl) and permeate flux (15 gfd) at 25℃ (recovery 15 %)




## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The Professional ***Reverse Osmosis Membrane Element*** was approved in the whole world.

# RE4040-BLN

*Low Pressure, Extended Effective Area, Brackish Water use*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 2,600 GPD (9.8 $m^3$/day) |
| Stabilized Salt Rejection : | 99.2 % |
| Effective Membrane Area : | 85 $ft^2$ (7.9 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 1,500 mg/L NaCl solution at 150 psig (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

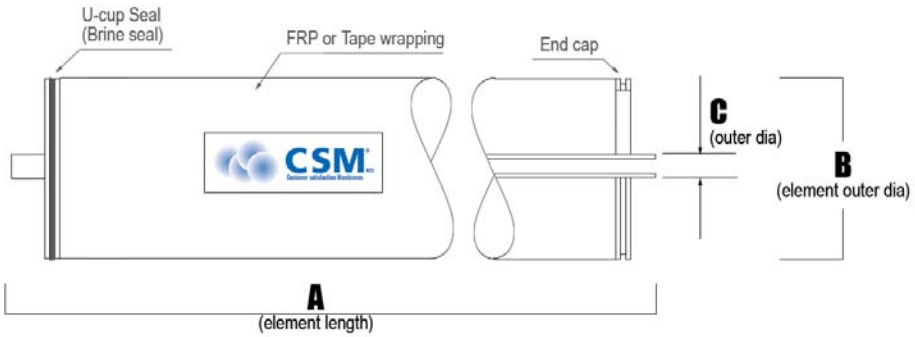
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 4.0 inch (102 mm)

C = 0.75 inch (19.1 mm)



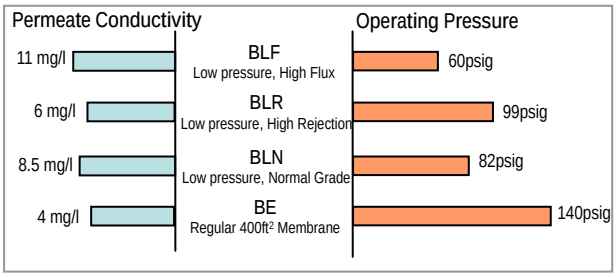

1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 4.0-inch (102 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM low pressure BLN elements have similar capabilities to the brackish water membrane at low pressure condition, which can reduce the energy cost and capital costs for high pressure pumps, plumbing and pressure vessels.
- Salt rejection and specific permeate flux of BLN are between BLR and BLF products.

## Product Characteristics Comparison

Comparison of CSM low pressure membranes with respect to permeate TDS and operating pressure under the same feed water condition (500 mg/l NaCl) and permeate flux (15 gfd) at 25℃ (recovery 15 %)




## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4040-BLR

*Low pressure RO membrane element with high salt rejection for brackish water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 1,900 GPD (7.2 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 85 $ft^2$ (7.9 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 1,500 mg/L NaCl solution at 150 psig (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.4%
3. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

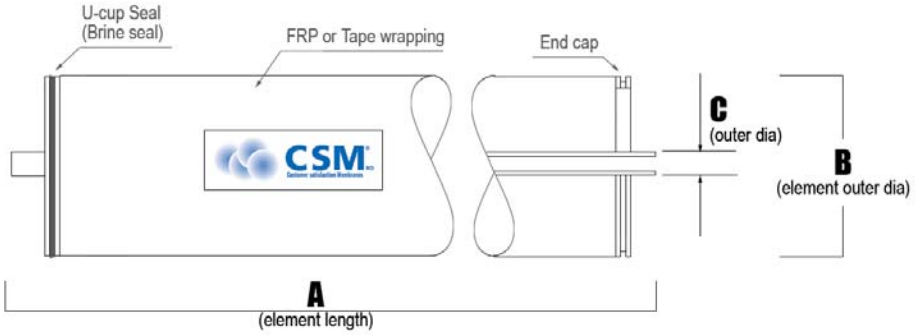
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 4.0 inch (102 mm)

C = 0.75 inch (19.1 mm)



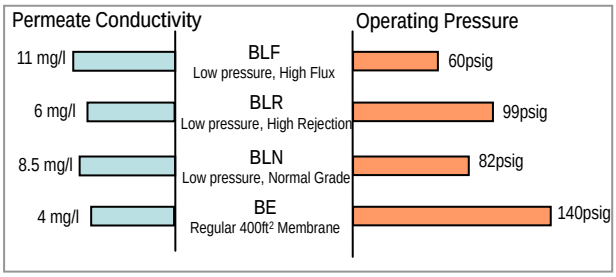

1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 4.0-inch (102 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM BLR element shows high salt rejection and high permeate flow at a lower pressure than regular brackish water membrane. It can produce higher quality of water using less energy and less capital cost for the high pressure pumps, plumbing and the pressure vessels than the regular membrane.
- More useful for high TDS feed water or for higher permeate quality.

## Product Characteristics Comparison

Comparison of CSM low pressure membranes with respect to permeate TDS and operating pressure under the same feed water condition (500 mg/l NaCl) and permeate flux (15 gfd) at 25℃ (recovery 15 %)




## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4040-BLF

*Ultra-low pressure RO membrane element for low TDS water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 2,500 GPD (9.5 $m^3$/day) |
| Stabilized Salt Rejection : | 99.2 % |
| Effective Membrane Area : | 85 $ft^2$ (7.9 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 500 mg/L NaCl solution at 100 psig (0.7 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

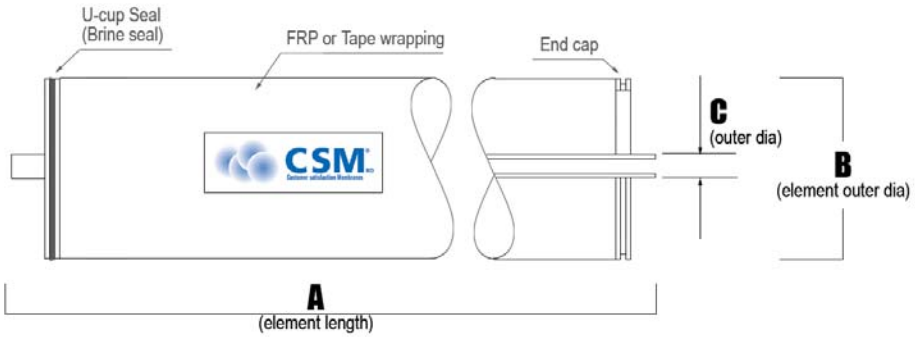
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 4.0 inch (1023 mm)

C = 0.75 inch (19.1 mm)



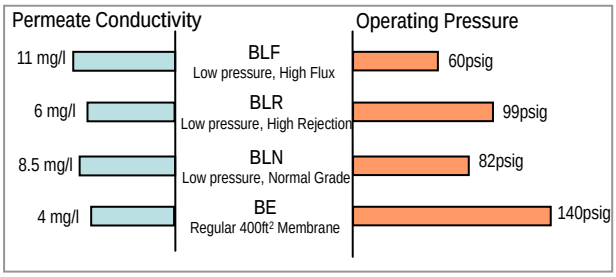

1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 4.0-inch (102 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM ultra-low pressure BLF element produces high permeate flow at a very low pressure, which can reduce energy cost and capital costs for a high pressure pump, plumbing and pressure vessels.
- More useful when feed water TDS is low and high permeate quality is not required.

## Product Characteristics Comparison

Comparison of CSM low pressure membranes with respect to permeate TDS and operating pressure under the same feed water condition (500 mg/l NaCl) and permeate flux (15 gfd) at 25℃ (recovery 15 %)




## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

# CSM Fouling Resistant RO Membrane Elements

| | |
|---|---|
| **RE8040-FE$^{n}$** | 8” in diameter X 40” in length, New FRM, Highly productive fouling resistant RO membrane element with extended area for brackish water and waste water reuse |
| **RE8040-FN** | 8” X 40”, Fouling resistant RO membrane element with a thick feed spacer for brackish water and waste water reuse |
| **RE8040-FN300** | 8” X 40”, Fouling resistant RO membrane element with a thick feed spacer and 300 ft$^2$ membrane area for brackish water and waste water reuse |
| **RE8040-FE** | 8” X 40”, Highly productive fouling resistant RO membrane element with extended area for brackish water and waste water reuse |
| **RE8040-FL** | 8” X 40”, Fouling resistant RO membrane element of low pressure grade for brackish water and waste water reuse |
| **RE8040-FD$^{n}$** | 8” X 40”, New FRM, Fouling resistant RO membrane element of low differential pressure for brackish water and waste water reuse |
| **RE8040-FD** | 8” X 40”, Fouling resistant RO membrane element of low differential pressure for brackish water and waste water reuse |
| **RE4040-FE** | 4” X 40”, High productive fouling resistant RO membrane element with extended area for brackish water and waste water reuse |
| **RE4040-FL** | 4” X 40”, Fouling resistant RO membrane element of low pressure grade for brackish water and waste water reuse |

# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-FE$^n$

*High productive new fouling resistant RO membrane element with extended are for brackish water and waste water reuse*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 11,000 GPD (41.6 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%.
3. Permeate Flow rate for individual elements may vary but will be no more than 10 below the value shown.
4. Effective membrane area may vary within 3 %.
5. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

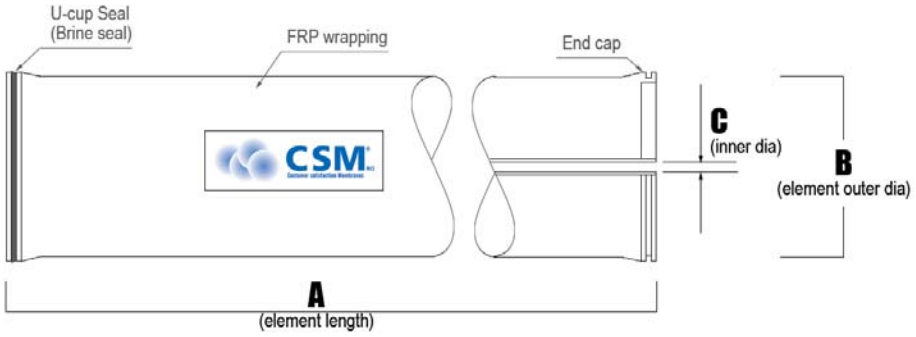
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Close to Neutral |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 8.0 inch (203 mm)

C = 1.12 inch (28 mm)

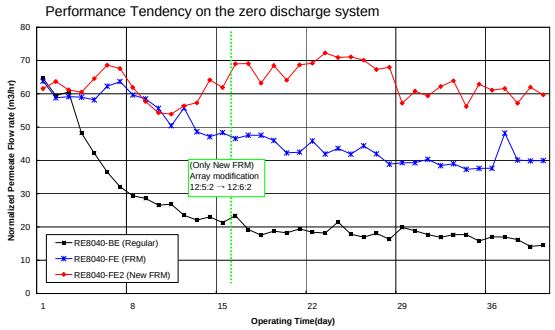



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM FE$^n$ element provides an excellent way to treat a feed water having relatively high fouling potential due to the remaining colloidal, biological and organic fouling agents even after controlled pretreatment.
- CSM FE$^n$ element has more fouling resistant property than CSM FE
- CSM FE$^n$ element has a high durability against CIP chemicals to sustain fouling resistant performance even after periodic CIP in a long term operation

## Fouling Resistance Characteristics

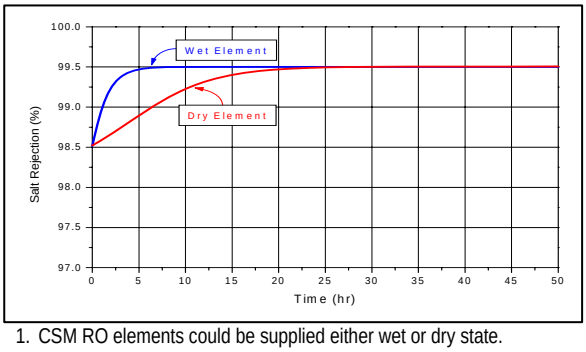



Fouling resistance characteristics of regular, FRM, and new FRM membranes tested under conditions of zero liquid discharge system. CSM New FRM maintains nearly the initial flux over 30 days, while FRM loses 30 % initial flux and the regular membrane loses 70 % of the initial flux.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry state.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-FN

*Fouling resistant RO membrane element with a thick feed spacer for brackish water and waste water reuse*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 10,000 GPD (37.9 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 365 $ft^2$ (33.9 $m^2$) |

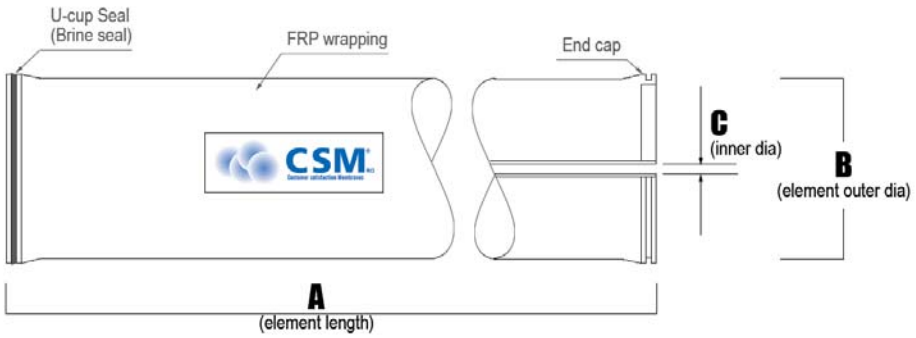
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%.
3. Permeate Flow rate for individual elements may vary but will be no more than 10 below the value shown.
4. Effective membrane area may vary within 3 %.
5. Thicker Feed spacer (32 mil) is used.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Close to Neutral |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |

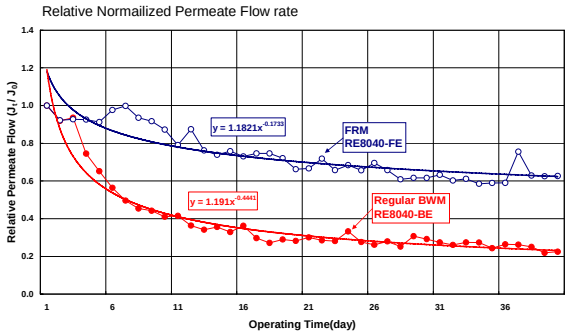



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM FN element provides an excellent way to treat a feed water which might still have fouling potential fouling agents
- CSM FN element has a high durability against CIP chemicals so that the fouling resistant performance can be sustained after periodic CIP in a long term operation.
- CSM FN element has a thick feed spacer to minimize membrane fouling due to the deposit of particles through creating more turbulent flow

## Fouling Resistance Characteristics

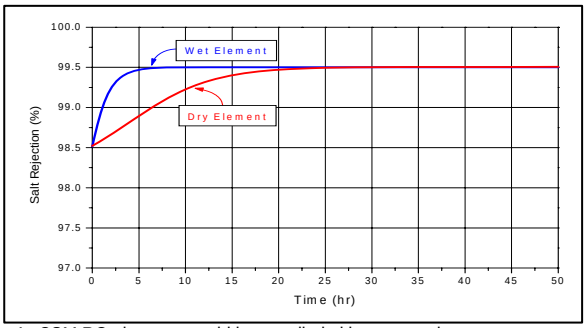



The flux decline of CSM FRM is only half of that of the general brackish water RO membrane under the condition of zero liquid discharge system.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry state.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-FN300

*Fouling resistant RO membrane element with thick feed spacer for brackish water and waste water reuse*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 9,000 GPD (34.1 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 300 $ft^2$ (27.9 $m^2$) |

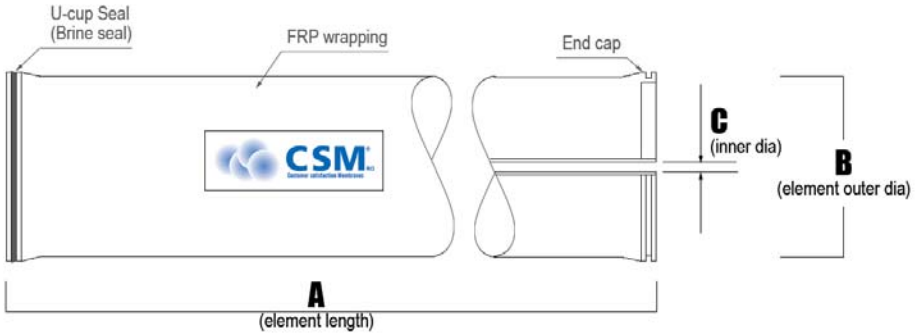
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%.
3. Permeate Flow rate for individual elements may vary but will be no more than -10 above the value shown.
4. Effective membrane area may vary within ±3 %.
5. Thicker Feed spacer (46 mil) is used.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Close to Neutral |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |

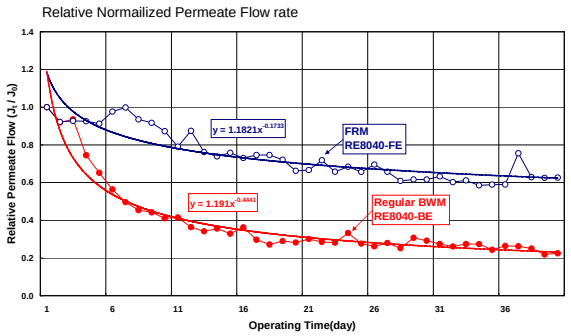



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM FN element provides an excellent way to treat a feed water which might still have fouling potential fouling agents
- CSM FN element has a high durability against CIP chemicals so that the fouling resistant performance can be sustained after periodic CIP in a long term operation.
- CSM FN element has a thick feed spacer to minimize membrane fouling due to the deposit of particles from depositing on the membrane surface

## Fouling Resistance Characteristics from zero discharge RO system

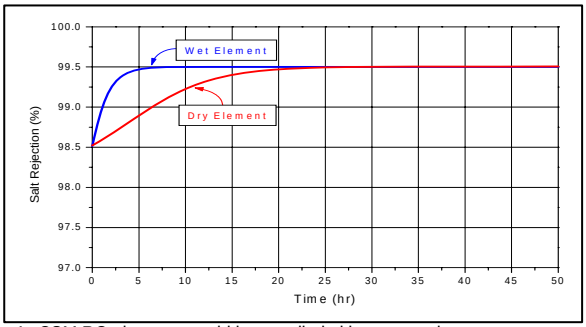



The flux decline of CSM FRM is only half of that of the general brackish water RO membrane under the condition of zero liquid discharge system.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is exposed to air, a new protection solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry state.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI of SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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Website http://www.saehancsm.com

# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-FE

*Highly productive fouling resistant RO membrane element with extended membrane area for brackish water and waste water reuse*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 11,000 GPD (41.6 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%.
3. Permeate Flow rate for individual elements may vary but will be no more than 10 below the value shown.
4. Effective membrane area may vary within 3 %.
5. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

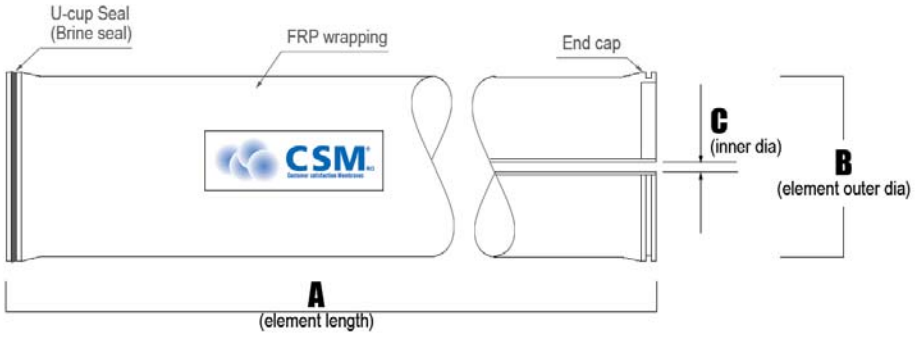
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Close to Neutral |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 8.0 inch (203 mm)

C = 1.12 inch (28 mm)

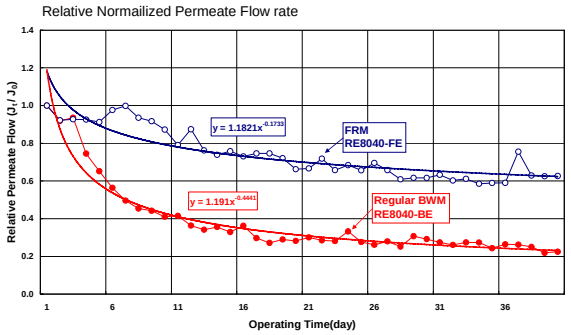



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM FE element provides an excellent way to treat a feed water having relatively high fouling potential due to the remaining colloidal, biological and organic fouling agents even after controlled pretreatment.
- CSM FE element has a high durability against CIP chemicals to sustain fouling resistant performance even after periodic CIP in a long term operation

## Fouling Resistance Characteristics

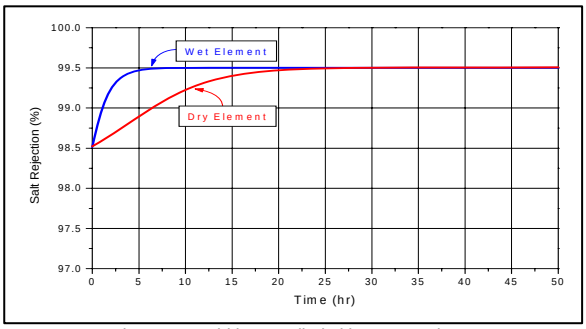



The flux decline of CSM FRM is only half of that of the general brackish water RO membrane under the condition of zero liquid discharge system.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## The Stabilization of salt rejection Characteristics




1. CSM RO elements could be supplied either wet or dry state.
2. The stabilization of system rejection largely depends on the feed water conditions and operating parameters

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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Website http://www.saehancsm.com

# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-FL

*Fouling resistant RO membrane element of low pressure grade for brackish water and waste water reuse*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 9,000 GPD (34.0 $m^3$/day) |
| Stabilized Salt Rejection : | 99.0 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 1,500 mg/L NaCl solution at 150 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 98.5%.
3. Permeate Flow rate for individual elements may vary but will be no more than 10 below the value shown.
4. Effective membrane area may vary within 3 %.
5. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

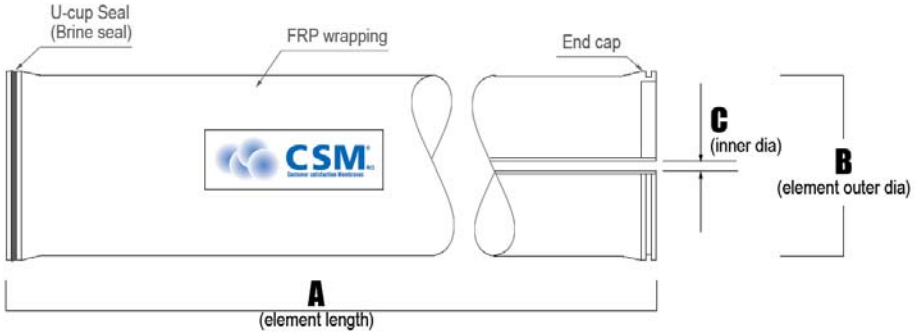
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Close to Neutral |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 8.0 inch (203 mm)

C = 1.12 inch (28 mm)

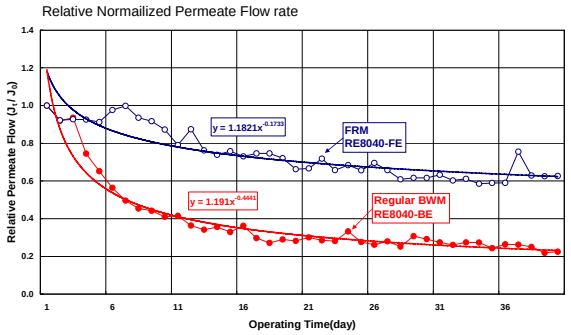



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM FL element provides an excellent way to treat a feed water which might still have fouling potential fouling agents
- CSM FL element has a high durability against CIP chemicals so that the fouling resistant performance can be sustained after periodic CIP in a long term operation.
- CSM FL element has a flow rate similar to CSM BLN at low pressure and in addition fouling resistant property.

## Fouling Resistance Characteristics




The flux decline of CSM FRM is only half of that of the general brackish water RO membrane under the condition of zero liquid discharge system.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# PRODUCT SPECIFICATION SHEET

CSM®
Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-FD$^n$

*New fouling resistant RO membrane element of low differential pressure with a thick feed spacer for waste water reuse*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 10,000 GPD (37.9 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 365 $ft^2$ (33.9 $m^2$) |

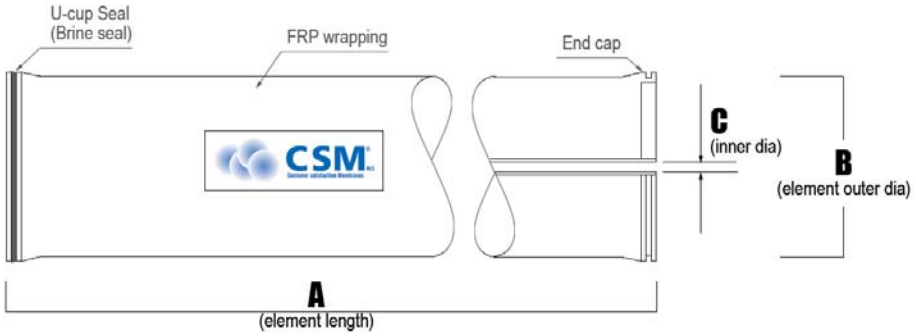
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%.
3. Permeate Flow rate for individual elements may vary but will be no more than 10 below the value shown.
4. Effective membrane area may vary within 3 %.
5. Thicker Feed spacer (32 mil) is used.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Close to Neutral |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |

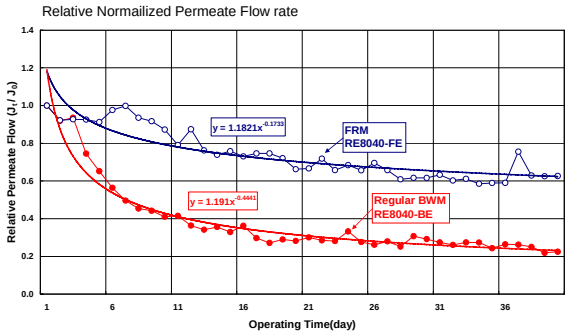



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM FD$^n$ element provides an excellent way to treat a feed water having relatively high fouling potential due to the remaining colloidal, biological and organic fouling agents even after controlled pretreatment.
- CSM FD$^n$ element has more fouling resistant property than CSM FD
- CSM FD$^n$ element can be used for treating a feed water of high fouling potential due to the presence of heavy colloidal particles.

## Fouling Resistance Characteristics

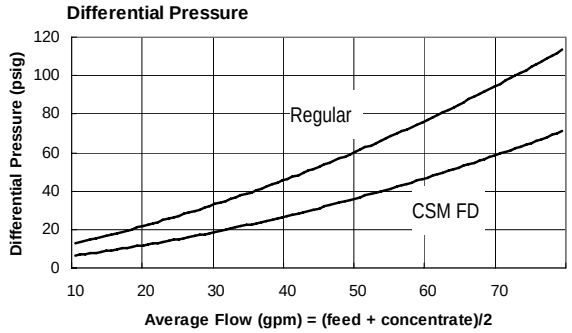



The flux decline of CSM FRM is only half of that of the general brackish water RO membrane under the condition of zero liquid discharge system.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Differential Pressure Comparing between Regular element and CSM FD




1. CSM FD shows less differential pressure than the regular elements as shown in the above graph

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-FD

*Fouling resistant RO membrane element of low differential pressure with a thick feed spacer for waste water reuse*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 10,000 GPD (37.9 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 365 $ft^2$ (33.9 $m^2$) |

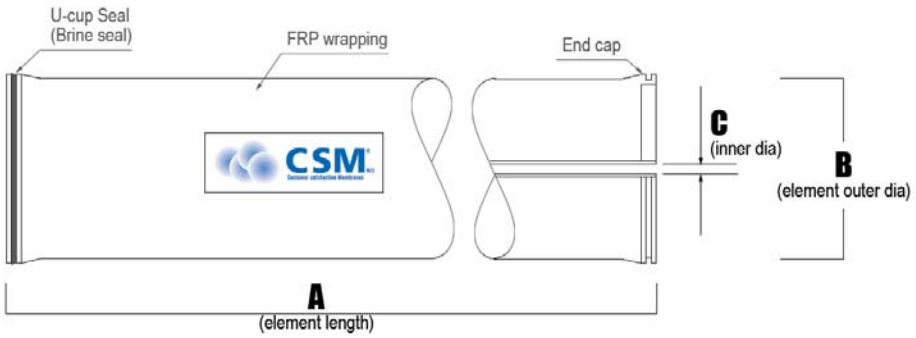
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%.
3. Permeate Flow rate for individual elements may vary but will be no more than 10 below the value shown.
4. Effective membrane area may vary within 3 %.
5. Thicker Feed spacer (32 mil) is used.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Close to Neutral |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |

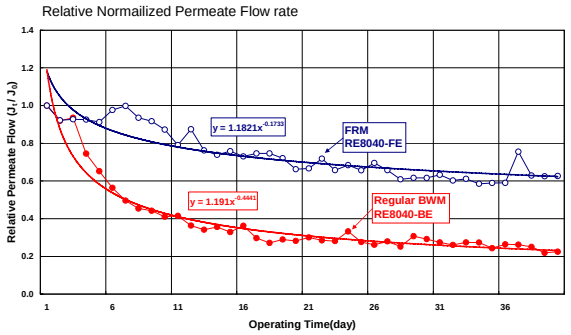



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM FD element provides an excellent way to treat a feed water which might still have fouling potential fouling agents.
- CSM FD element has a high durability against CIP chemicals so the fouling resistance performance can be sustained after periodic CIP in the long term operation.
- CSM FD element can be used for treating a feed water of high fouling potential due to the presence of heavy colloidal particles.

## Fouling Resistance Characteristics

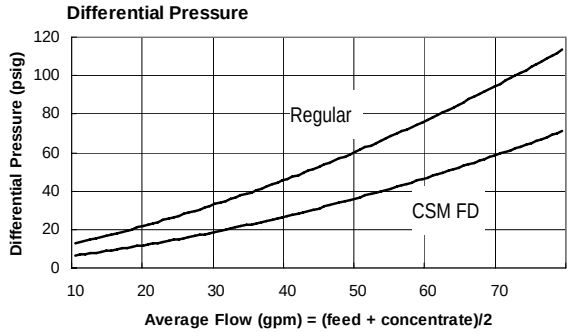



The flux decline of CSM FRM is only half of that of the general brackish water RO membrane under the condition of zero liquid discharge system.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Differential Pressure Comparing between Regular element and CSM FD




1. CSM FD shows less differential pressure than the regular elements as shown in the above graph

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4040-FE

*Highly productive fouling resistant RO membrane element with extended membrane area for brackish water and waste water reuse*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 2,100 GPD (7.9 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 85 $ft^2$ (7.9 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

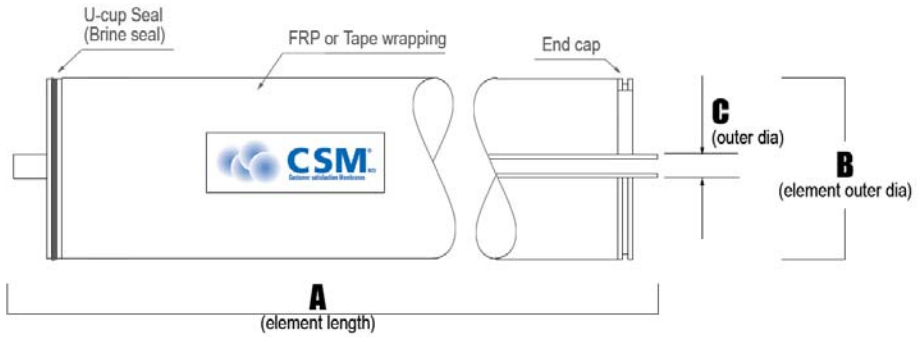
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Close to Neutral |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 4.0 inch (102 mm)

C = 0.75 inch (19.1 mm)

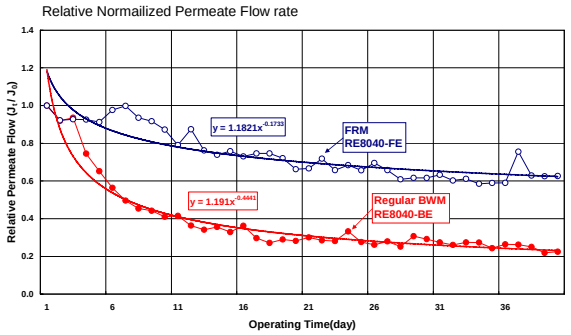



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM FE element provides an excellent way to treat a feed water which might still have fouling potential fouling agents.
- CSM FE element has a high durability against CIP chemicals so the fouling resistance performance can be sustained after periodic CIP in the long term operation.\

## Fouling Resistance Characteristics




The flux decline of CSM FRM is only half of that of the general brackish water RO membrane under the condition of zero liquid discharge system.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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Email wankk@saehan.co.kr
Website http://www.saehancsm.com

# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4040-FL

*Fouling resistant RO membrane element of low pressure grade for brackish water and waste water reuse*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 1,900 GPD (7.2 $m^3$/day) |
| Stabilized Salt Rejection : | 99.0 % |
| Effective Membrane Area : | 85 $ft^2$ (7.9 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 1,500 mg/L NaCl solution at 150 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

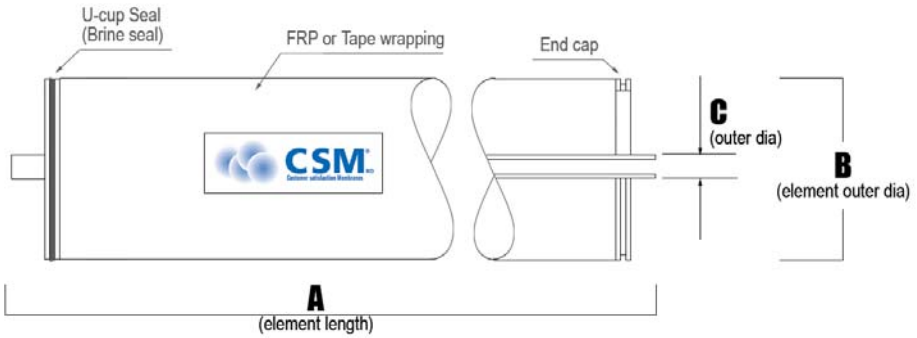
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Close to Neutral |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 4.0 inch (102 mm)

C = 0.75 inch (19.1 mm)

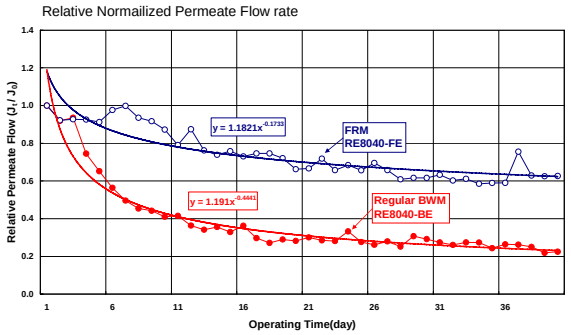



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM FL element provides an excellent way to treat a feed water which might still have fouling potential fouling agents.
- CSM FL element has a high durability against CIP chemicals so the fouling resistance performance can be sustained after periodic CIP in the long term operation.
- CSM FL element has a flow rate similar to CSM BL element at low pressure.

## Fouling Resistance Characteristics




The flux decline of CSM FRM is only half of that of the general brackish water RO membrane under the condition of zero liquid discharge system.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 °F (45 °C) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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Website http://www.saehancsm.com

CSM® Customer Satisfaction Membrane

# CSM Sea Water RO Membrane Elements

| | |
|---|---|
| **RE8040-SN** | 8” in diameter X 40” in length, Normal grade RO membrane element for sea water and high salinity well water |
| **RE8040-SR** | 8” X 40”, High rejection RO membrane element for sea water and high salinity well water |
| **RE8040-SR400** | 8” X 40”, High rejection RO membrane element with 400 $ft^2$ membrane area for sea water and high salinity well water |
| **RE8040-SH** | 8” X 40”, Ultra-high rejection RO membrane element for sea water and high salinity well water |
| **RE8040-SHN** | 8” X 40”, High productivity, Ultra-high rejection RO membrane element for sea water and high salinity well water |
| **RE8040-SHN400** | 8” X 40”, High productivity Ultra-high rejection RO membrane element with 400 $ft^2$ membrane area for sea water and high salinity well water |
| **RE4040-SR** | 4” X 40”, High rejection RO membrane element for sea water and high salinity well water |
| **RE4040-SH** | 4” X 40”, Ultra-high rejection RO membrane element for sea water and high salinity well water |
| **RE4021-SR** | 4” X 21”, High rejection RO membrane element for sea water and high salinity well water |
| **RE2540-SR** | 2.5” X 40”, High rejection RO membrane element for sea water and high salinity well water |
| **RE2521-SR** | 2.5” X 21”, High rejection RO membrane element for sea water and high salinity well water |

# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-SN

*Normal grade RO membrane element for sea water and high salinity well water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 6,000 GPD (22.7 $m^3$/day) |
| Stabilized Salt Rejection : | 99.2 % |
| Effective Membrane Area : | 370 $ft^2$ (34.4 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 32,000 mg/L NaCl solution at 800 psig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%.
3. Boron rejection is 88.0 % at pH 8.0 and 5 mg/L boron feed with the test condition as above note 1.
4. Permeate Flow rate for individual elements may vary but will be no more than 10 below the value shown.
5. Effective membrane area may vary within 5 %.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

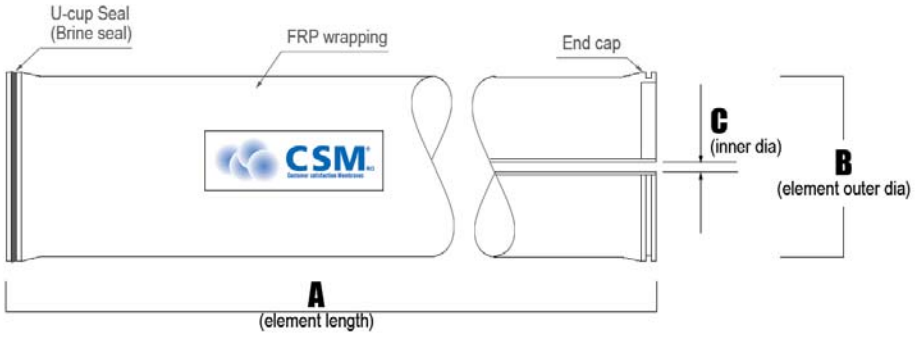
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 8.0 inch (203 mm)

C = 1.12 inch (28 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM SN element has good performance in terms of salt rejection and permeate flow rate, suitable for normal desalination process.
- CSM SN element has a high chemical durability which prevents declining of its performance after CIP.

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.41 Mpa) |
| Max. Operating pressure | 1,200 psi (8.27 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-SR

*High rejection RO membrane element for sea water and high salinity well water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 6,000 GPD (22.7 $m^3$/day) |
| Stabilized Salt Rejection : | 99.6 % |
| Effective Membrane Area : | 370 $ft^2$ (34.4 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 32,000 mg/L NaCl solution at 800 psig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.5%.
3. Boron rejection is 90.0 % at pH 8.0 and 5 mg/L boron feed with the test condition as above note 1.
4. Permeate Flow rate for individual elements may vary but will be no more than 15 below the value shown.
5. Effective membrane area may vary within 5 %.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

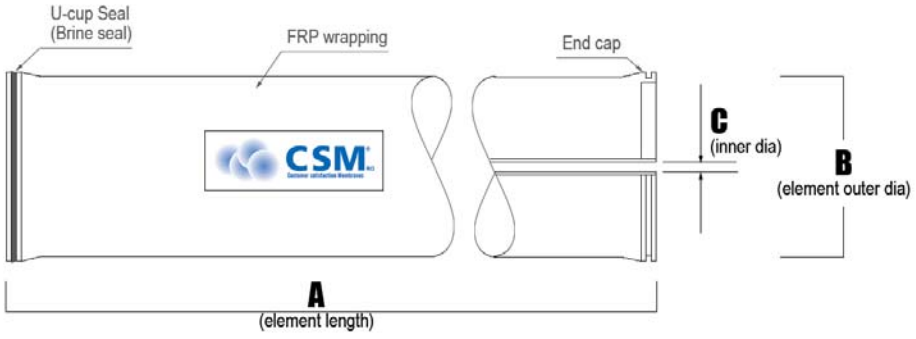
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 8.0 inch (203 mm)

C = 1.12 inch (28 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM SR element shows higher salt rejection than CSM SN, suitable for normal desalination process.
- CSM SR element has a high chemical durability which prevents declining of its performance after CIP.

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.41 Mpa) |
| Max. Operating pressure | 1,200 psi (8.27 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-SR400

*High rejection RO membrane element with extended area for sea water and high salinity well water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 6,500 GPD (24.6 $m^3$/day) |
| Stabilized Salt Rejection : | 99.6 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

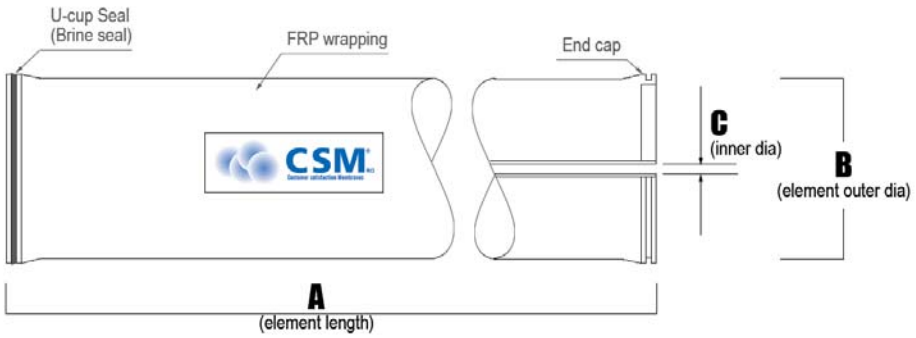
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 32,000 mg/L NaCl solution at 800 psig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.5%.
3. Boron rejection is 90.0 % at pH 8.0 and 5 mg/L boron feed with the test condition as above note 1.
4. Permeate Flow rate for individual elements may vary but will be no more than 15 below the value shown.
5. Effective membrane area may vary within 5 %.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM SR element shows higher salt rejection than CSM SN, suitable for normal desalination process.
- CSM SR400 element with extended membrane area shows higher flow rate than CSM SR, helpful in reducing total number of elements for a specified total permeate quantity. The high productivity of CSM SR400 due to the extended area also enables the element operable at a lower pressure than CSM SR for a specified amount of product water and thus the rate of membrane fouling can remain low.
- CSM SR element has a high chemical durability which prevents declining of its performance after CIP.

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.41 Mpa) |
| Max. Operating pressure | 1,200 psi (8.27 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-SH

*Ultra-high rejection RO membrane element for sea water and high salinity well water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 4,500 GPD (17.0 $m^3$/day) |
| Stabilized Salt Rejection : | 99.75 % |
| Effective Membrane Area : | 370 $ft^2$ (34.4 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 32,000 mg/L NaCl solution at 800 psig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.6%.
3. Boron rejection is 92.0 % at pH 8.0 and 5 mg/L boron feed with the test condition as above note 1.
4. Permeate Flow rate for individual elements may vary but will be no more than 15 below the value shown.
5. Effective membrane area may vary within 5 %.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

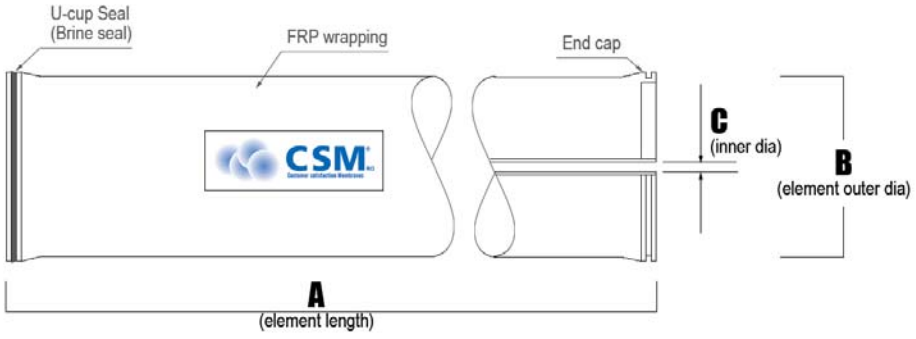
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 8.0 inch (203 mm)

C = 1.12 inch (28 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM SH showing ultra-high salt rejection can be used in seawater desalination under more severe condition such as higher salinity than 35000 mg/L, higher feed water temperature than 25 ℃ and higher recovery ratio than 40 %. However, the element is more suitable for replacing old elements in existing systems due to its lower permeate flow.
- CSM SH element has a high chemical durability which prevents declining of its performance after CIP.

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.41 Mpa) |
| Max. Operating pressure | 1,200 psi (8.27 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-SHN

*Ultra-high rejection RO membrane element for sea water and high salinity well water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 6,000 GPD (22.7 $m^3$/day) |
| Stabilized Salt Rejection : | 99.75 % |
| Effective Membrane Area : | 370 $ft^2$ (34.4 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 32,000 mg/L NaCl solution at 800 psig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.6%.
3. Boron rejection is 92.0 % at pH 8.0 and 5 mg/L boron feed with the test condition as above note 1.
4. Permeate Flow rate for individual elements may vary but will be no more than 15 below the value shown.
5. Effective membrane area may vary within 5 %.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

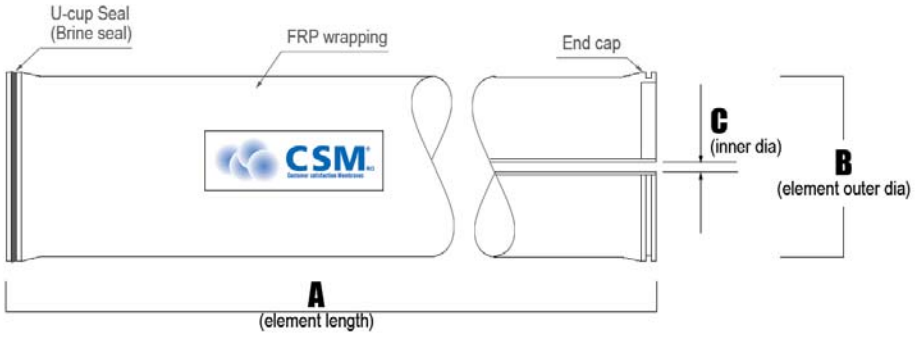
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 8.0 inch (203 mm)

C = 1.12 inch (28 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM SHN showing ultra-high salt rejection can be used in seawater desalination under more severe condition such as higher salinity than 35000 mg/L, higher feed water temperature than 25 ℃ and higher recovery ratio than 40 %. CSM SHN can also be useful for one (1) pass desalination RO system.
- CSM SHN element has a high chemical durability which prevents declining of its performance after CIP.

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.41 Mpa) |
| Max. Operating pressure | 1,200 psi (8.27 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# RE8040-SHN400

*Ultra-high rejection RO membrane element with extended area for sea water and high salinity well water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 6,500 GPD (24.6 $m^3$/day) |
| Stabilized Salt Rejection : | 99.75 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

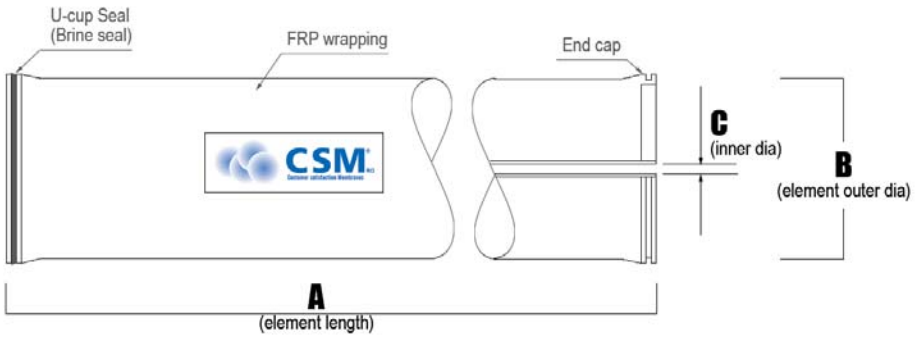
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 32,000 mg/L NaCl solution at 800 psig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.6%.
3. Boron rejection is 92.0 % at pH 8.0 and 5 mg/L boron feed with the test condition as above note 1.
4. Permeate Flow rate for individual elements may vary but will be no more than 15 below the value shown.
5. Effective membrane area may vary within 5 %.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM SHN400 with extended membrane area shows higher permeate flow than CSM SHN with ultra-high salt rejection, and thus can be used at a lower operating pressure to save energy or in reducing total number of elements to save capital cost in addition to an advantage in seawater desalination under more severe conditions such as higher TDS than 35000 mg/L, higher feed water temperature than 25 ℃ and higher recovery ratio than 40 %.
- CSM SHN element has a high chemical durability which prevents declining of its performance after CIP.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.41 Mpa) |
| Max. Operating pressure | 1,200 psi (8.27 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM®
Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4040-SR

*High rejection RO membrane element for sea water and high salinity well water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 1,200 GPD (4.5 $m^3$/day) |
| Stabilized Salt Rejection : | 99.6 % |
| Effective Membrane Area : | 74 $ft^2$ (6.9 $m^2$) |

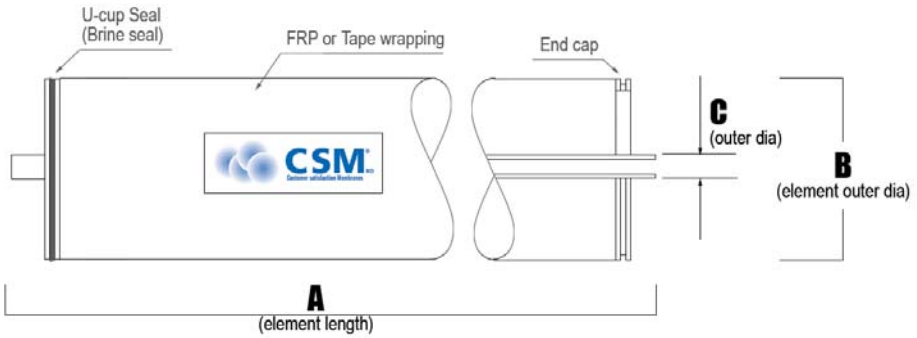
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 32,000 mg/L NaCl solution at 800 psig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)
B = 4.0 inch (102 mm)
C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM SR element shows higher salt rejection than CSM SN, suitable for normal desalination process.
- CSM SR element has a high chemical durability which prevents declining of its performance after CIP.

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.41 Mpa) |
| Max. Operating pressure | 1,200 psi (8.27 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4040-SH

*Ultra-high rejection RO membrane element for sea water and high salinity well water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 1,000 GPD (3.8 $m^3$/day) |
| Stabilized Salt Rejection : | 99.75 % |
| Effective Membrane Area : | 74 $ft^2$ (6.9 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 32,000 mg/L NaCl solution at 800 psig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Boron rejection is 92.0 % at pH 8.0 and 5 mg/L boron feed with the test condition as above note 1.
3. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

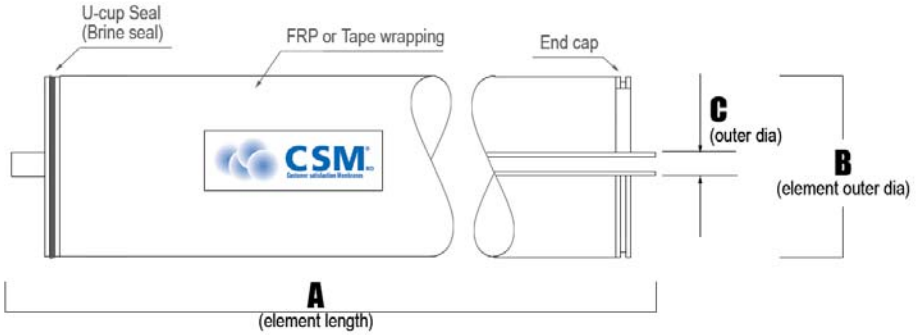
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 4.0 inch (102 mm)

C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM SH showing ultra-high salt rejection can be used in seawater desalination under more severe condition such as higher salinity than 35000 mg/L, higher feed water temperature than 25 ℃ and higher recovery ratio than 40 %. However the element is more suitable for replacing old elements in the existing system due to its lower permeate flow.
- CSM SH element has a high chemical durability which prevents declining of its performance after CIP.

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.41 Mpa) |
| Max. Operating pressure | 1,200 psi (8.27 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE4021-SR

*High rejection RO membrane element for sea water and high salinity well water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 600 GPD (2.3 $m^3$/day) |
| Stabilized Salt Rejection : | 99.6 % |
| Effective Membrane Area : | 35 $ft^2$ (3.3 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 32,000 mg/L NaCl solution at 800 psig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

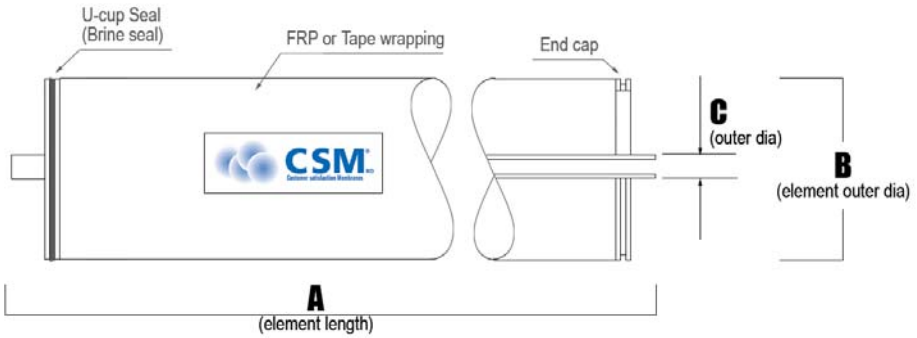
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

A = 21 inch (533 mm)

B = 4.0 inch (102 mm)

C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM SR element shows higher salt rejection than CSM SN, suitable for normal desalination process.
- CSM SR element has a high chemical durability which prevents declining of its performance after CIP.

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.41 Mpa) |
| Max. Operating pressure | 1,200 psi (8.27 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE2540-SR

*High rejection RO membrane element for sea water and high salinity well water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 500 GPD (1.9 $m^3$/day) |
| Stabilized Salt Rejection : | 99.6 % |
| Effective Membrane Area : | 24 $ft^2$ (2.2 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 32,000 mg/L NaCl solution at 800 psig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

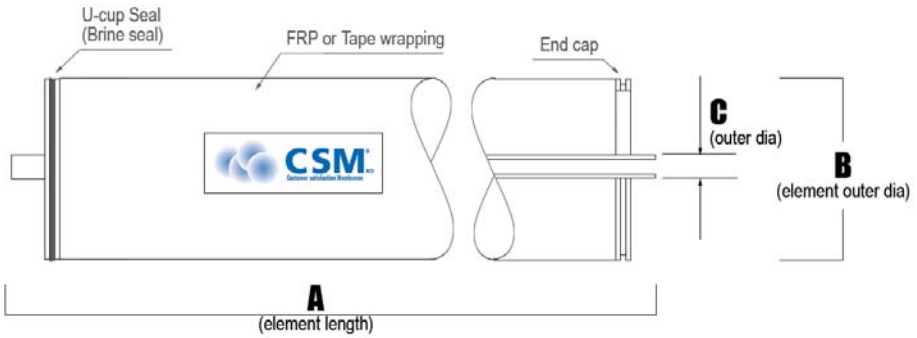
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)

B = 2.5 inch (64 mm)

C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM SR element shows higher salt rejection than CSM SN, suitable for normal desalination process.
- CSM SR element has a high chemical durability which prevents declining of its performance after CIP.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.41 Mpa) |
| Max. Operating pressure | 1,200 psi (8.27 MPa) |
| Max. Feed flow rate | 6 gpm (1.36 $m^3$/hr) |
| Min. Concentrate flow rate | 1 gpm (0.23 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE2521-SR

*High rejection RO membrane element for sea water and high salinity well water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 225 GPD (0.85 $m^3$/day) |
| Stabilized Salt Rejection : | 99.6 % |
| Effective Membrane Area : | 12 $ft^2$ (1.1 $m^2$) |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 32,000 mg/L NaCl solution at 800 psig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

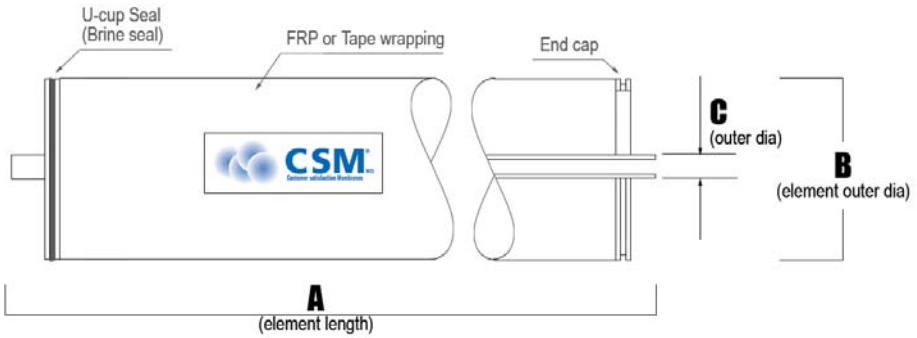
| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

A = 21 inch (533 mm)

B = 2.5 inch (64 mm)

C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM SR element shows higher salt rejection than CSM SN, suitable for normal desalination process.
- CSM SR element has a high chemical durability which prevents declining of its performance after CIP.

CSM® Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.41 Mpa) |
| Max. Operating pressure | 1,200 psi (8.27 MPa) |
| Max. Feed flow rate | 6 gpm (1.36 $m^3$/hr) |
| Min. Concentrate flow rate | 1 gpm (0.23 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Chlorine concentration | < 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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Website http://www.saehancsm.com

PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

# CSM Ultrapure Water RO Membrane Elements

| | |
|---|---|
| **RE8040-UE** | 8” in diameter X 40” in length, Normal grade RO membrane element for ultrapure water |
| **RE8040-HUE440** | 8” X 40”, High TOC rejection RO membrane element with 440 $ft^2$ membrane area for ultrapure water |
| **RE8040-HUE** | 8” X 40”, High TOC rejection RO membrane element for ultrapure water |
| **RE8040-UL** | 8” X 40”, Low pressure RO membrane element for ultrapure water |

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CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# RE8040-UE

*Normal grade RO membrane element for ultrapure water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 9,000 GPD (34.1 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

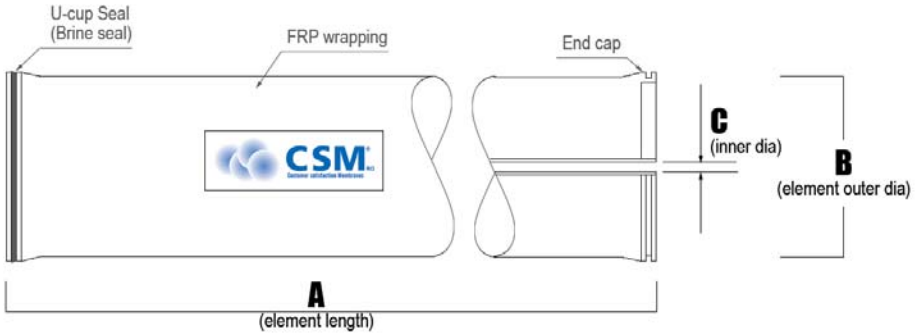
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%
3. IPA rejection is 95.0% after 2 hours of operation at the following test condition; 1,000 mg/L IPA solution at 225 psig (1.5 MPa) applied pressure, 15% recovery, 77 °F (25 °C) and pH 6.5~7.0.
4. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
5. Effective membrane area may vary within 3 %.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |

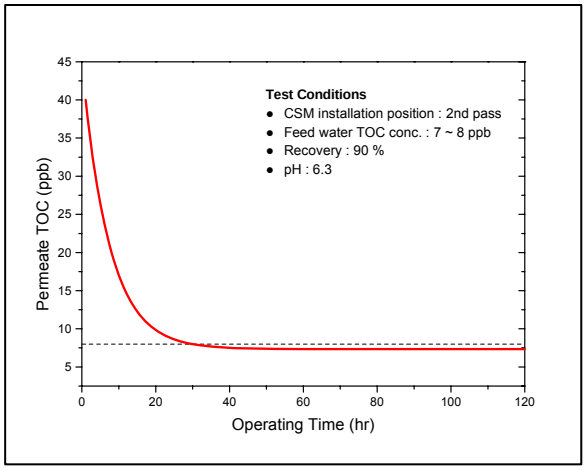



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM UE element has excellent characteristics such as high TOC rejection, low TOC extractable from element and low TOC rinse down time.

## The Rinse Down Time Characteristics




TOC reduction in CSM UPW products used in the 2nd pass ultrapure water system. Rinse down time may vary according to the feed water conditions.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.
-

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# RE8040-HUE440

*High TOC rejection RO membrane element with high extended area for ultrapure water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 10,000 GPD (37.9 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 440 $ft^2$ (40.9 $m^2$) |

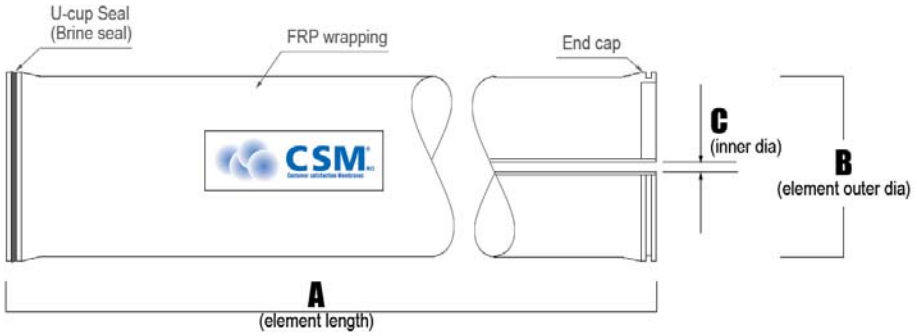
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%
3. IPA rejection is 96.0% after 2 hours of operation at the following test condition; 1,000 mg/L IPA solution at 225 psig (1.5 MPa) applied pressure, 15% recovery, 77 °F (25 °C) and pH 6.5~7.0.
4. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
5. Effective membrane area may vary within 3 %.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |

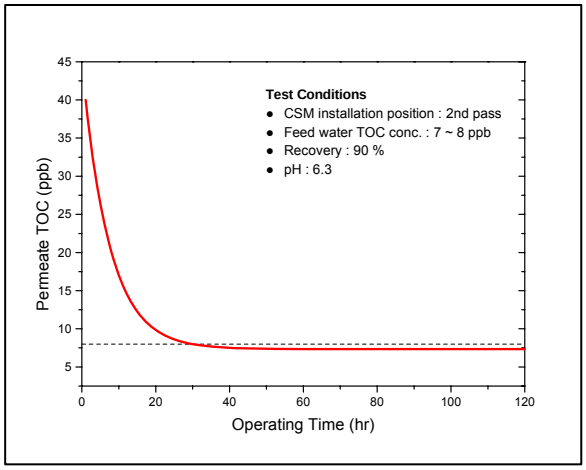



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM HUE element has excellent characteristics such as high TOC rejection, low TOC extractable from element and low TOC rinse down time.
- CSM HUE440 element with extended membrane area shows higher TOC rejection than CSM UE element in treating a feed water of low TOC (less than 100 ppb)
- CSM HUE element has a fouling resistant property similar to CSM FRM.

## The Rinse Down Time Characteristics




TOC reduction in CSM UPW products used in the 2nd pass ultrapure water system. Rinse down time may vary according to the feed water conditions.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# RE8040-HUE

*High TOC rejection RO membrane element for ultrapure water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 9,000 GPD (34.1 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

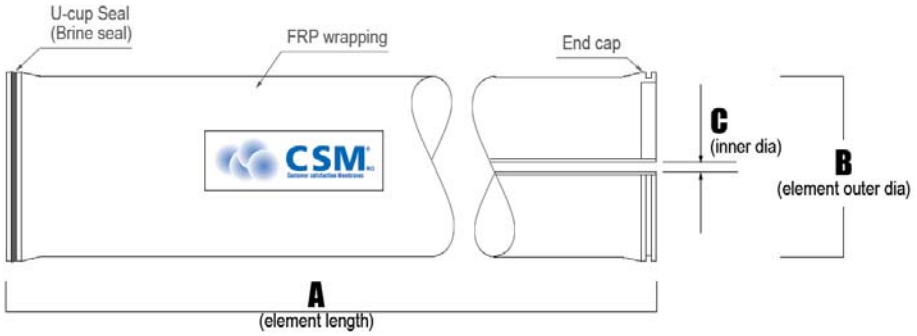
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 2,000 mg/L NaCl solution at 225 psig (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 99.0%
3. IPA rejection is 96.0% after 2 hours of operation at the following test condition; 1,000 mg/L IPA solution at 225 psig (1.5 MPa) applied pressure, 15% recovery, 77 °F (25 °C) and pH 6.5~7.0.
4. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
5. Effective membrane area may vary within 3 %.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |

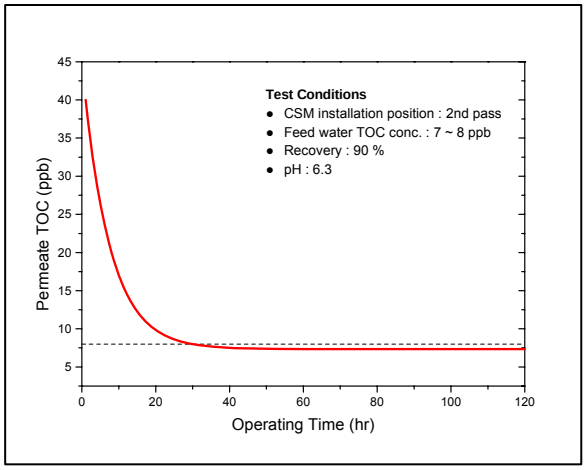



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM HUE element has excellent characteristics such as high TOC rejection, low TOC extractable from element and low TOC rinse down time.
- CSM HUE element shows higher TOC rejection than CSM UE element in treating a feed water of low TOC (less than 100 ppb)
- CSM HUE element has a fouling resistant property similar to CSM FRM.

## The Rinse Down Time Characteristics




TOC reduction in CSM UPW products used in the 2nd pass ultrapure water system. Rinse down time may vary according to the feed water conditions.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# RE8040-UL

*Low pressure RO membrane element for ultrapure water*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate : | 10,000 GPD (37.9 $m^3$/day) |
| Stabilized Salt Rejection : | 99.5 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

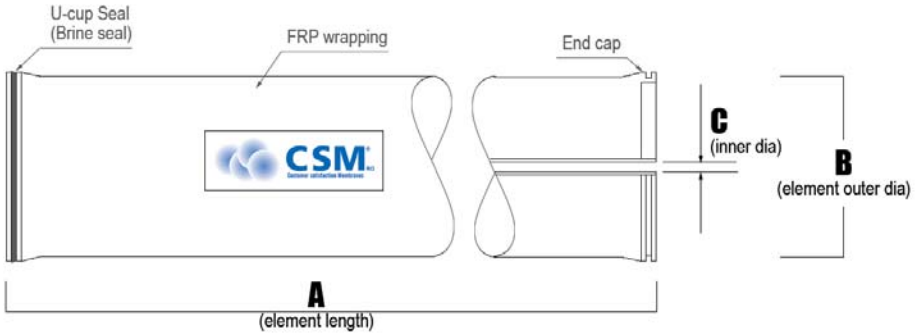
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 1,500 mg/L NaCl solution at 150 psig (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Minimum salt rejection is 98.5%
3. IPA rejection is 92.0% after 2 hours of operation at the following test condition; 1,000 mg/L IPA solution at 150 psig (1.5 MPa) applied pressure, 15% recovery, 77 °F (25 °C) and pH 6.5~7.0.
4. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
5. Effective membrane area may vary within 3 %.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

| | |
|---|---|
| A = | 40 inch (1,016 mm) |
| B = | 8.0 inch (203 mm) |
| C = | 1.12 inch (28 mm) |

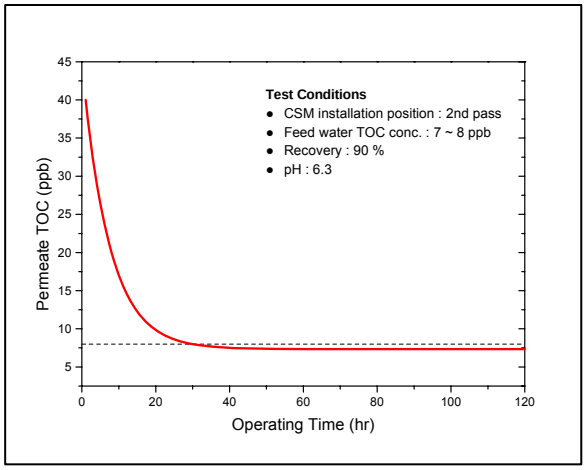



1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM UL element has excellent characteristics such as high permeate flow, low TOC extractable from element and low TOC rinse down time.
- CSM UL element has a flow rate similar to CSM BLR and CSM BLN at low pressure.

## The Rinse Down Time Characteristics




TOC reduction in CSM UPW products used in the 2nd pass ultrapure water system. Rinse down time may vary according to the feed water conditions.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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Email wankk@saehan.co.kr
Website http://www.saehancsm.com

PRODUCT SPECIFICATION SHEET

CSM®

Customer Satisfaction Membrane

# CSM Nanofiltration Membrane Elements

| | |
|---|---|
| **NE8040-90** | 8” in diameter X 40” in length, Nanofiltration membrane element with high monovalent ion rejection |
| **NE8040-70** | 8” X 40”, Nanofiltration membrane element with medium monovalent ion rejection |
| **NE4040-90** | 4” X 40”, Nanofiltration membrane element with high monovalent ion rejection |
| **NE4040-70** | 4” X 40”, Nanofiltration membrane element with medium monovalent ion rejection |
| **NE2540-90** | 2.5” X 40”, Nanofiltration membrane element with high monovalent ion rejection |
| **NE2540-70** | 2.5” X 40”, Nanofiltration membrane element with medium monovalent ion rejection |

# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM **NF MEMBRANE**, The approved Nanofiltration membrane in the whole world.

# NE8040-90

*Nanofiltration membrane element with high monovalent ion rejection*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate[1)] : | 9,000 GPD (34,1 $m^3$/day) |
| Monovalent Ion Rejection (NaCl)[1)] : | 85~95 % |
| Divalent Ion Rejection (MgSO4)[2)] : | 99.5 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

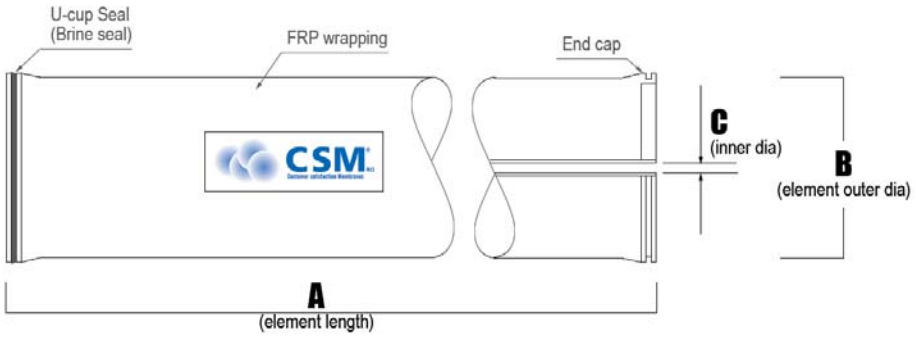
1. The stated performance is initial data taken after 30 minutes of operation based on the following monovalent test conditions;
   2,000 mg/L NaCl solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. The stated performance is initial data taken after 30 minutes of operation based on the following divalent test conditions;
   2,000 mg/L $MgSO_4$ solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
3. Permeate Flow rate for individual elements may vary but will be no more than 15 % below the value shown.
4. Minimum MgSO4 rejection 99.0 %
5. Effective membrane area may vary within 3 %.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)
B = 8.0 inch (203 mm)
C = 1.12 inch (28 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM NE90 elements with 90 % monovalent ion rejection and more than 99 % rejection of divalent ions are useful for water softening, removing endocrine disruption chemicals from drinking water and also food processing.

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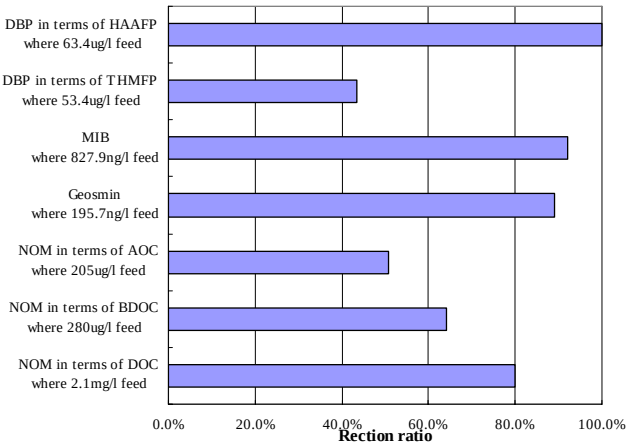
## Organic Rejection Characteristics




DBP (Di-butyl-phthalate), HAAFP (haloacetic acid formation potential), THMFP (THM Formation Potential), THM (Trihalomethane), MIB (methyl isoborneol), NOM (Natural organic matter), BDOC (biodegradable dissolved organic carbon), DOC (Dissolved organic carbon)

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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CSM® Customer Satisfaction Membrane

CSM **NF MEMBRANE**, The approved Nanofiltration membrane in the whole world.

# NE8040-70

*Nanofiltration membrane element with medium monovalent ion rejection*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate[1)] : | 7,000 GPD (34,1 $m^3$/day) |
| Monovalent Ion Rejection (NaCl)[1)] : | 60 ~ 70 % |
| Divalent Ion Rejection ($MgSO_4$)[2)] : | 99.5 % |
| Effective Membrane Area : | 400 $ft^2$ (37.2 $m^2$) |

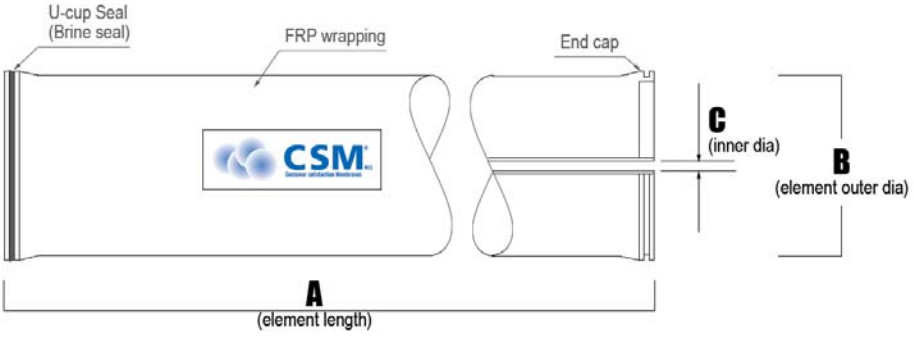
1. The stated performance is initial data taken after 30 minutes of operation based on the following monovalent test conditions;
   2,000 mg/L NaCl solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. The stated performance is initial data taken after 30 minutes of operation based on the following divalent test conditions;
   2,000 mg/L $MgSO_4$ solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
3. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown.
4. Minimum MgSO4 rejection 99.0 %
5. Effective membrane area may vary within 3 %.
6. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)
B = 8.0 inch (203 mm)
C = 1.12 inch (28 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM NE70 elements with medium monovalent ion rejection and more than 99 % rejection of divalent ions are useful for water softening, pretreatment for seawater desalination and food concentration.

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Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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Email wankk@saehan.co.kr
Website http://www.saehancsm.com

# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM **NF MEMBRANE**, The approved Nanofiltration membrane in the whole world.

# NE4040-90

*Nanofiltration membrane element with high monovalent ion rejection*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate[1)] : | 1,900 GPD (7.2 $m^3$/day) |
| Monovalent Ion Rejection (NaCl)[1)] : | 85~95 % |
| Divalent Ion Rejection ($MgSO_4$)[2)] : | 99.5 % |
| Effective Membrane Area : | 85 $ft^2$ (7.9 $m^2$) |

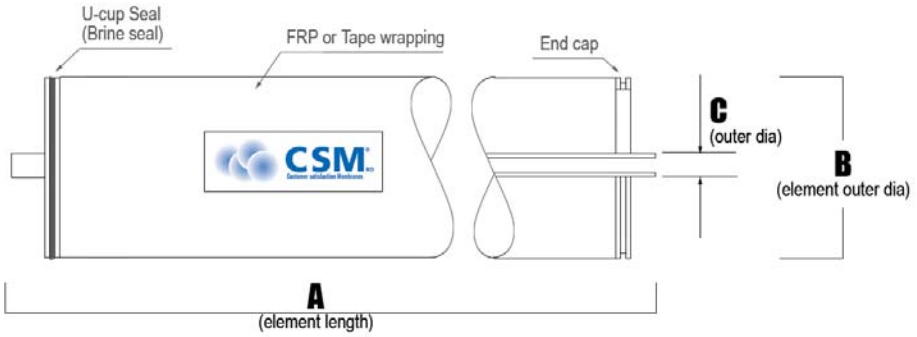
1. The stated performance is initial data taken after 30 minutes of operation based on the following monovalent test conditions;
   2,000 mg/L NaCl solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. The stated performance is initial data taken after 30 minutes of operation based on the following divalent test conditions;
   2,000 mg/L $MgSO_4$ solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
3. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)
B = 4.0 inch (102 mm)
C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM NE90 elements with 90 % monovalent ion rejection and more than 99 % rejection of divalent ions are useful for water softening, removing endocrine disruption chemicals from drinking water and also food processing in small size systems.

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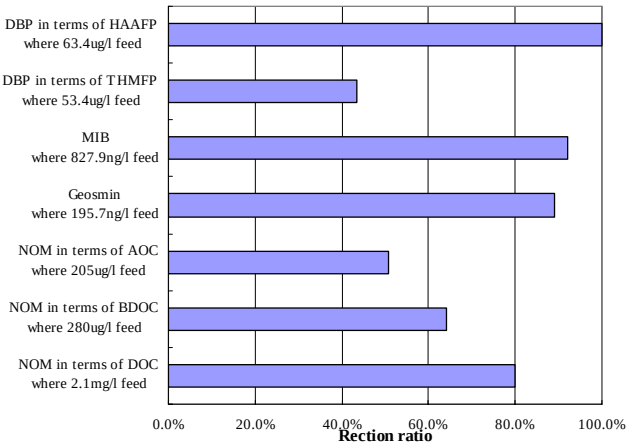
Customer Satisfaction Membrane

## Organic Rejection Characteristics




DBP (Di-butyl-phthalate), HAAFP (haloacetic acid formation potential), THMFP (THM Formation Potential), THM (Trihalomethane), MIB (methyl isoborneol), NOM (Natural organic matter), BDOC (biodegradable dissolved organic carbon), DOC (Dissolved organic carbon)

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 18 gpm (4.09 $m^3$/hr) |
| Min. Concentrate flow rate | 4 gpm (0.91 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM **NF MEMBRANE**, The approved Nanofiltration membrane in the whole world.

# NE4040-70

*Nanofiltration membrane element with medium monovalent ion rejection*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate[1] : | 1,500 GPD (5.7 $m^3$/day) |
| Monovalent Ion Rejection (NaCl)[1] : | 60 ~ 70 % |
| Divalent Ion Rejection ($MgSO_4$)[2] : | 99.5 % |
| Effective Membrane Area : | 85 $ft^2$ (7.9 $m^2$) |

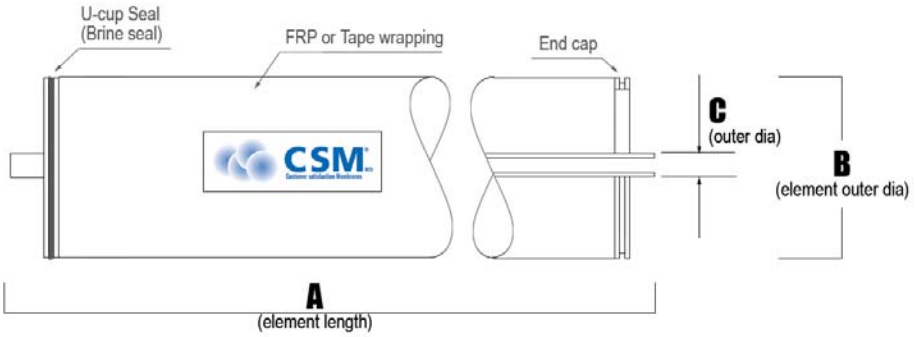
1. The stated performance is initial data taken after 30 minutes of operation based on the following monovalent test conditions;
   2,000 mg/L NaCl solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. The stated performance is initial data taken after 30 minutes of operation based on the following divalent test conditions;
   2,000 mg/L $MgSO_4$ solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
3. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, FRP wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)
B = 4.0 inch (102 mm)
C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM NE70 elements with medium monovalent ion rejection and more than 99 % rejection of divalent ions are useful for water softening, pretreatment for seawater desalination and food concentration in small size systems.

CSM®
Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 66 gpm (15.0 $m^3$/hr) |
| Min. Concentrate flow rate | 16 gpm (3.6 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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Email wankk@saehan.co.kr
Website http://www.saehancsm.com

# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM **NF MEMBRANE**, The approved Nanofiltration membrane in the whole world.

# NE2540-90

*Nanofiltration membrane element with high monovalent ion rejection*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate[1)] : | 450 GPD (1.7 $m^3$/day) |
| Monovalent Ion Rejection (NaCl)[1)] : | 85~95 % |
| Divalent Ion Rejection ($MgSO_4$)[2)] : | 99.5 % |
| Effective Membrane Area : | 27 $ft^2$ (2.5 $m^2$) |

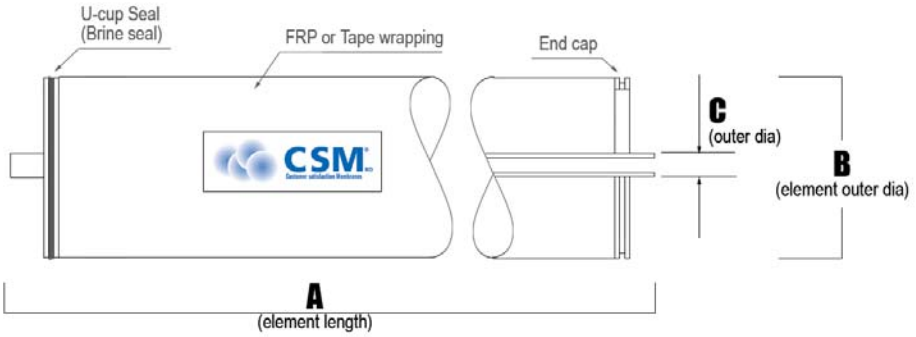
1. The stated performance is initial data taken after 30 minutes of operation based on the following monovalent test conditions;
   2,000 mg/L NaCl solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. The stated performance is initial data taken after 30 minutes of operation based on the following divalent test conditions;
   2,000 mg/L $MgSO_4$ solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
3. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)
B = 2.5 inch (64 mm)
C = 0.75 inch (19.1 mm)



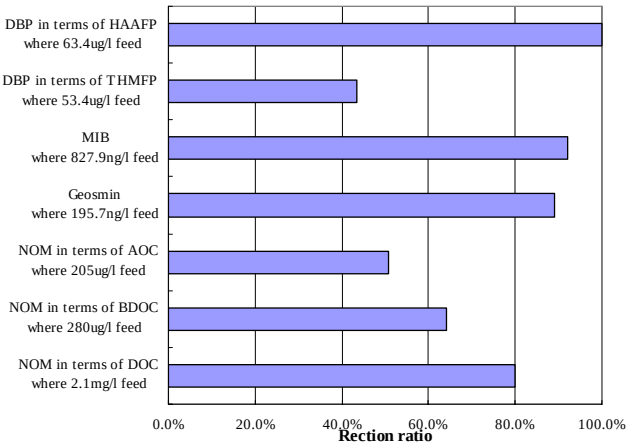

1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM NE90 elements with 90 % monovalent ion rejection and more than 99 % rejection of divalent ions are useful for water softening, removing endocrine disruption chemicals from drinking water and also food processing in small size systems.

CSM®
Customer Satisfaction Membrane

## Organic Rejection Characteristics




DBP (Di-butyl-phthalate), HAAFP (haloacetic acid formation potential), THMFP (THM Formation Potential), THM (Trihalomethane), MIB (methyl isoborneol), NOM (Natural organic matter), BDOC (biodegradable dissolved organic carbon), DOC (Dissolved organic carbon)

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| Max. Pressure drop / Element | 15 psi (0.1 MPa) |
| Max. Pressure drop / 240" vessel | 60 psi (0.42 Mpa) |
| Max. Operating pressure | 600 psi (4.14 MPa) |
| Max. Feed flow rate | 6 gpm (1.36 $m^3$/hr) |
| Min. Concentrate flow rate | 1 gpm (0.23 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

| | |
|---|---|
| Waste water (SDI < 5) | 8 ~ 12 gfd |
| Waste water pretreated by UF (SDI < 3) | 10 ~ 14 gfd |
| Seawater, open intake (SDI < 5) | 7 ~ 10 gfd |
| High salinity well water (SDI < 3) | 8 ~ 12 gfd |
| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

### Saturation Limits for Salts

| | |
|---|---|
| $CaSO_4$ | 230 % saturation |
| $SrSO_4$ | 800 % saturation |
| $BaSO_4$ | 6,000 % saturation |
| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

### $CaCO_3$ Scaling potential limits as LSI or SDSI

| | |
|---|---|
| Without scale inhibitor | < -0.2 |
| LSI (SDSI) with SHMP | < +0.5 |
| LSI (SDSI) with special inhibitor[1] | < +1.5 |
| SDSI with any inhibitor | < +0.5 |

1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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# PRODUCT SPECIFICATION SHEET

CSM® Customer Satisfaction Membrane

CSM **NF MEMBRANE**, The approved Nanofiltration membrane in the whole world.

# NE2540-70

*Nanofiltration membrane element with medium monovalent ion rejection*

## Product Specifications

| | |
|---|---|
| Permeate Flow rate[1)] : | 350 GPD (1.3 $m^3$/day) |
| Monovalent Ion Rejection (NaCl)[1)] : | 60 ~ 70 % |
| Divalent Ion Rejection ($MgSO_4$)[2)] : | 99.5 % |
| Effective Membrane Area : | 27 $ft^2$ (2.5 $m^2$) |

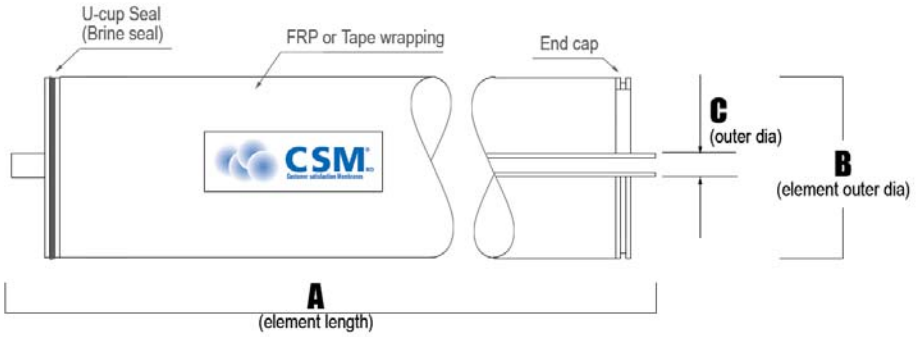
1. The stated performance is initial data taken after 30 minutes of operation based on the following monovalent test conditions;
   2,000 mg/L NaCl solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. The stated performance is initial data taken after 30 minutes of operation based on the following divalent test conditions;
   2,000 mg/L $MgSO_4$ solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
3. All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and packaged individually in a cardboard box.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

A = 40 inch (1,016 mm)
B = 2.5 inch (64 mm)
C = 0.75 inch (19.1 mm)




1. One interconnector (coupler) would be supplied for each membrane element.
2. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel.
3. Outer feature may vary as design revisions take place.

## Features

- CSM NE70 elements with medium monovalent ion rejection and more than 99 % rejection of divalent ions are useful for water softening, pretreatment for seawater desalination and food concentration in small size systems.

CSM®
Customer Satisfaction Membrane

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

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|---|---|
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| Min. Concentrate flow rate | 1 gpm (0.23 $m^3$/hr) |
| Max. Operating temperature | 113 $^oF$ (45 $^oC$) |
| Operating pH range | 3.0 ~ 10.0 |
| CIP pH range | 2.0 ~ 11.0 |
| Max. Turbidity | 1.0 NTU |
| Max. SDI (15 min) | 5.0 |
| Max. Free Chlorine concentration | 0.1 mg/L |

### Design Guideline for Various Water Source

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|---|---|
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| Surface water (SDI < 5) | 12 ~ 16 gfd |
| Surface water (SDI < 3) | 13 ~ 17 gfd |
| Well water (SDI < 3) | 13 ~ 17 gfd |
| RO/UF permeate (SDI < 1) | 21 ~ 30 gfd |

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| $SiO_2$ | 100 % saturation |

Above values are saturation limit at the tail end of the membrane elements for each sparingly soluble salts with proper scale inhibitor.

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| Without scale inhibitor | < -0.2 |
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1. Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.

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PRODUCT SPECIFICATION SHEET

CSM®

Customer Satisfaction Membrane

# CSM Household RO Membrane Elements

CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# CSM HOUSEHOLD RO MEMBRANE

*High performance household membrane* (Up to 1.8 inch diameter elements)

## Product Specifications

| Model name | Permeate Flow rate gpd (L/day) | Salt Rejection % |
|---|---|---|
| RE1810-30 | 30 (114) | 96.0 |
| RE1810-50 | 50 (189) | 96.0 |
| RE1812-35 | 35 (132) | 96.0 |
| RE1812-50 | 50 (189) | 96.0 |
| RE1812-60 | 60 (227) | 96.0 |
| RE1812-80 | 80 (303) | 96.0 |

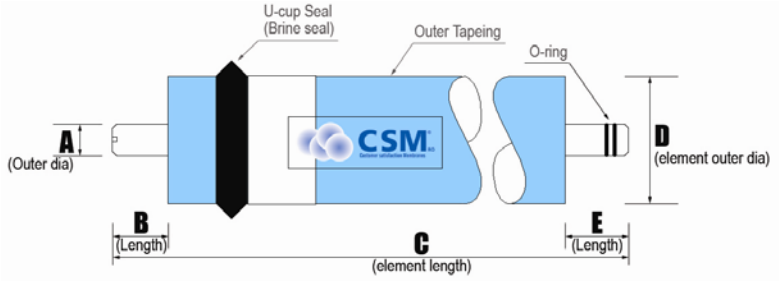
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 250 mg/L NaCl solution at 60 psig applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Dry type elements are vacuum leak tested using the *Sandiego Protocol* so that the performance shall satisfy their specifications.
3. Permeate flow rate is based on standard test conditions and may vary depending on feed water quality. Individual element's permeate flow may vary within 15%.
4. All wet type elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution. All dry type elements are sealed in a polyethylene bag without vacuum.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

| Model name | A (inch) | B (inch) | C (inch) | D (inch) | E (inch) |
|---|---|---|---|---|---|
| RE1810-30 | 0.67 | 0.55 | 10.08 | 1.77 | 0.98 |
| RE1810-50 | 0.67 | 0.55 | 10.08 | 1.77 | 0.98 |
| RE1812-35 | 0.67 | 0.87 | 11.73 | 1.77 | 0.87 |
| RE1812-50 | 0.67 | 0.87 | 11.73 | 1.77 | 0.87 |
| RE1812-60 | 0.67 | 0.87 | 11.73 | 1.77 | 0.87 |
| RE1812-80 | 0.67 | 0.87 | 11.73 | 1.77 | 0.87 |




1. Outer feature may vary as design revisions take place.

## Features

- CSM Household RO membrane has high permeability.
- CSM Household RO membrane can remove most of harmful substances such as Carcinogen, THMs (Trihalomethanes), heavy metal ions, bacteria and virus in drinking water.

## IMPORTANT NOTICE

Elements contain preservative solution, therefore the permeate from the first hour of operation should be discarded.
If the operating conditions in this document are not followed, no warranty of the element is honored.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| • Max. Operating pressure | 125 psi (0.86 MPa) |
| • Max. Feed flow rate | 2 gpm (0.45 $m^3$/hr) |
| • Max. Operating temperature | 113 °F (45 °C) |
| • Operating pH range | 3.0 ~ 10.0 |
| • Max. Turbidity | 1.0 NTU |
| • Max. SDI (15 min) | 5.0 |
| • Max. Free Chlorine concentration | 0.1 mg/L |

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PRODUCT SPECIFICATION SHEET

CSM®

Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# CSM HOUSEHOLD RO MEMBRANE

*High performance household membrane* (Larger than 1.8 inch diameter element)

## Product Specifications

| Model name | Permeate Flow rate gpd (L/day) | Salt Rejection % |
|---|---|---|
| RE2012-100 | 100 (397) | 96.0 |
| RE2012-LPF | 180 (681) | 93.0 |
| RE2812-300 | 300 (1,136) | 96.0 |

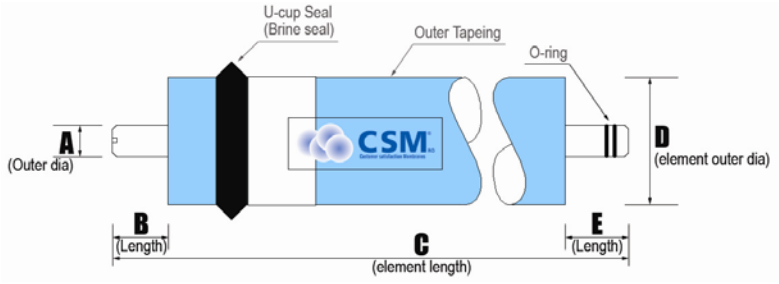
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 250 mg/L NaCl solution at 60 psig applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Dry type elements are vacuum leak tested using the *Sandiego Protocol* so that the performance shall satisfy their specifications.
3. Permeate flow rate is based on standard test conditions and may vary depending on feed water quality. Individual element's permeate flow may vary within 15%.
4. All wet type elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution. All dry type elements are sealed in a polyethylene bag without vacuum.

## Product Description

Membrane Type : Thin-film Composite
Membrane Material : PA (Polyamide)
Membrane Surface Charge : Negative
Element Configuration : Spiral-Wound, Tape wrapping

## Product Dimensions

| Model name | A (inch) | B (inch) | C (inch) | D (inch) | E (inch) |
|---|---|---|---|---|---|
| RE2012-100 | 0.67 | 0.47 | 11.73 | 1.91 | 0.91 |
| RE2012-LPF | 0.67 | 0.47 | 11.73 | 1.91 | 0.91 |
| RE2812-300 | 0.67 | 0.87 | 11.73 | 2.87 | 0.87 |




1. Outer feature may vary as design revisions take place.

## Features

- CSM Household RO membrane has high permeability.
- CSM Household RO membrane can remove most of harmful substances such as Carcinogen, THMs (Trihalomethanes), heavy metal ions, bacteria and virus in drinking water.

## IMPORTANT NOTICE

Elements contain preservative solution, therefore the permeate from the first hour of operation should be discarded.
If the operating conditions in this document are not followed, no warranty of the element is honored.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| • Max. Operating pressure | 125 psi (0.86 MPa) |
| • Max. Feed flow rate | 2 gpm (0.45 $m^3$/hr) |
| • Max. Operating temperature | 113 °F (45 °C) |
| • Operating pH range | 3.0 ~ 10.0 |
| • Max. Turbidity | 1.0 NTU |
| • Max. SDI (15 min) | 5.0 |
| • Max. Free Chlorine concentration | 0.1 mg/L |

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CSM® Customer Satisfaction Membrane

CSM RO MEMBRANE, The approved ***Reverse Osmosis Membrane*** in the world.

# CSM HOUSEHOLD LOW PRESSURE RO MEMBRANE

*High performance household membrane*

## Product Specifications

| Model name | Permeate Flow rate gpd (L/day) | Salt Rejection % |
|---|---|---|
| RE2010-LP | 30 (114) | 93.0 |
| RE2012-LP | 50 (189) | 93.0 |

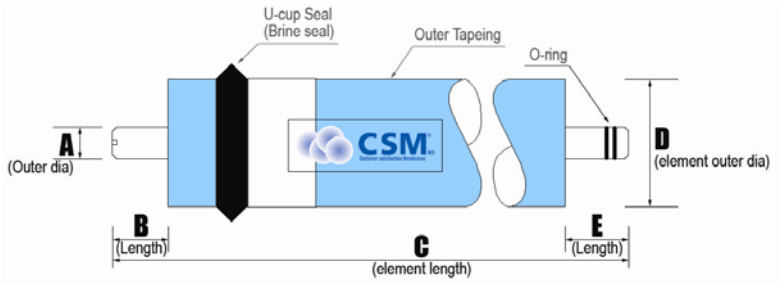
1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; 100 mg/L NaCl solution at 20 psig applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.
2. Dry type elements are vacuum leak tested using the *Sandiego Protocol* so that the performance shall satisfy their specifications.
3. Permeate flow rate is based on standard test conditions and may vary depending on feed water quality. Individual element's permeate flow may vary within 15%.
4. All wet type elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution. All dry type elements are sealed in a polyethylene bag without vacuum.

## Product Description

| | |
|---|---|
| Membrane Type : | Thin-film Composite |
| Membrane Material : | PA (Polyamide) |
| Membrane Surface Charge : | Negative |
| Element Configuration : | Spiral-Wound, Tape wrapping |

## Product Dimensions

| Model name | A (inch) | B (inch) | C (inch) | D (inch) | E (inch) |
|---|---|---|---|---|---|
| RE2010-LP | 0.67 | 0.55 | 10.08 | 1.91 | 0.98 |
| RE2012-LP | 0.67 | 0.47 | 11.73 | 1.91 | 0.91 |




1. Outer feature may vary as design revisions take place.

## Features

- CSM Household RO membrane has high permeability.
- CSM Household RO membrane can remove most of harmful substances such as Carcinogen, THMs (Trihalomethanes), heavy metal ions, bacteria and virus in drinking water.

## IMPORTANT NOTICE

Elements contain preservative solution, therefore the permeate from the first hour of operation should be discarded.
If the operating conditions in this document are not followed, no warranty of the element is honored.

## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
- Keep elements moist at all times after initial wetting
- Permeate water obtained from first hour of operation should be discarded in order to flush the protective solution in the elements.
- CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains one (1) weight percent sodium bisulfite or sodium metabisulfite (food grade). For short term storage of one week, one (1) weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.
- The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

## Application Data

### Operating Limits

| | |
|---|---|
| • Max. Operating pressure | 125 psi (0.86 MPa) |
| • Max. Feed flow rate | 2 gpm (0.45 $m^3$/hr) |
| • Max. Operating temperature | 113 °F (45 °C) |
| • Operating pH range | 3.0 ~ 10.0 |
| • Max. Turbidity | 1.0 NTU |
| • Max. SDI (15 min) | 5.0 |
| • Max. Free Chlorine concentration | 0.1 mg/L |

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CSM® Customer Satisfaction Membrane

CSM UF MEMBRANE, The approved ***Ultrafiltration Membrane*** in the world.

# CSM HOUSEHOLD UF MEMBRANE

*High performance household membrane*

## Product Specifications

| Model name | Permeate Flow rate gpd (L/day) | MWCO (Molecular Weight Cut Off) |
|---|---|---|
| UE1810 | 200 (757) | 1,000K |
| UE1812 | 250 (946) | 1,000K |
| UE2010 | 450 (1,703) | 1,000K |

1. The stated performance is initial data taken after 30 minutes of operation based on the following conditions; Pure water (2 MΩ) at 20 psig applied pressure, 100 % recovery and 77 °F (25 °C).
2. Dry type elements are vacuum leak tested using the *Sandiego Protocol* so that the performance shall satisfy their specifications.
3. Permeate flow rate is based on standard test conditions and may vary depending on feed water quality. Individual element's permeate flow may vary within 15%.
4. All wet type elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution. All dry type elements are sealed in a polyethylene bag without vacuum.

## Product Description

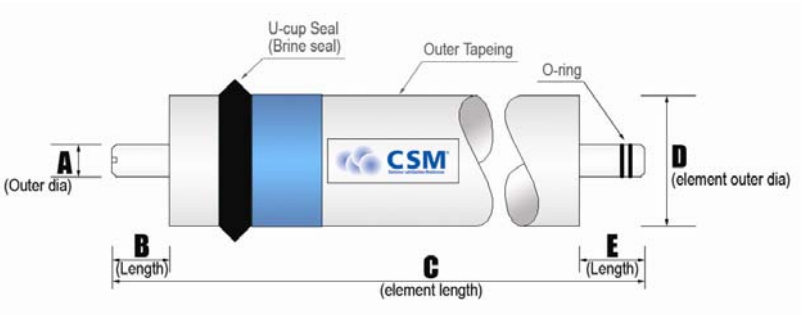
Membrane Type : Thin-film Composite

Membrane Material : PSf (Polysulfone)

Element Configuration : Spiral-Wound, Tape wrapping

## Product Dimensions

| Model name | A (inch) | B (inch) | C (inch) | D (inch) | E (inch) |
|---|---|---|---|---|---|
| UE1810 | 0.67 | 0.55 | 10.08 | 1.77 | 0.98 |
| UE1812 | 0.67 | 0.00 | 11.02 | 1.77 | 0.79 |
| UE2010 | 0.67 | 0.55 | 10.08 | 1.91 | 0.98 |




1. Outer feature may vary as design revisions take place.

## Features

- CSM Household UF membrane has high permeability with homogeneous pore size less than 0.01 μm.
- CSM Household UF membrane can remove most of harmful substances larger than 0.01 μm so that it is suitable for home purifier.

CSM® Customer Satisfaction Membrane

## IMPORTANT NOTICE

Elements contain preservative solution, therefore the permeate from the first hour of operation should be discarded.
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## Conditions for Handling CSM in general

- Customers must keep the element boxes dry at room temperature to prevent them from freezing and damages from heat. If the polyethylene bag is broken, a new protective solution has to be added to the RO membrane element and the element has to be repackaged air-tight to prevent from biological growth.
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| • Max. Feed flow rate | 2 gpm (0.45 $m^3$/hr) |
| • Max. Operating temperature | 113 °F (45 °C) |
| • Operating pH range | 3.0 ~ 10.0 |
| • Max. Turbidity | 1.0 NTU |
| • Max. SDI (15 min) | 5.0 |

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