: Product Specification

April 15, 2007



<u>CSM Brackish Water R0 Membrane Elements</u>

embrane

CSM.

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	$8^{\prime\prime}$ X 40^{\prime\prime}, High productivity RO membrane element with 440 ft^2 membrane area for brackish water
RE8040-BR	$8^{\prime\prime}$ X 40^{\prime\prime}, 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	$2.5^{\prime\prime}$ X 40", Normal grade RO membrane element with thick feed spacer for brackish water

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RE8040-BN

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

Product	Permeate Flow rate :	10,000 GPD (37.9 m ³ /day)	
Specifications	Stabilized Salt Rejection :	99.5 %	
	Effective Membrane Area :	365 ft ² (33.9 m ²)	
	 The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig Minimum salt rejection is 99.0% Permeate Flow rate for individual elect Effective membrane area may vary v Thicker Feed spacer (32 mil) is used All elements are vacuum sealed i packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. ements may vary but will be no more than 10 % below the value shown. within 3 %. I. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and I box.	
Product	Membrane Type :	Thin-film Composite	
Description	Membrane Material :	PA (Polyamide)	
	Membrane Surface Charge :	Negative	
	Element Configuration :	Spiral-Wound, FRP wrapping	
Product Dimensions	A = 40 inch (1,016 m B = 8.0 inch (203 mn C = 1.12 inch (28 mn U-cup Seal (Brine seal) (Brine seal) (elem 1. One interconnector (couplet 2. All CSM membrane elemen 3. Outer feature may vary as c	m) h) h) RP wrapping End cap (element outer dia) (element outer dia) ent length) r) would be supplied for each membrane element. ts fit nominal 8.0-inch (203 mm) I.D. pressure vessel. lesign revisions take place.	
Features	 CSM Brackish water high r their ability to sustain excelle CSM membrane elements h performance after CIP. 	ejection membrane elements are used most widely because of ent performance. nave a high chemical durability which prevents declining of their	

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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

• CaSO4	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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-BN300

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

Product	Permeate Flow rate :	9,000 GPD (34.1 m ³ /day)
Specifications	Stabilized Salt Rejection :	99.5 %
	Effective Membrane Area :	300 ft ² (27.9 m ²)
	 The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig Minimum salt rejection is 99.0% Permeate Flow rate for individual ele Effective membrane area may vary v Thicker Feed spacer (46 mil) is used All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. ements may vary but will be no more than 10 % below the value shown. within 3 %. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	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) U-cup Seal (Brine seal) FRP wrapping End cap (element outer dia) (element outer dia) (element length) 1. One interconnector (coupler) would be supplied for each membrane element. 2. All CSM membrane elements fit nominal 8.0-inch (203 mm) 1.D. a pressure vessel. 3. Outer feature may vary as design revisions take place.	
Features	 CSM Brackish water high reject to sustain excellent performant prevents declining of their performant The thicker feed spacer (46 containing a high load of colloid 	ction membrane elements are used most widely because of their ability ace. CSM membrane elements have a high chemical durability which prmance after CIP. mil) of CSM BN300 element enables element to treat a feed water lal particles.

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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 °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
 SrSO₄ 	800 % saturation
• BaSO ₄	6,000 % saturation
SiO₂	100 % saturation

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

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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	Permeate Flow rate :	11,000 GPD (41.6 m ³ /day)	
Specifications	Stabilized Salt Rejection :	99.5 %	
	Effective Membrane Area :	400 ft ² (37.2 m ²)	
	 The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig Minimum salt rejection is 99.0% Permeate Flow rate for individual election Effective membrane area may vary vary All elements are vacuum sealed individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. ements may vary but will be no more than 10 % below the value shown. within 3 %. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.	
Product	Membrane Type :	Thin-film Composite	
Description	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) U-cup Seal (Brine seal) FRP wrapping End cap (Brine seal) (Brine seal) (Complexity of the seal) (Co		
Features	 CSM Brackish water high r their ability to sustain excell CSM membrane elements l performance after CIP. 	rejection membrane elements are used most widely because of ent performance. have a high chemical durability which prevents declining of their	

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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

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 SrSO₄ 	800 % saturation
• BaSO ₄	6,000 % saturation
SiO₂	100 % saturation

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

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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

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

Product	Permeate Flow rate :	12,000 GPD (45.4 m ³ /day)	
Specifications	Stabilized Salt Rejection :	99.5 %	
	Effective Membrane Area :	440 ft ² (40.9 m ²)	
	 The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig Minimum salt rejection is 99.0% Permeate Flow rate for individual elet Effective membrane area may vary to 5. Central tube inner diameter is 1.5 int All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5–7.0. ements may vary but will be no more than 10 % below the value shown. within 3 %. ches which is not same to regular element. in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and d box.	
Product	Membrane Type :	Thin-film Composite	
Description	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) U-cup Seal (Brine seal) FRP wrapping End cap (element outer dia) (element outer dia) (element length) 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 permeate flow due to its extend be operated at a lower pressur CSM membrane elements h performance after CIP. 	same high rejection membrane as BN and BE but produces more ded membrane area. For the same amount of product water, BE440 can e and fouled less than the regular BE and BN have a high chemical durability which prevents declining of their	

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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
 SrSO₄ 	800 % saturation
• BaSO ₄	6,000 % saturation
SiO₂	100 % saturation

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

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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.

RE8040-BR

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

Product	Permeate Flow rate :	5,500 GPD (20.8 m³/day)	
Specifications	Stabilized Salt Rejection :	99.7 %	
	Effective Membrane Area :	380 ft ² (35.3 m ²)	
	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. ements may vary but will be no more than 10 % below the value shown. within 3 %. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.		
Product	Membrane Type :	Thin-film Composite	
Description	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) U-cup Seal (Brine seal) FRP wrapping End cap (circle of the seal) (circle of the sea		
Features	 CSM BR is a brackish of desalination of highly bracki CSM membrane elements h performance after CIP. 	water ultra high rejection membrane element used for the sh water with TDS higher than 2,000 mg/L have a high chemical durability which prevents declining of their	

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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.
- 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

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- 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-BN

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

Product Specifications	Permeate Flow rate : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig 2. All elements are vacuum sealed in packaged individually in a cardboard	2,000 GPD (7.6 m ³ /day) 99.5 % 75 ft ² (7.0 m ²) a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	Memorane Material :	
	Membrane Surface Charge :	Negative
	Element Configuration :	Spiral-Wound, FRP wrapping
Product Dimensions	A = 40 inch (1,016 m B = 4.0 inch (102 mm C = 0.75 inch (19.1 m U-cup Seal (Brine seal) FI (Brine seal) (C m (elem 1. One interconnector (coupler) 2. All CSM membrane elements 3. Outer feature may vary as det	m) h) hm) RP or Tape wrapping End cap Couter dia) SIM- SIM- SIM- ent length) would be supplied for each membrane element. fit nominal 4.0-inch (102 mm) I.D. pressure vessel. sign revisions take place.
Features	 CSM Brackish water high r their ability to sustain excelle CSM membrane elements h performance after CIP. 	ejection membrane elements are used most widely because of ent performance. nave a high chemical durability which prevents declining of their

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1. CSM RO elements could be supplied either wet or dry.

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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.
- · 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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 : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig 2. All elements are vacuum sealed in packaged individually in a cardboard	2,400 GPD (9.1 m ³ /day) 99.5 % 85 ft ² (7.9 m ²) a taken after 30 minutes of operation based on the following conditions; 9 (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product Description	Membrane Type : Membrane Material : Membrane Surface Charge : Element Configuration :	Thin-film Composite PA (Polyamide) Negative Spiral-Wound, FRP wrapping
Product Dimensions	A = 40 inch (1,016 m B = 4.0 inch (102 mm C = 0.75 inch (19.1 m U-cup Seal (Brine seal) FF (elements) 1. One interconnector (coupler) w 2. All CSM membrane elements f 3. Outer feature may vary as designed	m) h) hm) RP or Tape wrapping End cap C (outer dia) B (element outer dia) A ent length) rould be supplied for each membrane element. it nominal 4.0-inch (102 mm) I.D. pressure vessel. ign revisions take place.
Features	 CSM Brackish water high retrieved their ability to sustain excelle CSM membrane elements her formance after CIP. 	ejection membrane elements are used most widely because of ent performance. have a high chemical durability which prevents declining of their

 Customer Satisfaction Membrane

 The Stabilization of salt rejection
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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 °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
 SrSO₄ 	800 % saturation
• BaSO ₄	6,000 % saturation
SiO₂	100 % saturation

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

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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

-	Dame at Flaureta	$4.050.000(4.0.m^3/dm)$	
Product	Permeate Flow rate :	1,050 GPD (4.0 m ⁻ /day)	
Specifications	Stabilized Salt Rejection :	99.5 %	
	Effective Membrane Area :	35 ft ² (3.3 m ²)	
	 The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig All elements are vacuum sealed i packaged individually in a cardboard 	taken after 30 minutes of operation based on the following conditions; (1.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.	
Product	Membrane Type :	Thin-film Composite	
Description	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 m U-cup Seal (Brine seal) FI (elem 1. One interconnector (coupler) would b 2. All CSM membrane elements fit nom 3. Outer feature may vary as design rev) h) RP or Tape wrapping End cap C (outer dia) B (element outer dia) A ent length) re supplied for each membrane element. inal 4.0-inch (102 mm) I.D. pressure vessel. risions take place.	
Features	 CSM Brackish water high r their ability to sustain excelle CSM membrane elements h performance after CIP. 	ejection membrane elements are used most widely because of ent performance. nave a high chemical durability which prevents declining of their	

 Customer Satisfaction Membrane

 The Stabilization of salt rejection
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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 °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
 SrSO₄ 	800 % saturation
• BaSO ₄	6,000 % saturation
SiO₂	100 % saturation

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

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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

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RE2540-BN

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

Product Specifications	Permeate Flow rate : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig 2. All elements are vacuum sealed in packaged individually in a cardboard	600 GPD (2.3 m ³ /day) 99.5 % 24 ft ² (2.5 m ²) taken after 30 minutes of operation based on the following conditions; (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product Description	Membrane Type :	Thin-film Composite
Description		PA (Polyamide)
	Membrane Surface Charge :	
	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) U-cup Seal (Brine seal) FRP or Tape wrapping End cap (couter dia) (element outer dia) (element length) 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. 	

 Customer Satisfaction Membrane

 The Stabilization of salt rejection
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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	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

<u>CSM Tap Water R0 Membrane Elements</u>

lembrane

CSM.

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	$4^{\prime\prime}$ X $40^{\prime\prime},$ 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	

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

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RE4040-TE

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

Product	Permeate Flow rate :	2,400 GPD (9.1 m³/day)
Specifications	Stabilized Salt Rejection :	99.5 %
	Effective Membrane Area :	85 ft ² (7.9 m ²)
	 The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	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) U-cup Seal (Brine seal) FRP or Tape wrapping End cap (cuter dia) (cuter dia) (element outer dia) (element length) 1. One interconnector (coupler) would be supplied for each membrane element. 2. All CSM membrane elements fit nominal 2.5 inch (64 mm) LD, pressure vessel	
Features	Outer reature may vary as design revisions take place. 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 suital	ble for treatment of small systems

Customer Satisfaction Membrane

 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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- · 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 m³/hr) Min. Concentrate flow rate 4 gpm (0.91 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 • 2.0 ~ 11.0 • CIP pH range 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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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Customer Satisfaction Membrane CSM RO MEMBRANE, The approved *Reverse Osmosis Membrane* in the world.

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RE4021-TE

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

Product Specifications	Permeate Flow rate : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 2,000 mg/L NaCl solution at 225 psic 2. All elements are vacuum sealed in packaged individually in a cardboard	1,050 GPD (4.0 m ³ /day) 99.5 % 35 ft ² (3.3 m ²) a taken after 30 minutes of operation based on the following conditions; 9 (1.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	Membrane Material :	PA (Polyamide)
	Membrane Surface Charge :	Negative
	Element Configuration :	Spiral-Wound, Tape wrapping
Product Dimensions	A = 21 inch (533 mm) $B = 4.0 inch (102 mm)$ $C = 0.75 inch (19.1 mm)$ $U-cup Seal (Brine seal) FRP or Tape wrapping End cap (outer dia) (outer dia) (element outer dia$	
	(element length)	
	 One interconnector (coup 2. All CSM membrane elem Outer feature may vary a 	oler) would be supplied for each membrane element. ents fit nominal 2.5-inch (64 mm) I.D. pressure vessel. s 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 	

Customer Satisfaction Membrane

 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.

R

- · 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 m³/hr) Min. Concentrate flow rate 4 gpm (0.91 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 • 2.0 ~ 11.0 • CIP pH range 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

• CaSO4	230 % saturation
 SrSO₄ 	800 % saturation
 BaSO₄ 	6,000 % saturation
 SiO₂ 	100 % saturation

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

CaCO₃ Scaling potential limits as LSI or SDSI

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- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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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Customer Satisfaction Membrane CSM RO MEMBRANE, The approved *Reverse Osmosis Membrane* in the world.

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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 : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 2,000 mg/L NaCl solution at 225 psic 2. All elements are vacuum sealed in packaged individually in a cardboard	800 GPD (3.0 m ³ /day) 99.5 % 27 ft ² (2.5 m ²) a taken after 30 minutes of operation based on the following conditions; (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	Membrane Material :	PA (Polyamide)
	Membrane Surface Charge :	Negative
	Element Configuration :	Spiral-Wound, Tape wrapping
Product Dimensions	A = 40 inch (1,016 mm) $B = 2.5 inch (64 mm)$ $C = 0.75 inch (19.1 mm)$ $U-cup Seal (Brine seal) FRP or Tape wrapping End cap (outer dia) (outer dia) (element outer dia) (element outer$	
	(element length)	
	 One interconnector (coupler) All CSM membrane elements Outer feature may vary as des 	would be supplied for each membrane element. fit nominal 2.5-inch (64 mm) I.D. pressure vessel. sign 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 	

Customer Satisfaction Membrane

 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.

R

- · 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

• 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 m³/hr) Min. Concentrate flow rate 1 gpm (0.23 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 • 2.0 ~ 11.0 • CIP pH range 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.

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- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
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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.



SAEHAN INDUSTRIES INC.

Customer Satisfaction Membrane

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

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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 : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig 2. All elements are vacuum sealed in packaged individually in a cardboard	300 GPD (1.1 m ³ /day) 99.5 % 12 ft ² (1.1 m ²) taken after 30 minutes of operation based on the following conditions; (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. h a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	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) U-cup Seal (Brine seal) FRP or Tape wrapping End cap (outer dia) B (element outer dia)	
	A (element length)	
	 One interconnector (coupler) All CSM membrane elements Outer feature may vary as des 	would be supplied for each membrane element. fit nominal 2.5-inch (64 mm) I.D. pressure vessel. sign 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 	

Customer Satisfaction Membrane

 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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- · 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 m³/hr) Min. Concentrate flow rate 1 gpm (0.23 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 • 2.0 ~ 11.0 • CIP pH range 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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	Permeate Flow rate :	2,600 GPD (9.8 m ³ /day)	
Specifications	Stabilized Salt Rejection :	99.0 %	
-	Effective Membrane Area :	85 ft ² (7.9 m ²)	
	 The stated performance is initial data 1,500 mg/L NaCl solution at 150 psig All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.	
Product	Membrane Type :	Thin-film Composite	
Description	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) U-cup Seal (Brine seal) FRP or Tape wrapping End cap (cuter dia) End cap (outer dia) (element outer dia) (element length) 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

Customer Satisfaction Membrane

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- 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 m³/hr) • Min. Concentrate flow rate 4 gpm (0.91 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 • 2.0 ~ 11.0 • CIP pH range 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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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RE4021-TL

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

Product	Permeate Flow rate :	1,050 GPD (4.0 m³/day)	
Specifications	Stabilized Salt Rejection :	99.0 %	
	Effective Membrane Area :	35 ft ² (3.3 m ²)	
	 The stated performance is initial data 1,500 mg/L NaCl solution at 150 psig All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.	
Product	Membrane Type :	Thin-film Composite	
Description	Membrane Material :	PA (Polyamide)	
	Membrane Surface Charge :	Negative	
	Element Configuration :	Spiral-Wound, Tape wrapping	
Product	A = 21 inch (533 mm)	
Dimensions	B = 4.0 inch (102 mm)		
C = 0.75 inch (19.1		ım)	
	U-cup Seal		
	(Brine seal) FRP or Tape wrapping End cap		
	C (element outer dia)		
	 One interconnector (coupler) All CSM membrane elements Outer feature may vary as de: 	tor (coupler) would be supplied for each membrane element. Ine elements fit nominal 2.5-inch (64 mm) I.D. pressure vessel. Iv 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 surface. 		
	pumps, piumping and press	ure vesseis in small systems	

Conditions for Handling CSM in general

Customer Satisfaction Membrane

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- 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 m³/hr) • Min. Concentrate flow rate 4 gpm (0.91 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 • 2.0 ~ 11.0 • CIP pH range 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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	Permeate Flow rate :	850 GPD (3.2 m ³ /day)
Specifications	Stabilized Salt Rejection :	99.0 %
	Effective Membrane Area :	27 ft ² (2.5 m ²)
	 The stated performance is initial data 1,500 mg/L NaCl solution at 150 psig All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	Membrane Material :	PA (Polyamide)
	Membrane Surface Charge :	Negative
	Element Configuration :	Spiral-Wound, Tape wrapping
	-	
Product	A = 40 inch (1,016 m	m)
Dimensions	B = 2.5 inch (64 mm)	
	C = 0.75 inch (19.1 m	nm)
	C = 0.75 inch (19.1 mm) U-cup Seal (Brine seal) FRP or Tape wrapping End cap (outer dia) (element length) 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

Customer Satisfaction Membrane

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- 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 m³/hr) • Min. Concentrate flow rate 1 gpm (0.23 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 • 2.0 ~ 11.0 • CIP pH range 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

 CaSO₄ 	230 % saturation
 SrSO₄ 	800 % saturation
• BaSO ₄	6,000 % saturation
 SiO₂ 	100 % saturation

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

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

Customer Satisfaction Membrane

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

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)	
opeeniealiene	Effective Membrane Area	$42 \pm \frac{4}{2} (1 + m^2)$	
	 The stated performance is initial data 	a taken after 30 minutes of operation based on the following conditions;	
	 1,500 mg/L NaCl solution at 150 psig All elements are vacuum sealed in packaged individually in a cardboard 	g (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.	
Product	Membrane Type :	Thin-film Composite	
Description	Membrane Material :	PA (Polyamide)	
	Membrane Surface Charge :	Negative	
	Element Configuration :	Spiral-Wound, Tape wrapping	
Product	A = 21 inch (533 mm)	
Dimensions	B = 2.5 inch (64 mm)		
C = 0.75 inch (19.1 mm)		m)	
	U-cup Seal (Brine seal) FRP or Tape wrapping End cap HI C (outer dia) B (clement exter dia)		
	(elem	ent length)	
	 One interconnector (coupler) w All CSM membrane elements f Outer feature may vary as designed 	vould be supplied for each membrane element. it nominal 2.5-inch (64 mm) I.D. pressure vessel. ign revisions take place.	
Features	 High rejection CSM tap wate enough to drink without furth CSM low pressure TL elen regular brackish water mem CSM low pressure TL elem 	I tap water membrane elements can be useful when tap water is not safe hout further purification. TL elements have capabilities in salt rejection and flux similar to the ater membrane under low pressure condition to reduce the energy cost.	
	pumps, plumbing and press	ure vessels in small systems	
Conditions for Handling CSM in general

Customer Satisfaction Membrane

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- 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 m³/hr) • Min. Concentrate flow rate 1 gpm (0.23 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 • 2.0 ~ 11.0 • CIP pH range 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

 CaSO₄ 	230 % saturation
 SrSO₄ 	800 % saturation
• BaSO ₄	6,000 % saturation
 SiO₂ 	100 % saturation

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

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

CSM

<u>CSM Low Pressure RO Membrane Elements</u>

lembrane

RE8040-BLN440	$8^{\prime\prime}$ in diameter X 40 $^{\prime\prime}$ in length, Normal low pressure grade RO membrane element with 440 ft^ membrane area for brackish water
RE8040-BLN	$8^{\prime\prime}$ 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	$4^{\mbox{\tiny "}}$ X 40", Normal low pressure grade RO membrane element for brackish water
RE4040-BLR	$4^{\prime\prime}$ 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

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

RE8040-BLN440

®

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

Product	Permeate Flow rate :	13,000 GPD (49.2 m ³ /day)
Specifications	Stabilized Salt Rejection :	99.0 %
	Effective Membrane Area :	440 ft ² (40.9 m ²)
	 The stated performance is initial data 1,500 mg/L NaCl solution at 150 psig Minimum salt rejection is 98.5% Permeate Flow rate for individual ele Effective membrane area may vary v Central tube inner diameter is 1.5 inc All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. ements may vary but will be no more than 10 % below the value shown. within 3 %. ches which is larger than 1.12 inch of the regular element. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and l box.
Product	Membrane Type :	Thin-film Composite
Description	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) Ucup Seal Branch Breach Breach Branch Br	
Features	 CSM low pressure BLN440 low pressure membrane (BL CSM BLN440 produce more The high flux BLN440 elem pump, plumbing and pressu Salt rejection and specific period 	element is made of the same high flux membrane as the regular N). e permeate flow than BLN because it has more membrane area. tent can save energy cost and capital costs for a high pressure re vessels. ermeate flux of BLN440 are between BLR and BLF products.

Customer Satisfaction Membrane Product Characteristics Comparison

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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 $^{\circ}$ C (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 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
 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

Customer Satisfaction Membrane

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

RE8040-BLN

Normal low pressure grade RO membrane element for brackish water

®

Product	Permeate Flow rate :	12,000 GPD (45.4 m ³ /day)	
Specifications	Stabilized Salt Rejection :	99.2 %	
	Effective Membrane Area :	400 ft ² (37.2 m ²)	
	 The stated performance is initial data 1,500 mg/L NaCl solution at 150 psig Minimum salt rejection is 99.0% Permeate Flow rate for individual ele Effective membrane area may vary v All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5–7.0. ments may vary but will be no more than 10 % below the value shown. vithin 3 %. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.	
Product	Membrane Type :	Thin-film Composite	
Description	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) Ucup Seal (Brine seal) FRP wrapping End cap (c, mor dia) (element outer dia) (element length) 1. One interconnector (coupler) would be supplied for each membrane element. 3. All CSM membrane elements fit nominal 8.0-inch (203 mm) 1.D. pressure vessel. 3. Outer feature may vary as design revisions take place.		
Features	 CSM low pressure BLN eler at low pressure condition, w pressure pumps, plumbing a Salt rejection and specific period 	ments have similar capabilities to the brackish water membrane which can reduce the energy cost and capital costs for the high and the pressure vessels. ermeate flux of BLN are between BLR and BLF products.	

Customer Satisfaction Membrane Product Characteristics Comparison

R

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 $^{\circ}$ C (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 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
 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate :	9,000 GPD (34.0 m ³ /day)
Specifications	Stabilized Salt Rejection :	99.6 %
	Effective Membrane Area :	400 ft ² (37.2 m ²)
	 The stated performance is initial data 1,500 mg/L NaCl solution at 150 psig Minimum salt rejection is 99.5% Permeate Flow rate for individual ele Effective membrane area may vary v All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5-7.0. ments may vary but will be no more than 10 % below the value shown. within 3 %. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	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) U-cup Seal Brine seal FRP wrapping End cap (inner dia) (inn	
Features	 CSM BLR element shows hi than regular brackish water energy and less capital co vessels than the regular mer More useful for high TDS fee 	igher salt rejection and higher permeate flow at a lower pressure membrane. It can produce higher quality of water using less ost for the high pressure pumps, plumbing and the pressure mbrane. ed water or for higher permeate quality.

Customer Satisfaction Membrane Product Characteristics Comparison

R

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 $^{\circ}$ C (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

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 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

Customer Satisfaction Membrane

$\mathsf{CSM}\;\mathsf{RO}\;\mathsf{MEMBRANE}, \mathsf{The}\;\mathsf{approved}\;\textit{Reverse}\;\textit{Osmosis}\;\textit{Membrane}\;\mathsf{in}\;\mathsf{the}\;\mathsf{world}.$

RE8040-BLF

Ultra-low pressure RO membrane element for low TDS water

®

Product	Permeate Flow rate :	11,500 GPD (43.5 m ³ /day)	
Specifications	Stabilized Salt Rejection :	99.2 %	
	Effective Membrane Area :	400 ft ² (37.2 m ²)	
	 The stated performance is initial data 500 mg/L NaCl solution at 100 psig (Minimum salt rejection is 99.0% Permeate Flow rate for individual ele Effective membrane area may vary v All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; 0.7 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5-7.0. ments may vary but will be no more than 10 % below the value shown. vithin 3 %. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.	
Product	Membrane Type :	Thin-film Composite	
Description	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) U-cup Seal Brine seal FRP wrapping End cap (element outer dia) (Brine seal (Brine seal) (composition of the seal (composition of the s		
Features	 CSM ultra-low pressure BLF which can reduce energy c pressure vessels. More useful when feed wate 	² element produces high permeate flow at a very low pressure, ost and capital costs for a high pressure pump, plumbing and r TDS is low and high permeate quality is not required.	

Customer Satisfaction Membrane Product Characteristics Comparison

R

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 $^{\circ}$ C (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 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
 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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

®

Desident	Dormooto Flow rate .	$2600 \text{CDD} (0.8 \text{m}^3/\text{dout})$
Specifications		2,600 GPD (9.8 m /day)
opecifications	Stabilized Salt Rejection :	99.2 %
	Effective Membrane Area :	85 ft² (7.9 m²)
	 The stated performance is initial da mg/L NaCl solution at 150 psig (1.0 l All elements are vacuum sealed in packaged individually in a cardboard 	ta taken after 30 minutes of operation based on the following conditions; 1,500 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	Membrane Material :	PA (Polyamide)
	Membrane Surface Charge :	Negative
	Element Configuration :	Spiral-Wound, FRP wrapping
Product Dimensions	A = 40 inch (1,016 m B = 4.0 inch (102 mm C = 0.75 inch (19.1 m U-cup Seal (Brine seal) FI (Brine seal) (elem 1. One interconnector (coupler) 2. All CSM membrane elements	m) h) hm) RP or Tape wrapping End cap Couter dia) SML SML SML B (element outer dia) A ent length) would be supplied for each membrane element. fit nominal 4.0-inch (102 mm) 1.D. pressure vessel. cisca servicient to the restored
Features	 CSM low pressure BLN eleration at low pressure condition, pressure pumps, plumbing a Salt rejection and specific period 	ments have similar capabilities to the brackish water membrane which can reduce the energy cost and capital costs for high and pressure vessels. ermeate flux of BLN are between BLR and BLF products.

Customer Satisfaction Membrane Product Characteristics Comparison

R

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 $^{\circ}$ (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 m³/hr) Min. Concentrate flow rate 4 gpm (0.91 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 2.0 ~ 11.0 CIP pH range • 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
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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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +1.5
- SDSI with any inhibitor <+0.5
- Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.



SAEHAN INDUSTRIES INC.

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 : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 1,500 mg/L NaCl solution at 150 psig 2. Minimum salt rejection is 99.4% 3. All elements are vacuum sealed in packaged individually in a cardboard	1,900 GPD (7.2 m ³ /day) 99.5 % 85 ft ² (7.9 m ²) a taken after 30 minutes of operation based on the following conditions; g (1.0 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	Membrane Material :	PA (Polyamide)
	Membrane Surface Charge :	Negative
	Element Configuration :	Spiral-Wound, FRP wrapping
Product Dimensions	A = 40 inch (1,016 m B = 4.0 inch (102 mm C = 0.75 inch (19.1 m U-cup Seal (Brine seal) Fr (elemu 1. One interconnector (coupler) w 2. All CSM membrane elements f 3. Outer feature may vary as designed	m) h) hm) RP or Tape wrapping End cap Couter dia) B (element outer dia) A ent length) rould be supplied for each membrane element. it nominal 4.0-inch (102 mm) I.D. pressure vessel. ign revisions take place.
Features	 CSM BLR element shows I than regular brackish water energy and less capital co vessels than the regular me 	high salt rejection and high permeate flow at a lower pressure r membrane. It can produce higher quality of water using less ost for the high pressure pumps, plumbing and the pressure mbrane.

• More useful for high TDS feed water or for higher permeate quality.

Customer Satisfaction Membrane Product Characteristics Comparison

R

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 $^{\circ}$ (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.
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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 18 gpm (4.09 m³/hr) Min. Concentrate flow rate 4 gpm (0.91 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 2.0 ~ 11.0 CIP pH range • 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

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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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- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +1.5
- SDSI with any inhibitor <+0.5
- Special inhibitor means one of approved organic inhibitors. It should be approved from real plant for more than three years.



SAEHAN INDUSTRIES INC.

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 : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 500 mg/L NaCl solution at 100 psig (2. All elements are vacuum sealed in packaged individually in a cardboard	2,500 GPD (9.5 m ³ /day) 99.2 % 85 ft ² (7.9 m ²) a taken after 30 minutes of operation based on the following conditions; 0.7 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5-7.0. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product Description	Membrane Type : Membrane Material : Membrane Surface Charge : Element Configuration :	Thin-film Composite PA (Polyamide) Negative Spiral-Wound, FRP wrapping
Product Dimensions	A = 40 inch (1,016 m B = 4.0 inch (1023 m C = 0.75 inch (19.1 m U-cup Seal (Brine seal) FF (element 1. One interconnector (coupler) 1 2. All CSM membrane elements 3. Outer feature may vary as desired	m) m) m) m) RP or Tape wrapping End cap Couter dia) SML Couter dia) Estimate and the supplied for each membrane element. fit nominal 4.0-inch (102 mm) 1.D. pressure vessel. sign revisions take place.
Features	 CSM ultra-low pressure BLF which can reduce energy c pressure vessels. More useful when feed wate 	² element produces high permeate flow at a very low pressure, ost and capital costs for a high pressure pump, plumbing and r TDS is low and high permeate quality is not required.

Customer Satisfaction Membrane Product Characteristics Comparison

R

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 $^{\circ}$ (recovery 15 %)



Conditions for Handling CSM in general

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Design Guideline for Various Water Source

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- 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

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• CaSO ₄	230 % saturation
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SAEHAN INDUSTRIES INC.

<u>CSM Fouling Resistant R0 Membrane Elements</u>

CSM

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

Customer Satisfaction Membrane

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

RE8040-FEⁿ

®

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 m³/day)
	Stabilized Salt Rejection :	99.5 %
	Effective Membrane Area :	400 ft ² (37.2 m ²)
	 The stated performance is initial dat 2,000 mg/L NaCl solution at 225 psi 2. Minimum salt rejection is 99.0%. Permeate Flow rate for individual ele 4. Effective membrane area may vary 5. All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. ements may vary but will be no more than 10 below the value shown. within 3 %. in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and d box.
Product	Membrane Type :	Thin-film Composite
Description	Membrane Material :	PA (Polyamide)
	Membrane Surface Charge :	Close to Neutral
	Element Configuration :	Spiral-Wound, FRP wrapping
Product Dimensions	A = 40 inch (1,016 m B = 8.0 inch (203 m C = 1.12 inch (28 m U-cup Seal (Brine seal) F (Brine seal) F (elem 1. One interconnector (coupler) v 2. All CSM membrane elements 3. Outer feature may vary as des	nm) n) RP wrapping End cap C C (inner dia) B (element outer dia) A nent length) would be supplied for each membrane element. fit nominal 8.0-inch (203 mm) I.D. pressure vessel. sign revisions take place.
Features	 CSM FEⁿ element provides fouling potential due to the after controlled pretreatmen CSM FEⁿ element has more CSM FEⁿ element has a h performance even after period 	s an excellent way to treat a feed water having relatively high remaining colloidal, biological and organic fouling agents even at. e fouling resistant property than CSM FE igh durability against CIP chemicals to sustain fouling resistant iodic CIP in a long term operation

Customer Satisfaction Membrane

Fouling Resistance Characteristics

R



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.

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 afd

• 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor < -0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate :	10,000 GPD (37.9 m ³ /day)	
Specifications	Stabilized Salt Rejection :	99.5 %	
	Effective Membrane Area :	365 ft ² (33.9 m ²)	
	 The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig Minimum salt rejection is 99.0%. Permeate Flow rate for individual ele Effective membrane area may vary v Thicker Feed spacer (32 mil) is used All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. ements may vary but will be no more than 10 below the value shown. within 3 %. I. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and I box.	
Product	Membrane Type :	Thin-film Composite	
Description	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) Ucup Seal (Brine seal) FRP wrapping End cap (clement outer dia) (element outer dia) (element length) 1. One interconnector (coupler) would be supplied for each membrane element. 3. 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 fouling potential fouling ager CSM FN element has a hig performance can be sustain CSM FN element has a thic of particles through creating 	an excellent way to treat a feed water which might still have nts gh durability against CIP chemicals so that the fouling resistant ed after periodic CIP in a long term operation. ck feed spacer to minimize membrane fouling due to the deposit more turbulent flow	

Customer Satisfaction Membrane

Fouling Resistance Characteristics

R



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.

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)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd
- Surface water (SDI < 3)
 Well water (SDI < 3)
 13 ~ 17 gfd
 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor < -0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate :	9,000 GPD (34.1 m ³ /day)	
Specifications	Stabilized Salt Rejection :	99.5 %	
	Effective Membrane Area :	300 ft ² (27.9 m ²)	
	 The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig Minimum salt rejection is 99.0%. Permeate Flow rate for individual ele Effective membrane area may vary v Thicker Feed spacer (46 mil) is used All elements are vacuum sealed i packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. ements may vary but will be no more than -10 above the value shown. within ±3 %. d. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and d box.	
Product	Membrane Type :	Thin-film Composite	
Description	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) Ucup Seal (Brine seal) FRP wrapping End cap (cmment dia) (element outer dia) (element length) 1. One interconnector (coupler) would be supplied for each membrane element. 2. All CSM membrane elements fit nominal 8.0-inch (203 mm) 1.D. pressure vessel. 3. Outer feature may vary as design revisions take place.		
Features	 CSM FN element provides fouling potential fouling ager CSM FN element has a hig performance can be sustain CSM FN element has a thic of particles from depositing 	an excellent way to treat a feed water which might still have nts gh durability against CIP chemicals so that the fouling resistant red after periodic CIP in a long term operation. ck feed spacer to minimize membrane fouling due to the deposit on the membrane surface	

Customer Satisfaction Membrane

Fouling Resistance Characteristics from zero discharge RO system

R

Relative Normailized Permeate Flow rate



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.

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)
 Waste water pretreated by UF (SDI < 3)
 Seawater, open intake (SDI < 5)
 High salinity well water (SDI < 3)
 Surface water (SDI < 5)
 12 ~ 16 gfd
- Surface water (SDI < 3)
 Well water (SDI < 3)
 13 ~ 17 gfd
 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.

CaCO₃ Scaling potential limits as LSI of SDSI

- Without scale inhibitor < -0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate :	11,000 GPD (41.6 m³/day)	
Specifications	Stabilized Salt Rejection :	99.5 %	
	Effective Membrane Area :	400 ft ² (37.2 m ²)	
	 The stated performance is initial dat 2,000 mg/L NaCl solution at 225 psi Minimum salt rejection is 99.0%. Permeate Flow rate for individual ele Effective membrane area may vary All elements are vacuum sealed packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. ements may vary but will be no more than 10 below the value shown. within 3 %. in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and d box.	
Product	Membrane Type :	Thin-film Composite	
Description	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) U-cup Seal (Brine seal) FRP wrapping End cap (cinner dia) (cinner dia) (cinner dia) (ciement length) 1. One interconnector (coupler) would be supplied for each membrane element. 3. 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 fouling potential due to the after controlled pretreatmen CSM FE element has a hi performance even after perior 	an excellent way to treat a feed water having relatively high remaining colloidal, biological and organic fouling agents even it. gh durability against CIP chemicals to sustain fouling resistant iodic CIP in a long term operation	

Customer Satisfaction Membrane

Fouling Resistance Characteristics

R



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.

SAEHAN Industries Inc. Specification Sheet Rev. 2411112 04/15/07

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)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd
- Surface water (SDI < 3) 13 ~ 17 gfd
- Well water (SDI < 3)
- RO/UF permeate (SDI < 1) 21 ~ 30 gfd

13 ~ 17 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor < -0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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

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	Permeate Flow rate :	9,000 GPD (34.0 m ³ /day)	
Specifications	Stabilized Salt Rejection :	99.0 %	
	Effective Membrane Area :	400 ft ² (37.2 m ²)	
	 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. Minimum salt rejection is 98.5%. Permeate Flow rate for individual elements may vary but will be no more than 10 below the value shown. Effective membrane area may vary within 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	Membrane Type :	Thin-film Composite	
Description	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) U-cup Seal Brine seal FRP wrapping End cap (inner dia) (c (inner dia) (element outer dia) (element length) 1. One interconnector (coupler) would be supplied for each membrane element. 2. All CSM membrane elements fit nominal 8.0-inch (203 mm) 1.D. pressure vessel. 3. Outer feature may vary as design revisions take place.		
Features	 CSM FL element provides fouling potential fouling ager CSM FL element has a hig performance can be sustain CSM FL element has a flow resistant property. 	an excellent way to treat a feed water which might still have nts gh durability against CIP chemicals so that the fouling resistant ed after periodic CIP in a long term operation. grate similar to CSM BLN at low pressure and in addition fouling	

Customer Satisfaction Membrane

Fouling Resistance Characteristics

R



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)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 • Surface water (SDI < 3)</td>
 13 ~ 17 gfd
 - Surface water (SDI < 3)</th>
 13 ~ 17 gfd

 Well water (SDI < 3)</td>
 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor < -0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

Customer Satisfaction Membrane

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

RE8040-FDⁿ

®

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

Product	Permeate Flow rate :	10,000 GPD (37.9 m ³ /day)
Specifications	Stabilized Salt Rejection :	99.5 %
	Effective Membrane Area :	365 ft ² (33.9 m ²)
	 The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig Minimum salt rejection is 99.0%. Permeate Flow rate for individual elet Effective membrane area may vary vary solution for the state of t	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. ements may vary but will be no more than 10 below the value shown. within 3 %. J. in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and d box.
Product	Membrane Type :	Thin-film Composite
Description	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) U^{-cup Seal} FRP wrapping End cap (clement outer dia) Gement length I. One interconnector (coupler) would be supplied for each membrane element. All CSM membrane elements fit nominal 8.0-inch (203 mm) 1.D. pressure vessel. Outer feature may vary as design revisions take place. 	
Features	 CSM FDⁿ element provides fouling potential due to the after controlled pretreatmen CSM FDⁿ element has more CSM FDⁿ element can be upresence of heavy colloidal 	s an excellent way to treat a feed water having relatively high remaining colloidal, biological and organic fouling agents even it. e fouling resistant property than CSM FD used for treating a feed water of high fouling potential due to the particles

Customer Satisfaction Membrane

Fouling Resistance Characteristics

R



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 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)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd
- Surface water (SDI < 3)
 Well water (SDI < 3)
 13 ~ 17 gfd
 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate :	10,000 GPD (37.9 m ³ /day)	
Specifications	Stabilized Salt Rejection :	99.5 %	
	Effective Membrane Area :	365 ft ² (33.9 m ²)	
	 The stated performance is initial dat 2,000 mg/L NaCl solution at 225 psi 2. Minimum salt rejection is 99.0%. Permeate Flow rate for individual ele 4. Effective membrane area may vary v 5. Thicker Feed spacer (32 mil) is used 6. All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5–7.0. ements may vary but will be no more than 10 below the value shown. within 3 %. J. in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and d box.	
Product	Membrane Type :	Thin-film Composite	
Description	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) U-cup Seal (Bine seal) FRP wrapping End cap (clement cuter dia) (element outer dia) (element length) 1. One interconnector (coupler) would be supplied for each membrane element. All CSM membrane elements fit nominal 8.0-inch (203 mm) 1.D. pressure vessel. Outer feature may vary as design revisions take place. 		
Features	 CSM FD element provides fouling potential fouling age CSM FD element has a h performance can be sustain CSM FD element can be u presence of heavy colloidal 	an excellent way to treat a feed water which might still have nts. high durability against CIP chemicals so the fouling resistance and after periodic CIP in the long term operation. sed for treating a feed water of high fouling potential due to the particles.	

Customer Satisfaction Membrane

Fouling Resistance Characteristics

R



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 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)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd
- Surface water (SDI < 3)
 Well water (SDI < 3)
 13 ~ 17 gfd
 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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 : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig 2. All elements are vacuum sealed i packaged individually in a cardboard	2,100 GPD (7.9 m ³ /day) 99.5 % 85 ft ² (7.9 m ²) a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	Membrane Material :	PA (Polyamide)
	Membrane Surface Charge :	Close to Neutral
	Element Configuration :	Spiral-Wound, FRP wrapping
Product Dimensions	A = 40 inch (1,016 m B = 4.0 inch (102 mn C = 0.75 inch (19.1 m U-cup Seal (Brine seal) F (elem 1. One interconnector (coupler) w 2. All CSM membrane elements 3. Outer feature may vary as des	Im) h) hm) RP or Tape wrapping End cap (outer dia) SM: SM: SM: Couter dia) B (element outer dia) A ent length) vould be supplied for each membrane element. fit nominal 8.0-inch (203 mm) 1.D. pressure vessel. ign revisions take place.
Features	 CSM FE element provides fouling potential fouling ager CSM FE element has a h performance can be sustain 	an excellent way to treat a feed water which might still have nts. igh durability against CIP chemicals so the fouling resistance ed after periodic CIP in the long term operation.\

Customer Satisfaction Membrane

Fouling Resistance Characteristics

R



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 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)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 • Surface water (SDI < 3)</td>
 13 ~ 17 gfd
- Surface water (SDI < 3)
 Well water (SDI < 3)
 13 ~ 17 gfd
 13 ~ 17 gfd
- RO/UF permeate (SDI < 1) 21 ~ 30 gfd

Saturation Limits for Salts

• CaSO ₄	230 % saturation
 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor < -0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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 : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 1,500 mg/L NaCl solution at 150 psig 2. All elements are vacuum sealed i	1,900 GPD (7.2 m ³ /day) 99.0 % 85 ft ² (7.9 m ²) a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and
Product Description	Membrane Type : Membrane Material : Membrane Surface Charge : Element Configuration :	Thin-film Composite PA (Polyamide) Close to Neutral 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) C = 0.75 inch (19.1 mm) Image: Comparison of the second	
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. 	

Customer Satisfaction Membrane

Fouling Resistance Characteristics

R



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 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)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 • Surface water (SDI < 3)</td>
 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor < -0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.
<u>CSM Sea Water RO Membrane Elements</u>

embrane

CSM

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	$2.5^{\prime\prime}$ 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

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	Permeate Flow rate :	6,000 GPD (22.7 m ³ /day)
Specifications	Stabilized Salt Rejection :	99.2 %
	Effective Membrane Area :	370 ft ² (34.4 m ²)
	 The stated performance is initial dat 32,000 mg/L NaCl solution at 800 ps Minimum salt rejection is 99.0%. Boron rejection is 88.0 % at pH 8.0 at Permeate Flow rate for individual election Effective membrane area may vary vary of All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; sig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. and 5 mg/L boron feed with the test condition as above note 1. ements may vary but will be no more than 10 below the value shown. within 5 %. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	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) Ucup Seal (Brine seal) FRP wrapping End cap (clement longth) I. One interconnector (coupler) would be supplied for each membrane element. 3. All CSM membrane elements fit nominal 2.5-inch (64 mm) 1.D. pressure vessel. 3. Outer feature may vary as design revisions take place.	
Features	 CSM SN element has good suitable for normal desalina CSM SN element has a hig after CIP. 	I performance in terms of salt rejection and permeate flow rate, tion process. h chemical durability which prevents declining of its performance

Customer Satisfaction Membrane

Conditions for Handling CSM in general

R

- 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 m³/hr) Min. Concentrate flow rate 16 gpm (3.6 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 CIP pH range 2.0 ~ 11.0 1.0 NTU Max. Turbidity Max. SDI (15 min) 5.0 • Chlorine concentration < 0.1 mg/L

Design Guideline for Various Water Source

- • Waste water (SDI < 5)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 • Surface water (SDI < 3)</td>
 13 ~ 17 gfd
 - Well water (SDI < 3)</th>
 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate :	6,000 GPD (22.7 m ³ /day)
Specifications	Stabilized Salt Rejection :	99.6 %
	Effective Membrane Area :	370 ft ² (34.4 m ²)
	 The stated performance is initial dat 32,000 mg/L NaCl solution at 800 ps Minimum salt rejection is 99.5%. Boron rejection is 90.0 % at pH 8.0 at Permeate Flow rate for individual let Effective membrane area may vary is All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; sig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. and 5 mg/L boron feed with the test condition as above note 1. ements may vary but will be no more than 15 below the value shown. within 5 %. in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and d box.
Product	Membrane Type :	Thin-film Composite
Description	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) U-cup Seal (Brine seal) FRP wrapping End cap (Inner dia) C (inner dia) C (element outer dia) C (element length) 1. One interconnector (coupler) would be supplied for each membrane element. 2. All CSM membrane elements fit nominal 2.5-inch (64 mm) 1.D. pressure vessel. 3. Outer feature may vary as design revisions take place. 	
Features	 CSM SR element shows hig process. CSM SR element has a hig after CIP. 	gher salt rejection than CSM SN, suitable for normal desalination h chemical durability which prevents declining of its performance

Customer Satisfaction Membrane

Conditions for Handling CSM in general

R

- 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 m³/hr) Min. Concentrate flow rate 16 gpm (3.6 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 CIP pH range 2.0 ~ 11.0 1.0 NTU Max. Turbidity Max. SDI (15 min) 5.0 • Chlorine concentration < 0.1 mg/L

Design Guideline for Various Water Source

- • Waste water (SDI < 5)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 • Surface water (SDI < 3)</td>
 13 ~ 17 gfd
 - Well water (SDI < 3)</th>
 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate :	6,500 GPD (24.6 m³/day)
Specifications	Stabilized Salt Rejection :	99.6 %
	Effective Membrane Area :	400 ft ² (37.2 m ²)
	 The stated performance is initial data 32,000 mg/L NaCl solution at 800 ps Minimum salt rejection is 99.5%. Boron rejection is 90.0% at pH 8.0 a Permeate Flow rate for individual ele Effective membrane area may vary v All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; ig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. and 5 mg/L boron feed with the test condition as above note 1. ements may vary but will be no more than 15 below the value shown. within 5 %. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and I box.
Product	Membrane Type :	Thin-film Composite
Description	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) Ucup Seal Brine seal FRP wrapping End cap (inner dia) Interest of the seal of the seal	
Features	 CSM SR element shows higher CSM SR400 element with extereducing total number of elemer SR400 due to the extended are for a specified amount of prodution CSM SR element has a high characteristic structure 	r salt rejection than CSM SN, suitable for normal desalination process. ended membrane area shows higher flow rate than CSM SR, helpful in ents for a specified total permeate quantity. The high productivity of CSM ea also enables the element operable at a lower pressure than CSM SR ict water and thus the rate of membrane fouling can remain low. memical durability which prevents declining of its performance after CIP.

Customer Satisfaction Membrane

Conditions for Handling CSM in general

R

- 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 m³/hr) Min. Concentrate flow rate 16 gpm (3.6 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 CIP pH range 2.0 ~ 11.0 1.0 NTU Max. Turbidity Max. SDI (15 min) 5.0 • Chlorine concentration < 0.1 mg/L

Design Guideline for Various Water Source

- • Waste water (SDI < 5)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 • Surface water (SDI < 3)</td>
 13 ~ 17 gfd
 - Well water (SDI < 3)</th>
 13 ~ 17 gfd
- RO/UF permeate (SDI < 1) 21 ~ 30 gfd

Saturation Limits for Salts

• CaSO4	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate :	4,500 GPD (17.0 m³/day)
Specifications	Stabilized Salt Rejection :	99.75 %
	Effective Membrane Area :	370 ft ² (34.4 m ²)
	 The stated performance is initial dat 32,000 mg/L NaCl solution at 800 ps Minimum salt rejection is 99.6%. Boron rejection is 92.0 % at pH 8.0.4. Permeate Flow rate for individual elefs Effective membrane area may vary All elements are vacuum sealed packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; sig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. and 5 mg/L boron feed with the test condition as above note 1. ements may vary but will be no more than 15 below the value shown. within 5 %. in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and d box.
Product	Membrane Type :	Thin-film Composite
Description	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) Use Seal (Brine seal) FRP wrapping End cap (element outer dia) (element length) I one interconnector (coupler) would be supplied for each membrane element. All CSM membrane elements fit nominal 2.5-inch (64 mm) 1.D. pressure vessel. 3. Outer feature may vary as design revisions take place.	
Features	 CSM SH showing ultra-high s condition such as higher salir higher recovery ratio than 40 existing systems due to its low 	alt rejection can be used in seawater desalination under more severe hity than 35000 mg/L, higher feed water temperature than 25 $^{\circ}$ C and $^{\circ}$. However, the element is more suitable for replacing old elements in er permeate flow.

• CSM SH element has a high chemical durability which prevents declining of its performance after CIP.

Customer Satisfaction Membrane

Conditions for Handling CSM in general

R

- 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 m³/hr) Min. Concentrate flow rate 16 gpm (3.6 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 CIP pH range 2.0 ~ 11.0 1.0 NTU Max. Turbidity Max. SDI (15 min) 5.0 • Chlorine concentration < 0.1 mg/L

Design Guideline for Various Water Source

- • Waste water (SDI < 5)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 • Surface water (SDI < 3)</td>
 13 ~ 17 gfd
 - Well water (SDI < 3)</th>
 13 ~ 17 gfd
- RO/UF permeate (SDI < 1) 21 ~ 30 gfd

Saturation Limits for Salts

• CaSO4	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate :	6,000 GPD (22.7 m ³ /day)	
Specifications	Stabilized Salt Rejection :	99.75 %	
	Effective Membrane Area :	370 ft ² (34.4 m ²)	
	 The stated performance is initial data 32,000 mg/L NaCl solution at 800 ps Minimum salt rejection is 99.6%. Boron rejection is 92.0 % at pH 8.0 a Permeate Flow rate for individual elections Effective membrane area may vary to All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; ig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. and 5 mg/L boron feed with the test condition as above note 1. ments may vary but will be no more than 15 below the value shown. within 5 %. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and I box.	
Product	Membrane Type : Thin-film Composite		
Description	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) Ucup Seal (Brine seal) FRP wrapping End cap (c, mor dia) B (element outer dia) C = 0.01 in interconnector (coupler) would be supplied for each membrane element. 2. All CSM membrane elements fit nominal 2.5-inch (64 mm) 1.D. pressure vessel. 3. Outer feature may vary as design revisions take place.		
Features	 CSM SHN showing ultra-high condition such as higher salin higher recovery ratio than 40 system. CSM SHN element has a high CIP. 	salt rejection can be used in seawater desalination under more severe ity than 35000 mg/L, higher feed water temperature than 25 $^{\circ}$ C and $^{\circ}$ C CSM SHN can also be useful for one (1) pass desalination RO n chemical durability which prevents declining of its performance after	

Customer Satisfaction Membrane

Conditions for Handling CSM in general

R

- 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 m³/hr) Min. Concentrate flow rate 16 gpm (3.6 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 CIP pH range 2.0 ~ 11.0 1.0 NTU Max. Turbidity Max. SDI (15 min) 5.0 • Chlorine concentration < 0.1 mg/L

Design Guideline for Various Water Source

- • Waste water (SDI < 5)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 • Surface water (SDI < 3)</td>
 13 ~ 17 gfd
 - Well water (SDI < 3)</th>
 13 ~ 17 gfd
- RO/UF permeate (SDI < 1) 21 ~ 30 gfd

Saturation Limits for Salts

• CaSO4	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

Customer Satisfaction Membrane

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

RE8040-SHN400

®

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

Product	Permeate Flow rate :	6,500 GPD (24.6 m³/day)
Specifications	Stabilized Salt Rejection :	99.75 %
	Effective Membrane Area :	400 ft ² (37.2 m ²)
	 The stated performance is initial data 32,000 mg/L NaCl solution at 800 ps Minimum salt rejection is 99.6%. Boron rejection is 92.0 % at pH 8.0 at Permeate Flow rate for individual election Effective membrane area may vary with All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; ig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. and 5 mg/L boron feed with the test condition as above note 1. ments may vary but will be no more than 15 below the value shown. vithin 5 %. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	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) Ucup Seal Branch (203 mm) Ucup Seal Branch (20 mm) Ucup	
Features	 CSM SHN400 with extended n high salt rejection, and thus ca total number of elements to s under more severe conditions than 25 °C and higher recovery CSM SHN element has a high CIP. 	nembrane area shows higher permeate flow than CSM SHN with ultra- in be used at a lower operating pressure to save energy or in reducing ave capital cost in addition to an advantage in seawater desalination such as higher TDS than 35000 mg/L, higher feed water temperature ratio than 40 %.

Customer Satisfaction Membrane

Conditions for Handling CSM in general

R

- 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 m³/hr) Min. Concentrate flow rate 16 gpm (3.6 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 CIP pH range 2.0 ~ 11.0 1.0 NTU Max. Turbidity Max. SDI (15 min) 5.0 • Chlorine concentration < 0.1 mg/L

Design Guideline for Various Water Source

- Waste water (SDI < 5)
 Waste water pretreated by UF (SDI < 3)
 Waste water pretreated by UF (SDI < 3)
 10 ~ 14 gfd
 Seawater, open intake (SDI < 5)
 High salinity well water (SDI < 3)
 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

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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 : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 32,000 mg/L NaCl solution at 800 ps 2. All elements are vacuum sealed in packaged individually in a cardboard	1,200 GPD (4.5 m ³ /day) 99.6 % 74 ft ² (6.9 m ²) a taken after 30 minutes of operation based on the following conditions; ig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product Description	Membrane Type : Membrane Material : Membrane Surface Charge : Element Configuration :	Thin-film Composite PA (Polyamide) Negative Spiral-Wound, FRP wrapping
Product Dimensions	A = 40 inch (1,016 m B = 4.0 inch (102 mm C = 0.75 inch (19.1 m U-cup Seal (Brine seal) FF (Brine seal) FF (elements) (elements) 1. One interconnector (coupler) w 2. All CSM membrane elements f 3. Outer feature may vary as desired	m) n) RP or Tape wrapping End cap Couter dia) SML (element outer dia) A ent length) rould be supplied for each membrane element. it nominal 2.5-inch (64 mm) I.D. pressure vessel. ign revisions take place.
Features	 CSM SR element shows hig process. CSM SR element has a high after CIP. 	ther salt rejection than CSM SN, suitable for normal desalination n chemical durability which prevents declining of its performance

Customer Satisfaction Membrane

Conditions for Handling CSM in general

R

- 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 m³/hr) Min. Concentrate flow rate 4 gpm (0.91 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 CIP pH range 2.0 ~ 11.0 1.0 NTU Max. Turbidity Max. SDI (15 min) 5.0 • Chlorine concentration < 0.1 mg/L

Design Guideline for Various Water Source

- Waste water (SDI < 5)</td>
 8 ~ 12 gfd

 Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 Surface water (SDI < 3)</td>
 13 ~ 17 gfd
- Well water (SDI < 3)</th>
 13 ~ 17 gfd
- RO/UF permeate (SDI < 1) 21 ~ 30 gfd

Saturation Limits for Salts

• CaSO ₄	230 % saturation
 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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 : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 32,000 mg/L NaCl solution at 800 ps 2. Boron rejection is 92.0 % at pH 8.0 at 3. All elements are vacuum sealed in packaged individually in a cardboard	1,000 GPD (3.8 m ³ /day) 99.75 % 74 ft ² (6.9 m ²) a taken after 30 minutes of operation based on the following conditions; ig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. and 5 mg/L boron feed with the test condition as above note 1. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product Description	Membrane Type : Membrane Material : Membrane Surface Charge : Element Configuration :	Thin-film Composite PA (Polyamide) Negative Spiral-Wound, FRP wrapping
Product Dimensions	A = 40 inch (1,016 m B = 4.0 inch (102 mm C = 0.75 inch (19.1 m U-cup Seal (Brine seal) F (elem 1. One interconnector (coupler) v 2. All CSM membrane elements f 3. Outer feature may vary as des	am) h) hm) RP or Tape wrapping End cap Couter dia) SIM: SIM: Couter dia) But end cap (element outer dia) A ent length) vould be supplied for each membrane element. fit nominal 2.5-inch (64 mm) I.D. pressure vessel. ign revisions take place.
Features	 CSM SH showing ultra-high severe condition such as h than 25 °C and higher rec replacing old elements in the CSM SH element has a high after CIP. 	a salt rejection can be used in seawater desalination under more higher salinity than 35000 mg/L, higher feed water temperature overy ratio than 40 %. However the element is more suitable for e existing system due to its lower permeate flow. h chemical durability which prevents declining of its performance

Customer Satisfaction Membrane

Conditions for Handling CSM in general

R

- 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 m³/hr) Min. Concentrate flow rate 4 gpm (0.91 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 CIP pH range 2.0 ~ 11.0 1.0 NTU Max. Turbidity Max. SDI (15 min) 5.0 • Chlorine concentration < 0.1 mg/L

Design Guideline for Various Water Source

- Waste water (SDI < 5)</td>
 8 ~ 12 gfd

 Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 Surface water (SDI < 3)</td>
 13 ~ 17 gfd
- Well water (SDI < 3)</th>
 13 ~ 17 gfd
- RO/UF permeate (SDI < 1) 21 ~ 30 gfd

Saturation Limits for Salts

• CaSO ₄	230 % saturation
 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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 : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 32,000 mg/L NaCl solution at 800 psi 2. All elements are vacuum sealed in packaged individually in a cardboard	600 GPD (2.3 m ³ /day) 99.6 % 35 ft ² (3.3 m ²) a taken after 30 minutes of operation based on the following conditions; ig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	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 m U-cup Seal (Brine seal) FF (Brine seal) (Brine) nm) RP or Tape wrapping End cap (outer dia) SML SML B (element outer dia) A ent length) ould be supplied for each membrane element. It nominal 2.5-inch (64 mm) I.D. pressure vessel. gn revisions take place.
Features	 CSM SR element shows hig process. CSM SR element has a high after CIP. 	her salt rejection than CSM SN, suitable for normal desalination

Customer Satisfaction Membrane

Conditions for Handling CSM in general

R

- 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 m³/hr) Min. Concentrate flow rate 4 gpm (0.91 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 CIP pH range 2.0 ~ 11.0 1.0 NTU Max. Turbidity Max. SDI (15 min) 5.0 • Chlorine concentration < 0.1 mg/L

Design Guideline for Various Water Source

- Waste water (SDI < 5)</td>
 8 ~ 12 gfd

 Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 Surface water (SDI < 3)</td>
 13 ~ 17 gfd
- Well water (SDI < 3)</th>
 13 ~ 17 gfd
- RO/UF permeate (SDI < 1) 21 ~ 30 gfd

Saturation Limits for Salts

• CaSO ₄	230 % saturation
 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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 : Stabilized Salt Rejection : Effective Membrane Area : 1. The stated performance is initial data 32,000 mg/L NaCl solution at 800 ps 2. All elements are vacuum sealed in packaged individually in a cardboard	500 GPD (1.9 m ³ /day) 99.6 % 24 ft ² (2.2 m ²) a taken after 30 minutes of operation based on the following conditions; ig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product Description	Membrane Type : Membrane Material : Membrane Surface Charge : Element Configuration :	Thin-film Composite PA (Polyamide) Negative Spiral-Wound, Tape wrapping
Product Dimensions	A = 40 inch (1,016 m B = 2.5 inch (64 mm) C = 0.75 inch (19.1 m U-cup Seal (Brine seal) FF (Brine seal) FF (elements) (elements) 1. One interconnector (coupler) w 2. All CSM membrane elements f 3. Outer feature may vary as designed	m) RP or Tape wrapping End cap Couter dia) SML Couter dia) But couter dia) A ent length) rould be supplied for each membrane element. it nominal 2.5-inch (64 mm) I.D. pressure vessel. ign revisions take place.
Features	 CSM SR element shows hig process. CSM SR element has a high after CIP. 	ther salt rejection than CSM SN, suitable for normal desalination n chemical durability which prevents declining of its performance

Customer Satisfaction Membrane

Conditions for Handling CSM in general

R

- 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 m³/hr) Min. Concentrate flow rate 1 gpm (0.23 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 CIP pH range 2.0 ~ 11.0 1.0 NTU Max. Turbidity Max. SDI (15 min) 5.0 • Chlorine concentration < 0.1 mg/L

Design Guideline for Various Water Source

- Waste water (SDI < 5)</td>
 8 ~ 12 gfd

 Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 Surface water (SDI < 3)</td>
 13 ~ 17 gfd
- Surface water (SDI < 3)</th>
 13 ~ 17 gfd

 Well water (SDI < 3)</td>
 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate :	225 GPD (0.85 m³/day)
Specifications	Stabilized Salt Rejection :	99.6 %
	Effective Membrane Area :	12 ft ² (1.1 m ²)
	 The stated performance is initial data 32,000 mg/L NaCl solution at 800 ps All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; ig (5.5 MPa) applied pressure, 8 % recovery, 77 °F (25 °C) and pH 6.5~7.0. In a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	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 m U-cup Seal (Brine seal) Fr (Brine seal) (C = 0.75 inch (19.1 m (Brine seal) (C = 0.75 inch (19.1 m) (Brine seal) (C = 0.75 inch (19.1 m)) (Brine seal) (C = 0.75 inch (19.) RP or Tape wrapping End cap Couter dia) End cap (outer dia) B (element outer dia) A ent length) ould be supplied for each membrane element. It nominal 2.5-inch (64 mm) I.D. pressure vessel. gn revisions take place.
Features	 CSM SR element shows hig process. CSM SR element has a high after CIP. 	her salt rejection than CSM SN, suitable for normal desalination n chemical durability which prevents declining of its performance

Customer Satisfaction Membrane

Conditions for Handling CSM in general

R

- 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 m³/hr) Min. Concentrate flow rate 1 gpm (0.23 m³/hr) Max. Operating temperature 113 °F (45 °C) Operating pH range 3.0 ~ 10.0 CIP pH range 2.0 ~ 11.0 1.0 NTU Max. Turbidity Max. SDI (15 min) 5.0 • Chlorine concentration < 0.1 mg/L

Design Guideline for Various Water Source

- • Waste water (SDI < 5)</td>
 8 ~ 12 gfd

 • Waste water pretreated by UF (SDI < 3)</td>
 10 ~ 14 gfd

 • Seawater, open intake (SDI < 5)</td>
 7 ~ 10 gfd

 • High salinity well water (SDI < 3)</td>
 8 ~ 12 gfd

 • Surface water (SDI < 5)</td>
 12 ~ 16 gfd

 • Surface water (SDI < 3)</td>
 13 ~ 17 gfd
- Surface water (SDI < 3)</th>
 13 ~ 17 grd

 Well water (SDI < 3)</td>
 13 ~ 17 grd
- RO/UF permeate (SDI < 1) 21 ~ 30 gfd

Saturation Limits for Salts

• CaSO ₄	230 % saturation
 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

<u>CSM Ultrapure Water R0 Membrane Elements</u>

lembrane

CSM.

RE8040-UE	8" in diameter X 40" in length, Normal grade RO membrane element for ultrapure water
RE8040-HUE440	$8^{\prime\prime}$ 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

Customer Satisfaction Membrane

$\mathsf{CSM}\;\mathsf{RO}\;\mathsf{MEMBRANE}, \mathsf{The}\;\mathsf{approved}\;\textit{Reverse}\;\textit{Osmosis}\;\textit{Membrane}\;\mathsf{in}\;\mathsf{the}\;\mathsf{world}.$

RE8040-UE

Normal grade RO membrane element for ultrapure water

®

Product	Permeate Flow rate :	9,000 GPD (34.1 m³/day)
Specifications	Stabilized Salt Rejection :	99.5 %
	Effective Membrane Area :	400 ft ² (37.2 m ²)
	 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. Minimum salt rejection is 99.0% 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. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown. Effective membrane area may vary within 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	Membrane Type :	Thin-film Composite
Description	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) U-cup Seal (Brine seal) FRP wrapping End cap (inner dia) (element outer dia)	
	(element length)	
	 One interconnector (coupler) would be supplied for each membrane element. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel. Outer feature may vary as design revisions take place. 	
Features	CSM UE element has exercise extractable from element an	cellent characteristics such as high TOC rejection, low TOC d low TOC rinse down time.

Customer Satisfaction Membrane



R



TOC reduction in CSM UPW products used in the $2^{\rm nd}$ 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
 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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

RE8040-HUE440

®

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

Product	Permeate Flow rate :	10,000 GPD (37.9 m ³ /day)
Specifications	Stabilized Salt Rejection :	99.5 %
	Effective Membrane Area :	440 ft ² (40.9 m ²)
	 The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig Minimum salt rejection is 99.0% IPA rejection is 96.0% after 2 hours (1.5 MPa) applied pressure, 15% red Permeate Flow rate for individual elections Effective membrane area may vary vary All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. of operation at the following test condition; 1,000 mg/L IPA solution at 225 psig covery, 77 °F (25 °C) and pH 6.5~7.0. ements may vary but will be no more than 10 % below the value shown. within 3 %. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and l box.
Product	Membrane Type :	Thin-film Composite
Description	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) Ucup Seal Bin FRP wrapping End cap (inner dia) Bin (inner dia) (inner d	
Features	 CSM HUE element has executive extractable from element an CSM HUE440 element with CSM UE element in treating CSM HUE element has a for 	Accellent characteristics such as high TOC rejection, low TOC d low TOC rinse down time. h extended membrane area shows higher TOC rejection than a feed water of low TOC (less than 100 ppb) uling resistant property similar to CSM FRM.

Customer Satisfaction Membrane



R



TOC reduction in CSM UPW products used in the $2^{\rm nd}$ 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
 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor < -0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

Customer Satisfaction Membrane

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

RE8040-HUE

High TOC rejection RO membrane element for ultrapure water

®

Product	Permeate Flow rate :	9,000 GPD (34.1 m ³ /day)
Specifications	Stabilized Salt Rejection :	99.5 %
	Effective Membrane Area :	400 ft ² (37.2 m ²)
	 The stated performance is initial data 2,000 mg/L NaCl solution at 225 psig Minimum salt rejection is 99.0% IPA rejection is 96.0% after 2 hours (1.5 MPa) applied pressure, 15% rec Permeate Flow rate for individual ele Effective membrane area may vary v All elements are vacuum sealed in packaged individually in a cardboard 	a taken after 30 minutes of operation based on the following conditions; g (1.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. of operation at the following test condition; 1,000 mg/L IPA solution at 225 psig covery, 77 °F (25 °C) and pH 6.5~7.0. ments may vary but will be no more than 10 % below the value shown. vithin 3 %. n a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product	Membrane Type :	Thin-film Composite
Description	Membrane Material :	PA (Polyamide)
	Membrane Surface Charge :	Negative
	Element Configuration :	Spiral-Wound, FRP wrapping
Product	A = 40 inch (1,016 m	m)
Dimensions	B = 8.0 inch (203 mm)	
	C = 1.12 inch (28 mm)	
	U-cup Seal (Brine seal) F	End cap C C C C (inner dia) B (element outer dia) A ent length)
 One interconnector (coupler) would be supplied for each membrane element. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel. Outer feature may vary as design revisions take place. 		vould be supplied for each membrane element. it nominal 8.0-inch (203 mm) I.D. pressure vessel. ign revisions take place.
Features	 CSM HUE element has exertactable from element an CSM HUE element shows water of low TOC (less than CSM HUE element has a for 	Accellent characteristics such as high TOC rejection, low TOC d low TOC rinse down time. higher TOC rejection than CSM UE element in treating a feed 100 ppb) uling resistant property similar to CSM FRM.

Customer Satisfaction Membrane



R



TOC reduction in CSM UPW products used in the $2^{\rm nd}$ 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
 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor < -0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

Customer Satisfaction Membrane

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

RE8040-UL

Low pressure RO membrane element for ultrapure water

®

Product	Permeate Flow rate :	10,000 GPD (37.9 m ³ /day)	
Specifications	Stabilized Salt Rejection :	99.5 %	
	Effective Membrane Area :	400 ft ² (37.2 m ²)	
	 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. Minimum salt 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. Permeate Flow rate for individual elements may vary but will be no more than 10 % below the value shown. Effective membrane area may vary within 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	Membrane Type :	Thin-film Composite	
Description	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) U-cup Seal Brine seal FRP wrapping End cap C inner dia B (element outer dia) C inner dia C inner dia C inner dia B (element length) 1. One interconnector (coupler) would be supplied for each membrane element. All CSM membrane elements fit nominal 8.0-inch (203 mm) 1.D. pressure vessel. 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. 		

Customer Satisfaction Membrane



R



TOC reduction in CSM UPW products used in the $2^{\rm nd}$ 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 °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
 SrSO₄ 	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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

CSM Nanofiltration Membrane Elements

CSM

NE8040-90	$8^{\prime\prime}$ in diameter X $40^{\prime\prime}$ 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	$2.5^{\prime\prime}$ X 40^{\prime\prime}, Nanofiltration membrane element with medium monovalent ion rejection

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	Permeate Flow rate ¹⁾ :	9,000 GPD (34,1 m ³ /day)				
Specifications	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 conditions;	30 minutes of operation based on the following monovalent test				
	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					
	 2,000 mg/L MgSO₄ solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 3. Permeate Flow rate for individual elements may vary but will be no more than 15 % below the value show 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) packaged individually in a cardboard box. 					
Product	Membrane Type : Thin-film	n Composite				
Description	Membrane Material : PA (Poly	/amide)				
	Membrane Surface Charge : Negative	e				
	Element Configuration : Spiral-W	/ound, FRP wrapping				
Product Dimensions	A = 40 inch (1,016 mm) B = 8.0 inch (203 mm)					
	C = 1.12 inch (28 mm)					
	U-cup Seal (Brine seal) FRP wrapping	End cap				
	C CSM: CSM: C C C (inner dia) B (element outer dia)					
	(cloment length)					
	 One interconnector (coupler) would be supplied for each membrane element. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel. Outer feature may vary as design revisions take place. 					
Features	 CSM NE90 elements with 90 % monovalent are useful for water softening, removing er 	ion rejection and more than 99 % rejection of divalent ions docrine disruption chemicals from drinking water and also				

Customer Satisfaction Membrane

Organic Rejection Characteristics

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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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor < -0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.
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⁾ : Monovalent Ion Rejection (Nat Divalent Ion Rejection (MgSO4 Effective Membrane Area : 1. The stated performance is initial dat conditions; 2,000 mg/L NaCl solution at 75 psig (2. The stated performance is initial dat conditions; 2,000 mg/L MgSO4 solution at 75 psig 3. Permeate Flow rate for individual eler 4. Minimum MgSO4 rejection 99.0 % 5. Effective membrane area may vary w 6. All elements are vacuum sealed in packaged individually in a cardboard	7,000 GPD (34,1 m³/day)CI) 11 : $60 \sim 70 \%$ $4)^{21}$: 99.5% $400 \text{ ft}^2 (37.2 \text{ m}^2)$ a taken after 30 minutes of operation based on the following monovalent test 0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.at taken after 30 minutes of operation based on the following divalent test (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.at a taken after 30 minutes of operation based on the following divalent test $g (0.5 \text{ MPa})$ applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0.ments may vary but will be no more than 10 % below the value shown.within 3 %.n a polyethylere bag containing 1.0 % SBS (Sodium bisulfite) solution and box.
Product Description	Membrane Type : Membrane Material : Membrane Surface Charge : Element Configuration :	Thin-film Composite PA (Polyamide) Negative Spiral-Wound, FRP wrapping
Product Dimensions	A = 40 inch (1,016 mm) B = 8.0 inch (203 mm) C = 1.12 inch (28 mm) U-cup Seal (Brine seal) FRP wrapping End cap (clement outer of the seal) Construction of the seal of the	

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.

Customer Satisfaction Membrane

Conditions for Handling CSM in general

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- 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) 60 psi (0.42 Mpa) • Max. Pressure drop / 240" vessel • Max. Operating pressure 600 psi (4.14 MPa) · Max. Feed flow rate 66 gpm (15.0 m3/hr) • Min. Concentrate flow rate 16 gpm (3.6 m³/hr) 113 °F (45 °C) • Max. Operating temperature 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

 CaSO₄ 	230 % saturation
 SrSO₄ 	800 % saturation
 BaSO₄ 	6,000 % saturation
 SiO₂ 	100 % saturation

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

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate ¹⁾ :	1,900 GPD (7.2 m³/day)		
Specifications	Monovalent Ion Rejection (NaCl) ¹⁾ :	85~95 %		
	Divalent Ion Rejection (MgSO4) ²⁾ :	99.5 %		
	Effective Membrane Area :	85 ft ² (7.9 m ²)		
	 The stated performance is initial data taken after conditions; 	30 minutes of operation based on the following monovalent test		
	2,000 mg/L NaCl solution at 75 psig (0.5 MPa) app 2. The stated performance is initial data taken after conditions:	lied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5–7.0. er 30 minutes of operation based on the following divalent test		
	 2,000 mg/L MgSO4 solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7 All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) soluti packaged individually in a cardboard box. 			
Product	Membrane Type : Thin-film	n Composite		
Description	Membrane Material : PA (Poly	/amide)		
	Membrane Surface Charge : Negative	e		
	Element Configuration : Spiral-W	/ound, FRP wrapping		
Product Dimensions	A = 40 inch (1,016 mm) B = 4.0 inch (102 mm) C = 0.75 inch (19.1 mm) U-cup Seal (Brine seal) FRP or Tape wrapping End cap (couter dia) (couter dia) (element length) 1. One interconnector (coupler) would be supplied for each membrane element			
	 All CSM membrane elements fit nominal 8.0- Outer feature may vary as design revisions to 	inch (203 mm) I.D. pressure vessel. ake place.		
Features	 CSM NE90 elements with 90 % monovalent are useful for water softening, removing en food processing in small size systems. 	t ion rejection and more than 99 % rejection of divalent ions docrine disruption chemicals from drinking water and also		

Customer Satisfaction Membrane

Organic Rejection Characteristics

R



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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor < -0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate ¹⁾ :	1,500 GPD (5.7 m ³ /day)		
Specifications	Monovalent Ion Rejection (NaCI) ¹⁾ :	60 ~ 70 %		
	Divalent Ion Rejection (MgSO4) ²⁾ :	99.5 %		
	Effective Membrane Area :	85 ft² (7.9 m²)		
	 The stated performance is initial data taken after conditions; 	30 minutes of operation based on the following monovalent test		
	2,000 mg/L NaCl solution at 75 psig (0.5 MPa) app 2. The stated performance is initial data taken aft conditions;	blied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. er 30 minutes of operation based on the following divalent test		
	 2,000 mg/L MgSO₄ solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~ All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solut packaged individually in a cardboard box. 			
Product	Membrane Type : Thin-filr	n Composite		
Description	Membrane Material : PA (Pol	yamide)		
	Membrane Surface Charge : Negativ	e		
	Element Configuration : Spiral-V	Vound, FRP wrapping		
Product Dimensions	A = 40 inch (1,016 mm) B = 4.0 inch (102 mm) C = 0.75 inch (19.1 mm) Using Seal (Brine seal) FRP or Tape wrapping End cap (outer dia) (outer dia) (element outer dia) (element length) 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.			
Features	 CSM NE70 elements with medium monova ions are useful for water softening, pretrea small size systems. 	alent ion rejection and more than 99 % rejection of divalent atment for seawater desalination and food concentration in		

Customer Satisfaction Membrane

Conditions for Handling CSM in general

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- 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) 60 psi (0.42 Mpa) • Max. Pressure drop / 240" vessel • Max. Operating pressure 600 psi (4.14 MPa) · Max. Feed flow rate 66 gpm (15.0 m3/hr) • Min. Concentrate flow rate 16 gpm (3.6 m³/hr) 113 °F (45 °C) • Max. Operating temperature 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

 CaSO₄ 	230 % saturation
 SrSO₄ 	800 % saturation
 BaSO₄ 	6,000 % saturation
 SiO₂ 	100 % saturation

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

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate ¹⁾ :	450 GPD (1.7 m ³ /day)		
Specifications	Monovalent Ion Rejection (NaCl) ¹⁾ :	85~95 %		
	Divalent Ion Rejection (MgSO4) ²⁾ :	99.5 %		
	Effective Membrane Area :	27 ft ² (2.5 m ²)		
	1. The stated performance is initial data taken afte	r 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 6.5~7.1 The stated performance is initial data taken after 30 minutes of operation based on the following diva conditions; 2,000 mg/L MgSO₄ solution at 75 psig (0.5 MPa) applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~ All elements are vacuum sealed in a polyethylene bag containing 1.0 % SBS (Sodium bisulfite) solu packaged individually in a cardboard box. 			
Product	Membrane Type : Thin-file	n Composite		
Description	Membrane Material : PA (Pol	yamide)		
	Membrane Surface Charge : Negativ	/e		
	Element Configuration : Spiral-V	Vound, Tape wrapping		
Product	A = 40 inch (1,016 mm)			
Dimensions	B = 2.5 inch (64 mm)			
	C = 0.75 inch (19.1 mm) U-cup Seal (Brine seal) FRP or Tape wrapping End con			
	C Couter dia)			
	(element length)			
	lied for each membrane element.)-inch (203 mm) I.D. pressure vessel. take place.			
Features	 CSM NE90 elements with 90 % monovaler are useful for water softening, removing e food processing in small size systems. 	nt ion rejection and more than 99 % rejection of divalent ions ndocrine disruption chemicals from drinking water and also		

Customer Satisfaction Membrane

Organic Rejection Characteristics

R



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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor < -0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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 INC.

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	Permeate Flow rate ¹⁾ :	350 GPD (1.3 m ³ /day)						
Specifications	Monovalent Ion Rejection (NaCl) ¹⁾ :	60 ~ 70 %						
	Divalent Ion Rejection (MgSO4) ²⁾ :	99.5 %						
	Effective Membrane Area :	27 ft² (2.5 m²)						
	1. The stated performance is initial data taken afte	r 30 minutes of operation based on the following monovalent test						
	 conditions; 2,000 mg/L NaCl solution at 75 psig (0.5 MPa) ap 2. The stated performance is initial data taken africonditions; 2,000 mg/L MgSO₄ solution at 75 psig (0.5 MPa) at 3. All elements are vacuum sealed in a polyethy packaged individually in a cardboard box. 	plied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. ter 30 minutes of operation based on the following divalent test applied pressure, 15 % recovery, 77 °F (25 °C) and pH 6.5~7.0. dene bag containing 1.0 % SBS (Sodium bisulfite) solution and						
Product	Membrane Type : Thin-filr	n Composite						
Description	Membrane Material : PA (Pol	yamide)						
	Membrane Surface Charge : Negativ	e						
	Element Configuration : Spiral-V	Vound, Tape wrapping						
Product	A = 40 inch (1,016 mm)							
Dimensions	B = 2.5 inch (64 mm)							
	C = 0.75 inch (19.1 mm)							
	U-cup Seal (Brine seal) FRP or Tape wra	apping End cap						
	C (outer dia) (element outer dia)							
	(element length)							
	 One interconnector (coupler) would be supplied for each membrane element. All CSM membrane elements fit nominal 8.0-inch (203 mm) I.D. pressure vessel. Outer feature may vary as design revisions take place. 							
Features	 CSM NE70 elements with medium monova- ions are useful for water softening, pretreas small size systems. 	alent ion rejection and more than 99 % rejection of divalent atment for seawater desalination and food concentration in						

Customer Satisfaction Membrane

Conditions for Handling CSM in general

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- 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 m³/hr) • Min. Concentrate flow rate 1 gpm (0.23 m³/hr) 113 °F (45 °C) • Max. Operating temperature 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.

CaCO₃ Scaling potential limits as LSI or SDSI

- Without scale inhibitor <-0.2
- LSI (SDSI) with SHMP < +0.5
- LSI (SDSI) with special inhibitor¹ < +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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CSN[®] Customer Satisfaction Membrane

<u>CSM Household RO Membrane Elements</u>

Customer Satisfaction Membrane

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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 Specific stiens	Model name	;	Permeate Flo	ow rate	Salt Rejection				
Specifications	RE1810-30		30 (11/		0 40				
	RE1010-50		50 (189))	96.0				
	RE1812-35		35 (132	/ ')	96.0				
	RE1812-50		50 (189	//)					
	RE1812-60		60 (227	/) ')	96.0				
	RE1812-80		80 (303	5)	96.0				
	1. The stated performance 250 mg/L NaCl solution a	is initial data t at 60 psig app	aken after 30 minutes lied pressure, 15 % reg	of operation based	on the following con and pH 6.5~7.0.	ditions;			
	 Dry type elements are v specifications. Permeate flow rate is backet. 	acuum leak to	ested using the Sandi lard test conditions an	<i>ego Protocol</i> so that d may vary depend	at the performance and the	shall satisfy their quality. Individual			
	element's permeate flow 4. All wet type elements are	may vary with e vacuum seal	iin 15%. ed in a polyethylene b	ag containing 1.0 %	SBS (Sodium bisul	fite) solution.			
	All dry type elements are	sealed in a p	olyethylene bag withou	it vacuum.					
Product	Membrane Type :		Thin-film Comp	oosite					
Description	Membrane Material :		PA (Polyamide)					
	Membrane Surface Charge : Negative								
	Element Configuration	on :	Spiral-Wound,	Tape wrappi	ng				
Product	Model name	A (inch)	B (inch)	C (inch)	D (inch)	E (inch)			
Dimensions	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			
	U-cup Seal (Brine seal) Outer Tapeing O-ring								
	(Outer dia)								
	(Length) ^I		G (element length)	(Length)					
	1. Outer feature m	ay vary as des	sign revisions take pla	ce.					
Features	CSM Household R	O membra	ne has high perme	eability.					

• 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.

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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

tomer Satisfaction Membrane

Operating Limits

- Max. Operating pressure
- Max. Feed flow rate
- Max. Operating temperature
- Operating pH range •
- Max. Turbidity
- Max. SDI (15 min) •
- Max. Free Chlorine concentration
- 125 psi (0.86 MPa) 2 gpm (0.45 m³/hr)
- 113 °F (45 °C)
- 3.0 ~ 10.0
- 1.0 NTU
- 5.0
- 0.1 mg/L

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

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CSM HOUSEHOLD RO MEMBRANE

High performance household membrane (Larger than 1.8 inch diameter element)

Product Specifications	Model nam	le	Permeate Flo gpd (L/d	ow rate ay)	Salt Rejection %		
	RE2012-10	0	100 (39	7)	96.0		
	RE2012-LP	PF	180 (68	1)	93.0		
	RE2812-30	RE2812-300 300 (1,136)					
	 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. Dry type elements are vacuum leak tested using the <i>Sandiego Protocol</i> so that the performance shall satisfy th specifications. Permeate flow rate is based on standard test conditions and may vary depending on feed water quality. Individue element's permeate flow may vary within 15%. 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 CompositeMembrane Material :PA (Polyamide)Membrane Surface Charge :NegativeElement Configuration :Spiral-Wound, Tape wrapping						
Product	Model name	A (inch)	B (inch)	C (inch)	D (inch)	E (inch)	
Dimensions	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	
	(Outer dia)	U-cup Sr (Brine sc	eal Duter Tapein CSM (element length) esign revisions take plan	g O-ring L L (Length) Cce.	D (element outer dia)		
Features	 CSM Household CSM Household Carcinogen, THN water. 	RO membra I RO mem Ms (Trihalor	ane has high perme Ibrane can remo nethanes), heavy	eability. ve most of h metal ions, b	narmful substar pacteria and vir	nces such as us in drinking	

IMPORTANT NOTICE

Elements contain preservative solution, therefore the permeate from the first hour of operation should be discarded.

R

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

tomer Satisfaction Membrane

Operating Limits

- Max. Operating pressure
- Max. Feed flow rate
- Max. Operating temperature
- Operating pH range •
- Max. Turbidity
- Max. SDI (15 min) •
- Max. Free Chlorine concentration
- 125 psi (0.86 MPa) 2 gpm (0.45 m³/hr)
- 113 °F (45 °C)
- 3.0 ~ 10.0
- 1.0 NTU
- 5.0
- 0.1 mg/L

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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 nam	ie	Permeate Flo gpd (L/da	ow rate ay)	Salt Reje %	ction				
	RE2010-LF	C	30 (114)	93.0					
	RE2012-LI	D	50 (189)	93.0					
	 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. Dry type elements are vacuum leak tested using the <i>Sandiego Protocol</i> so that the performance shall satisfy their specifications. 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%. 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	Membrane Type :		Thin-film Comp	osite						
Description	Membrane Material	:	PA (Polyamide)							
	Membrane Surface Charge : Negative									
	Element Configuration : Spiral-Wound, Tape wrapping									
Product	Model name	A (inch)	B (inch)	C (inch)	D (inch)	E (inch)				
Dimensions	RE2010-LP	0.67	0.55	10.08	1.91	0.98				
	RE2012-LP	0.67	0.47	11.73	1.91	0.91				
	(Outer dia) (Outer dia) (Outer dia) (element length) 1. Outer feature may vary as design revisions take place.									
Features	CSM Household	RO membra	ane has high perme	eability.						

• 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.

R

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

tomer Satisfaction Membrane

Operating Limits

- Max. Operating pressure
- Max. Feed flow rate
- Max. Operating temperature
- Operating pH range •
- Max. Turbidity
- Max. SDI (15 min) •
- Max. Free Chlorine concentration
- 125 psi (0.86 MPa) 2 gpm (0.45 m³/hr)
- 113 °F (45 °C)
- 3.0 ~ 10.0
- 1.0 NTU
- 5.0
- 0.1 mg/L

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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	Model name		Permeate Flow rate gpd (L/day)		CO eight Cut Off)					
	UE1810		200 (75	7)	1,00	1,000K					
	UE1812	250 (94	6)	1,00	0K						
	UE2010 450 (1,703) 1,000K										
	 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). Dry type elements are vacuum leak tested using the <i>Sandiego Protocol</i> so that the performance shall satisfy their 										
	 specifications. 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%. 										
	 All wet type elements an All dry type elements are 	e vacuum sea e sealed in a p	aled in a polyethylene b polyethylene bag witho	ag containing 1 ut vacuum.	.0 % SBS (Sodium bi	sulfite) solution.					
Product	Membrane Type :		Thin-film Composite								
Description	Membrane Material :		PSf (Polysulfone)								
	Element Configurati	on :	Spiral-Wound, Tape wrapping								
Product	Model name	A (inch)	B (inch)	C (inch)	D (inch)	F (inch)					
Dimensions	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.

IMPORTANT NOTICE

Elements contain preservative solution, therefore the permeate from the first hour of operation should be discarded.

R

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

tomer Satisfaction Membrane

- Max. Operating pressure
- Max. Feed flow rate
- Max. Operating temperature
- Operating pH range
- Max. Turbidity
- Max. SDI (15 min)
- 125 psi (0.86 MPa) 2 gpm (0.45 m³/hr) 113 °F (45 °C) 3.0 ~ 10.0 1.0 NTU 5.0



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