

# CSM<sup>®</sup>



Membrane Technologies  
(RO/NF)



Updated June 1st, 2010

\* Additional updates to product specifications may have been implemented after the release of this document.  
Regularly check our website at [www.csmfilter.com](http://www.csmfilter.com) for the latest product performance data.

*Applying innovative ideas Woongjin Chemical brings you fresh solutions*

CSM membrane technologies aims to deliver innovative and reliable products that help enhance the standards of living.

## **CSM Applications**

### **ULTRAPURE WATER**

Rinsing water for fabrication of semiconductors, LCDs, and PCBs

### **PROCESS PURE WATER / COOLING TOWER MAKEUP WATER / BOILER FEED WATER**

Reduces ion concentrations and prevents scaling and corrosion within the pipe

### **POTABLE WATER**

Removes excess minerals, bacteria and viruses

### **RECYCLING AND ZERO DISCHARGE SYSTEM**

Elimination of sewage and accomplishment of zero discharge system

### **RECOVERY OF DYESTUFF**

Dye recovery and reuse

### **PRODUCTION OF BEVERAGES**

Concentration of fruit juices

### **SEAWATER DESALINATION**

Reduces salt concentrations for residential and industrial applications



## CSM BWM Brackish Water Membrane

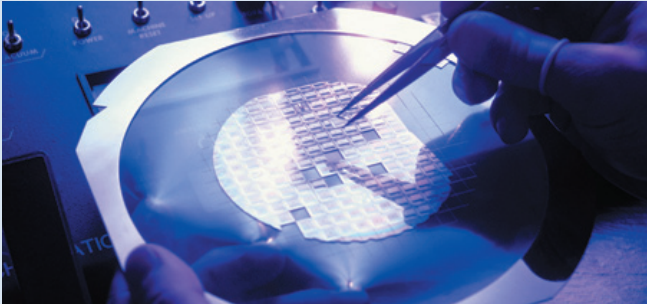
Model Name	Performance		Effective Area ft <sup>2</sup> (m <sup>2</sup> )	Dimension		Test Condition
	Permeate Flow rate GPD (m <sup>3</sup> /day)	Salt Rejection %		Dia Inch (mm)	Length Inch (mm)	
RE16040-BE	41,000 (155.0)	99.7	1600 (148.6)	16 (400)	40 (1016)	40" BW Standard
RE8040-BE*	10,500 (39.7)	99.7	400 (37.2)	8.0 (203)	40 (1016)	40" BW Standard
RE8040-BE440	11,500 (43.5)	99.7	440 (40.9)	8.0 (203)	40 (1016)	40" BW Standard
RE8040-BN	9,500 (36.0)	99.7	365 (33.9)	8.0 (203)	40 (1016)	40" BW Standard
RE8040-BR	6,000 (22.7)	99.75	380 (35.3)	8.0 (203)	40 (1016)	40" BW Standard
RE4040-BE	2,400 (9.1)	99.7	85 (7.9)	4.0 (102)	40 (1016)	40" BW Standard
RE4040-BN	2,000 (7.6)	99.7	75 (7.0)	4.0 (102)	40 (1016)	40" BW Standard
RE4021-BE	1,000 (3.8)	99.7	35 (3.3)	4.0 (102)	21 (533)	21" BW Standard

\* Certified by NSF to NSF/ANSI standard 61

- 40" BW Standard test conditions : NaCl 2,000 mg/L, Pressure 225 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- 21" BW Standard test conditions : NaCl 2,000 mg/L, Pressure 225 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 8%
- The above data were obtained after operating membrane element at the standard test conditions for 30min.



## CSM UPWM Ultrapure Water Membrane



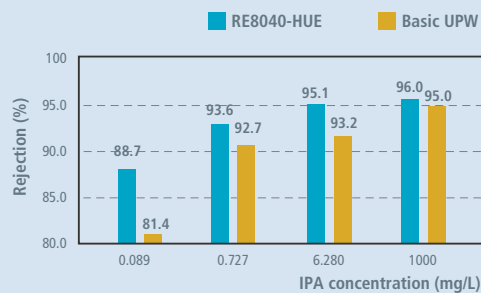
- Ultrapure water for manufacturing of semiconductors, LCDs and electronics.
- High TOC rejection, low TOC extraction and TOC rinse down.

Model Name	Performance			Effective Area ft <sup>2</sup> (m <sup>2</sup> )	Dimension		Test Condition
	Permeate Flow rate GPD (m <sup>3</sup> /day)	NaCl Rejection %	IPA Rejection %		Dia Inch (mm)	Length Inch (mm)	
RE8040-HUE440	10,000 (37.9)	99.5	96.0	440 (40.9)	8.0 (203)	40 (1016)	40" BW Standard
RE8040-HUE	9,000 (34.1)	99.5	96.0	400 (37.2)	8.0 (203)	40 (1016)	40" BW Standard
RE8040-UR	5,500 (20.8)	99.7	96.0	400 (37.2)	8.0 (203)	40 (1016)	40" BW Standard
RE8040-UL	10,000 (37.9)	99.5	92.0	400 (37.2)	8.0 (203)	40 (1016)	40" LP Standard

- 40" BW Standard test conditions : NaCl 2,000 mg/L, Pressure 225 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- 40" LP Standard test conditions : NaCl 1,500 mg/L, Pressure 150 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- IPA rejection test conditions : IPA 1,000 mg/L, Pressure 225 psig for UE, HUE and 150 psig for UL Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- The above data were obtained after operating membrane element at the standard test conditions for 30min.
- IPA rejection data were obtained after operating membrane element at the IPA rejection test conditions for 2 hours.

### IPA Rejections of CSM UPW Membrane

- Test Conditions : 225psig, 25 °C, Recovery15%, pH6.5~7.0
- Analyzed by Anatel -1000



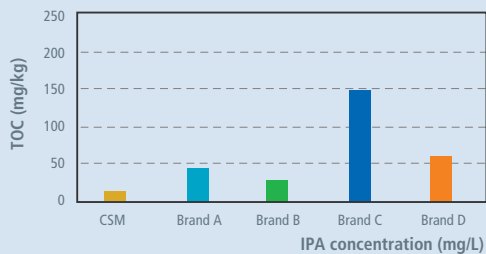
### Low TOC Extraction Property

#### Comparisons of TOC extractions of various UPW elements in the market:

- Extraction testing method: after dipping the weighted permeate channel in 800ml of feed water during 4hours, the extracted TOC conc. was measured. Calculation method for TOC quantity extracted from permeate channel:

$$\left[ \frac{\text{TOC conc. after 4hours dipping} - \text{feed water TOC conc. before dipping}}{\text{feed water quantity}} \times 0.8 \times 0.001 \right]$$

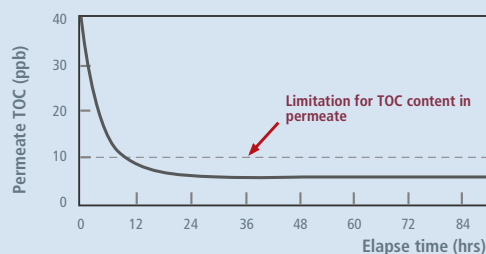
Feed water TOC conc. 198ppb



### TOC Rinse Down Behavior

#### Operating Conditions

- Feed TOC : 40~80 ppb
- recovery : 90%
- Feed Pressure : 15bar
- TOC analyzer : Anatel - A1000



## CSM LPM Low Pressure Membrane

- An efficient and cost-effective solution for energy-savings.
- High salt-rejection at low pressures.

Model Name	Performance		Effective Area ft <sup>2</sup> (m <sup>2</sup> )	Dimension		Test Condition
	Permeate Flow rate GPD (m <sup>3</sup> /day)	Salt Rejection %		Dia Inch (mm)	Length Inch (mm)	
RE16040-BLR	36,000 (136.3)	99.6	1600 (148.6)	16 (400)	40 (1016)	40" LP Standard
RE8040-BLN440	13,000 (49.2)	99.2	440 (40.9)	8.0 (203)	40 (1016)	40" LP Standard
RE8040-BLN*	12,000 (45.4)	99.2	400 (37.2)	8.0 (203)	40 (1016)	40" LP Standard
RE8040-BLF*	11,500 (43.5)	99.2	400 (37.2)	8.0 (203)	40 (1016)	40" LP High Flux
RE8040-BLR440	9,900 (37.4)	99.6	440 (40.9)	8.0 (203)	40 (1016)	40" LP Standard
RE8040-BLR*	9,000 (34.1)	99.6	400 (37.2)	8.0 (203)	40 (1016)	40" LP Standard
RE4040-BLN*	2,600 (9.8)	99.2	85 (7.9)	4.0 (102)	40 (1016)	40" LP Standard
RE4040-BLF*	2,500 (9.5)	99.2	85 (7.9)	4.0 (102)	40 (1016)	40" LP High Flux
RE4040-BLR*	1,900 (7.2)	99.6	85 (7.9)	4.0 (102)	40 (1016)	40" LP Standard
RE4040-TL	2,600 (9.8)	99.0	85 (7.9)	4.0 (102)	40 (1016)	40" LP Standard
RE4021-BL	1,000 (3.8)	99.2	35 (3.3)	4.0 (102)	21 (533)	21" BW Standard
RE4021-TL	1,050 (4.0)	99.0	35 (3.3)	4.0 (102)	21 (533)	21" LP Standard
RE2540-TL	850 (3.2)	99.0	27 (2.5)	2.5 (64)	40 (1016)	40" LP Standard
RE2521-TL	300 (1.1)	99.0	12 (1.1)	2.5 (64)	21 (533)	21" LP Standard

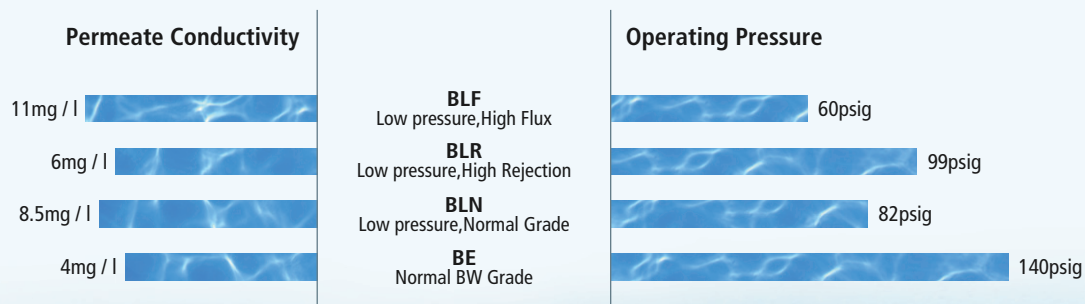
\*Certified by NSF to NSF/ANSI standard 61

- 40" LP Standard test conditions : NaCl 1,500 mg/L, Pressure 150 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- 21" LP Standard test conditions : NaCl 1,500 mg/L, Pressure 150 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 8%
- 40" LP High Flux test conditions : NaCl 500 mg/L, Pressure 100 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- 21" BW Standard test conditions : NaCl 2,000 mg/L, Pressure 225 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 8%
- The above data were obtained after operating membrane element at the standard test conditions for 30min.

### Product Characteristics

Comparisons of Permeate TDS and Operating Pressure between CSM Brackish Water and Low Pressure membranes

\*Feed water conditions: NaCl concentration: 500mg/L; permeate flux: 15gfd; Temp: 25°C; Recovery: 15%



**BLF**  
Ideal for when:

- Feed water TDS concentration is low
- High salt rejection is not required
- Energy saving is required through low pressure operation

**BLR**  
Ideal for when:

- Feed water TDS concentration is high
- Energy saving is needed through low pressure operation

**BLN**  
Ideal for when:

- Salt rejection and specific permeate flux are between BLR and BLF products

## CSM FRM Fouling Resistant Membrane

- Ideal for feed water with high fouling potentials such as wastewater reuse and surface water applications.
- Saves operating costs by reducing the number of CIPs.

Model Name	Performance		Effective Area ft <sup>2</sup> (m <sup>2</sup> )	Dimension		Test Condition
	Permeate Flow rate GPD (m <sup>3</sup> /day)	Salt Rejection %		Dia Inch (mm)	Length Inch (mm)	
RE16040-FE <sup>n</sup>	41,000 (155.0)	99.7	1600 (148.6)	16 (400)	40 (1016)	40" BW Standard
RE8040-FE <sup>n</sup>	10,500 (39.7)	99.7	400 (37.2)	8.0 (203)	40 (1016)	40" BW Standard
RE8040-FN	9,500 (36.0)	99.7	365 (33.9)	8.0 (203)	40 (1016)	40" BW Standard
RE8040-FD <sup>n</sup>	10,000 (37.9)	99.7	380 (35.3)	8.0 (203)	40 (1016)	40" BW Standard
RE4040-FE <sup>n</sup>	2,400 (9.1)	99.7	85 (7.9)	4.0 (102)	40 (1016)	40" BW Standard
RE16040-FLR	36,000 (136.0)	99.6	1600 (148.6)	16 (400)	40 (1016)	40" LP Standard
RE8040-FLR	9,000 (34.0)	99.6	400 (37.2)	8.0 (203)	40 (1016)	40" LP Standard
RE8040-FL <sup>n</sup>	11,000 (41.6)	99.0	400 (37.2)	8.0 (203)	40 (1016)	40" LP Standard
RE4040-FLR	1,900 (7.2)	99.6	85 (7.9)	4.0 (102)	40 (1016)	40" LP Standard
RE4040-FL <sup>n</sup>	2,400 (9.1)	99.0	85 (7.9)	4.0 (102)	40 (1016)	40" LP Standard

- 40" BW Standard test conditions : NaCl 2,000 mg/L, Pressure 225 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- 40" LP Standard test conditions : NaCl 1,500 mg/L, Pressure 150 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- The above data were obtained after operating membrane element at the standard test conditions for 30min

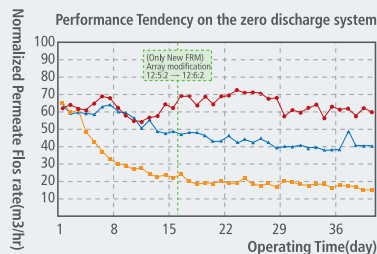
### FRM performance in the field

- Location : ASAN, KOREA (Motor Company)
- Capacity : 5,000m<sup>3</sup>/day (Zero Discharge)
- Feed Water Source : Tertiary Treated Wastewater & Sewage
- RO System Configuration
  - 1st Pass : 12 : 5 : 2 array, 75% recovery 2Trains of 114pcs of CSM FRM elements
  - 2nd Pass for 1st Pass Brine : 4 : 2 : 1 array, 50% recovery 32pcs of SW RO membrane

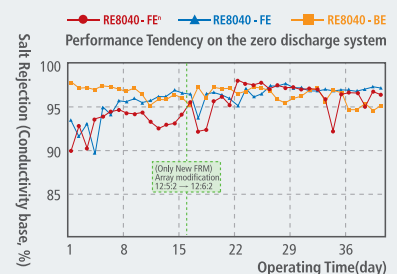
#### [ Feed Water Quality ]

Parameter	Unit	Jun.2004
Na	mg/L	810
Cl	mg/L	1,223
SiO <sub>2</sub>	mg/L	8.49
Turbidity	NTU	1.2
Conductivity	μS/cm	3,920
TOC	mg/L	23.6
SDI (15min)	-	Over5.0

#### [ Normalized Permeate Flow rate ]



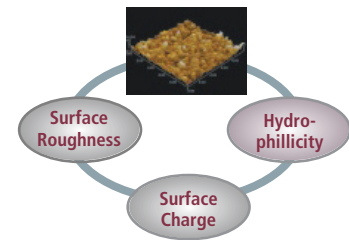
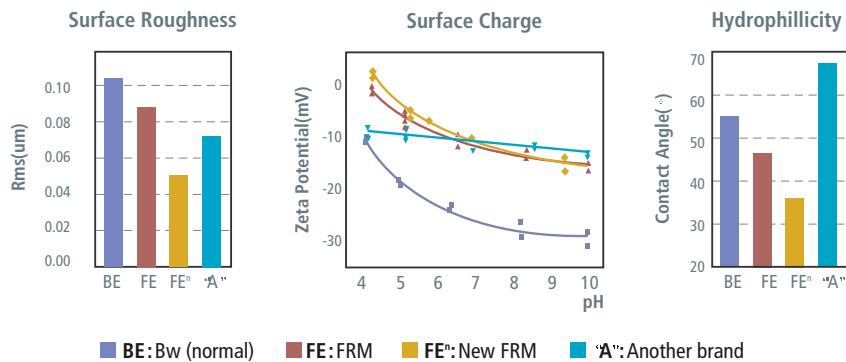
#### [ Salt Rejection ]



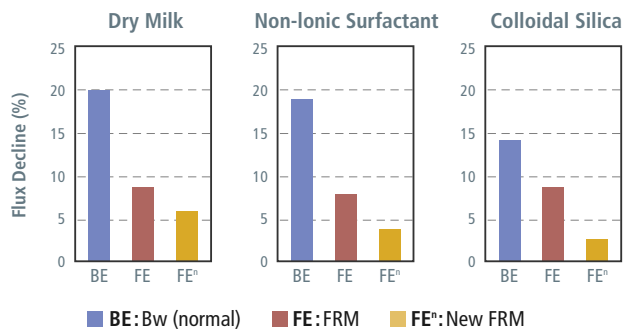
## CSM FRM Fouling Resistant Membrane

- Modification of surface roughness, surface charge, and hydrophilicity of the membrane.
- Feed water containing high amount of charged (+,-) and/or non-charged foulants, organic matters, colloidal particles.

### Surface Properties



### FRM performance with Model Foulants



- **Model Foulants : Test Conditions**
- **Dry-Milk** : 30 mg/L, after 8hrs operation
- **Non-Ionic Surfactant** : Tryton X-100:50 mg/L, after 8hrs operation
- **Colloidal Silica** : 100mg/L with divalent cation (Ca<sup>2+</sup>, Mg<sup>2+</sup>), after 8hrs operation at pH7

\* CSM FR membranes show excellent fouling resistant properties to organic and inorganic contaminants

### References

Customers	Location	Model	Capacity	Date
VEOLIA WATER (Wollongong) (Wastewater reclamation)	AUSTRALIA	RE8040-FE <sup>n</sup>	20,000 m <sup>3</sup> /day (1,610 pcs)	JUN. 2007 APR. 2008
BRISBANE WATER (Luggage Point) (Sewage reclamation)	AUSTRALIA	RE8040-FE <sup>n</sup>	16,000 m <sup>3</sup> /day (1,116 pcs)	MAR. 2008
SAMSUNG TOTAL (Boiler Feed)	KOREA	RE8040-FE	65,520 m <sup>3</sup> /day (3,168 pcs)	Since JUL. 2002
VEOLIA WATER (KRANJI II) Expansion (Sewage reclamation)	SINGAPORE	RE8040-FE	42,000 m <sup>3</sup> /day (2,674 pcs)	FEB. 2006
UNITED KG (Boiler Feed Water)	THAILAND	RE8040-FE	9,200 m <sup>3</sup> /day (540 pcs)	APR. 2006
WEIDNER (Process Water)	UKRAINE	RE8040-FL	5,200 m <sup>3</sup> /day (360 pcs)	AUG. 2005

## CSM SWM Sea Water Membrane

- Seawater desalination application for industrial or potable uses.
- Able to purify high TDS brackish water containing TDS more than 10,000 ppm.

Model Name	Performance		Effective Area ft <sup>2</sup> (m <sup>2</sup> )	Dimension		Test Condition
	Permeate Flow rate GPD (m <sup>3</sup> /day)	Salt Rejection %		Dia Inch (mm)	Length Inch (mm)	
RE16040-SHN	24,600 (93.1)	99.75	1600 (148.6)	16 (400)	40 (1016)	40" SW Standard
RE16040-SHF	36,000 (136.1)	99.7	1600 (148.6)	16 (400)	40 (1016)	40" SW Standard
RE8040-SN	6,000 (22.7)	99.2	370 (34.4)	8.0 (203)	40 (1016)	40" SW Standard
RE8040-SH	4,500 (17.0)	99.75	370 (34.4)	8.0 (203)	40 (1016)	40" SW Standard
RE8040-SHA400	7,500 (28.4)	99.75	400 (37.2)	8.0 (203)	40 (1016)	40" SW Standard
RE8040-SHF	9,000 (34.0)	99.7	370 (34.4)	8.0 (203)	40 (1016)	40" SW Standard
RE8040-SHN	6,000 (22.7)	99.75	370 (34.4)	8.0 (203)	40 (1016)	40" SW Standard
RE8040-SHN400	6,500 (24.6)	99.75	400 (37.2)	8.0 (203)	40 (1016)	40" SW Standard
RE4040-SHA	1,400 (5.3)	99.75	74 (6.9)	4.0 (102)	40 (1016)	40" SW Standard
RE4040-SHF	1,900 (7.2)	99.7	75 (7.0)	4.0 (102)	40 (1016)	40" SW Standard

- 40" SW Standard test conditions : NaCl 32,000 mg/L, Pressure 800 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 8%
- 21" SW Standard test conditions : NaCl 32,000 mg/L, Pressure 800 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 4%
- The above data were obtained after operating membrane element at the standard test conditions for 30min.

Customers	Location	Model	Capacity	Date
SOUTH PARS (PHASE 2&3)	IRAN	RE8040-SN RE8040-BE	1800 m <sup>3</sup> /day	AUG. 2000
SOUTH PARS (PHASE 4&5)	IRAN	RE8040-SR RE8040-BE	360 m <sup>3</sup> /day	MAY. 2003
CHANGZHOU CANGJIN CHEMICAL	CHINA	RE8040-SR	1200m <sup>3</sup> /hr	APR. 2004
HYDROPRO	VENEZUELA / MASHAL	RE8040-SR	153 PCS	MAR. 2003
MEMBRANE TECH. IND.	U.S.A / HAWAII	RE8040-SR	1440 m <sup>3</sup> /day	JUN. 2004
KOREA NAVY FORCE	KOREA JINHAЕ	RE4040-SR	1485 PCS	Since 1998



## CSM NFM Nanofiltration Membrane (NFM)



- Up to 95% rejection rate of divalent ions.
- Ideal for water softening, dye recovery, and food applications.
- Also used in the pretreatment of desalination systems.

Model Name	Performance				Effective Area ft <sup>2</sup> (m <sup>2</sup> )	Dimension		Test Condition
	Permeate Flow rate GPD (m <sup>3</sup> /day)	NaCl Rejection %	MgSO <sub>4</sub> Rejection %	CaCl <sub>2</sub> Rejection %		Dia Inch (mm)	Length Inch (mm)	
NE8040-90*	7,500 (28.4)	85~95	97.0	90-95	400 (37.2)	8.0 (203)	40 (1016)	NE Standard
NE4040-90*	1,600 (6.0)	85~95	97.0	90-95	85 (7.9)	4.0 (102)	40 (1016)	NE Standard
NE2540-90	500 (1.9)	85~95	97.0	90-95	27 (2.5)	2.5 (64)	40 (1016)	NE Standard
NE8040-70	7,000 (26.5)	40~70	97.0	45-70	400 (37.2)	8.0 (203)	40 (1016)	NE Standard
NE4040-70	1,500 (5.6)	40~70	97.0	45-70	85 (7.9)	4.0 (102)	40 (1016)	NE Standard
NE2540-70	450 (1.7)	40~70	97.0	45-70	27 (2.5)	2.5 (64)	40 (1016)	NE Standard

\*Certified by NSF to NSF/ANSI standard 61

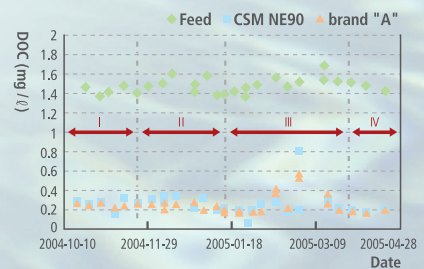
- NE Standard test conditions: NaCl 2,000 mg/L, 75psig, 25°C, pH 6.5 ~ 7.0, Recovery 15%
- MgSO<sub>4</sub> rejection test conditions: MgSO<sub>4</sub> 2,000 mg/L, 75psig, 25°C, pH 6.5 ~ 7.0, Recovery 15%
- CaCl<sub>2</sub> rejection test conditions: CaCl<sub>2</sub> 500 mg/L, 75psig, 25°C, pH 6.5 ~ 7.0, Recovery 15%

### Pilot test results in a municipal WTP

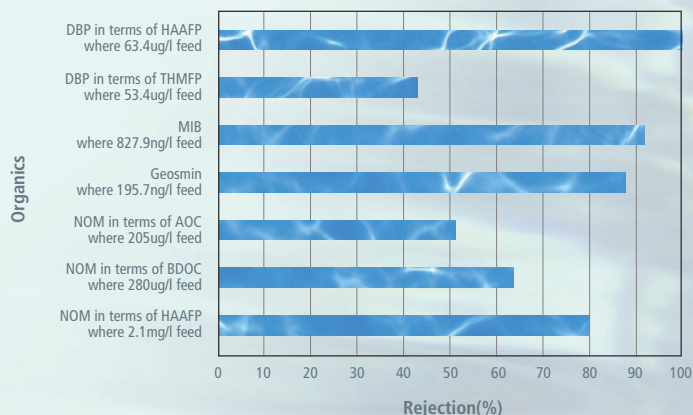
Water source: Paldang Lake in South Korea  
Model : NE4040-90

\*"A": Another brand

	CSM NE90	"A"	Remark
DOC Removal Efficiency	80% †	80% †	CSM NE 90 = "A"
Permeability (l/d .m <sup>2</sup> .kPa)	2.0	1.5	CSM NE 90 > "A"



### Organic Rejection Ratios of CSM NE90



## CSM TWM Tap Water Membrane

- Ideal for removing low molecular weight polluted substances.
- Ideal for treating small quantities of water.

Model Name	Performance		Effective Area ft <sup>2</sup> (m <sup>2</sup> )	Dimension		Test Condition
	Permeate Flow rate GPD (m <sup>3</sup> /day)	Salt Rejection %		Dia Inch (mm)	Length Inch (mm)	
RE4040-TE*	2,400 (9.1)	99.5	85 (7.9)	4.0 (102)	40 (1016)	40" BW Standard
RE4021-TE	1,000 (3.8)	99.5	35 (3.3)	4.0 (102)	21 (533)	21" BW Standard
RE2540-TE*	800 (3.0)	99.5	27 (2.5)	2.5 (64)	40 (1016)	40" BW Standard
RE2521-TE	300 (1.1)	99.5	12 (1.1)	2.5 (64)	21 (533)	21" BW Standard
RE4040-TL	2,600 (9.8)	99.2	85 (7.9)	4.0 (102)	40 (1016)	40" LP Standard
RE4021-TL	1,050 (4.0)	99.2	35 (3.3)	4.0 (102)	21 (533)	21" LP Standard
RE2540-TL	850 (3.2)	99.2	27 (2.5)	2.5 (64)	40 (1016)	40" LP Standard
RE2521-TL	300 (1.1)	99.2	12 (1.1)	2.5 (64)	21 (533)	21" LP Standard

\* Certified by NSF to NSF/ANSI standard 61

- 40" BW Standard test conditions : NaCl 2,000 mg/L, Pressure 225 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- 21" BW Standard test conditions : NaCl 2,000 mg/L, Pressure 225 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 8%
- 40" LP Standard test conditions : NaCl 1,500 mg/L, Pressure 150 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- 21" LP Standard test conditions : NaCl 1,500 mg/L, Pressure 150 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 8%
- The above data were obtained after operating membrane element at the standard test conditions for 30min.

## CSM HOUSEHOLD MEMBRANE

- CSM Household or Residential membranes can eliminate substances larger than 0.0001<sub>µm</sub> such as carcinogens, THMs (Trihalomethanes), heavy metal ions, bacteria and viruses in the water.
- There are several different products from 35 GPD to 100 GPD.
- Both wet and dry type elements are available

Model Name	Performance		Dimension		Test Condition
	Permeate Flow rate GPD (L /day)	Salt Rejection %	Dia Inch (mm)	Length Inch (mm)	
RE1810-30	30 (114)	98.0	1.8 (46)	10 (254)	Household Standard
RE1810-50*	50 (189)	98.0	1.8 (45.7)	10 (254)	Household Standard
RE1812-35*	35 (132)	98.0	1.8 (46)	12 (305)	Household Standard
RE1812-CE60	60 (227)	99.5	1.8 (46)	10 (254)	Household Standard
RE70-1812-50	50 (189)	98.0	1.8 (45)	12 (305)	Household Standard
RE1812-60*	60 (227)	98.0	1.8 (46)	12 (305)	Household Standard
RE1812-80*	80 (303)	98.0	1.8 (46)	12 (305)	Household Standard
RE2012-100*	100 (397)	98.0	2.0 (50)	12 (304.8)	Household Standard
RE2012-HD	75 (284)	98.0	1.8 (45)	12 (305)	Household Standard
RE2012-LPF	60 (227)	93.0	2.0 (48)	12 (305)	Household LP
RE2010-LP*	30 (114)	93.0	2.0 (50)	10 (254)	Household LP
RE2012-LP*	50 (189)	93.0	2.0 (50)	12 (305)	Household LP
RE2812-300	300 (1136)	98.0	2.9 (74)	12 (305)	Household Standard

\* Certified by NSF to NSF/ANSI standard 58

- Household Standard test conditions : NaCl 200mg/L, Pressure 60 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 10~20%
- Household LP test conditions : NaCl 100mg/L, Pressure 20 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 10~20%
- The above data were obtained after operating membrane element at the standard test conditions for 30min.
- The above data are based on nominal salt rejection

TYPE	Model Name	Performance		Effective Area ft <sup>2</sup> (m <sup>2</sup> )	Dimension		Test Condition
		Permeate Flow rate GPD (m <sup>3</sup> /day)	Salt Rejection %		Dia Inch (mm)	Length Inch (mm)	
16 INCH	RE16040-BE	41,000 (155.0)	99.7	1600 (148.6)	16(400)	40 (1016)	40" BW Standard
	RE16040-FE <sup>n</sup>	41,000 (155.0)	99.7	1600 (148.6)	16(400)	40 (1016)	40" BW Standard
	RE16040-BLR	36,000 (136.3)	99.6	1600 (148.6)	16(400)	40 (1016)	40" LP Standard
	RE16040-FLR	36,000 (136.0)	99.6	1600 (148.6)	16(400)	40 (1016)	40" LP Standard
	RE16040-SHN	24,600 (93.1)	99.75	1600 (148.6)	16(400)	40 (1016)	40" SW Standard
	RE16040-SHF	36,000 (136.1)	99.7	1600 (148.6)	16(400)	40 (1016)	40" SW Standard
8 INCH	RE8040-BE	10,500 (39.7)	99.7	400 (37.2)	8.0 (203)	40 (1016)	40" BW Standard
	RE8040-BE440	11,500 (43.5)	99.7	440 (40.9)	8.0 (203)	40 (1016)	40" BW Standard
	RE8040-BN	9,500 (36.0)	99.7	365 (33.9)	8.0 (203)	40 (1016)	40" BW Standard
	RE8040-BR	6,000 (22.7)	99.75	380 (35.3)	8.0 (203)	40 (1016)	40" BW Standard
	RE8040-FE <sup>n</sup>	10,500 (39.7)	99.7	400 (37.2)	8.0 (203)	40 (1016)	40" BW Standard
	RE8040-FN	9,500 (36.0)	99.7	365 (33.9)	8.0 (203)	40 (1016)	40" BW Standard
	RE8040-FD <sup>n</sup>	10,000 (37.9)	99.7	380 (35.3)	8.0 (203)	40 (1016)	40" BW Standard
	RE8040-FLR	9,000 (34.0)	99.6	400 (37.2)	8.0 (203)	40 (1016)	40" LP Standard
	RE8040-FL <sup>n</sup>	11,000 (41.6)	99.0	400 (37.2)	8.0 (203)	40 (1016)	40" LP Standard
	RE8040-BLN440	13,000 (49.2)	99.2	440 (40.9)	8.0 (203)	40 (1016)	40" LP Standard
	RE8040-BLN	12,000 (45.4)	99.2	400 (37.2)	8.0 (203)	40 (1016)	40" LP Standard
	RE8040-BLF	11,500 (43.5)	99.2	400 (37.2)	8.0 (203)	40 (1016)	40" LP High Flux
	RE8040-BLR440	9,900 (37.4)	99.6	440 (40.9)	8.0 (203)	40 (1016)	40" LP Standard
	RE8040-BLR	9,000 (34.1)	99.6	400 (37.2)	8.0 (203)	40 (1016)	40" LP Standard
	RE8040-SN	6,000 (22.7)	99.2	370 (34.4)	8.0 (203)	40 (1016)	40" SW Standard
	RE8040-SH	4,500 (17.0)	99.75	370 (34.4)	8.0 (203)	40 (1016)	40" SW Standard
	RE8040-SHA400	7,500 (28.4)	99.75	400 (37.2)	8.0 (203)	40 (1016)	40" SW Standard
	RE8040-SHF	9,000 (34.0)	99.7	370 (34.4)	8.0 (203)	40 (1016)	40" SW Standard
	RE8040-SHN	6,000 (22.7)	99.75	370 (34.4)	8.0 (203)	40 (1016)	40" SW Standard
	RE8040-SHN400	6,500 (24.6)	99.75	400 (37.2)	8.0 (203)	40 (1016)	40" SW Standard
	RE8040-HUE440	10,000 (37.9)	99.5 (IPA 96)	440 (40.9)	8.0 (203)	40 (1016)	40" BW Standard
RE8040-HUE	9,000 (34.1)	99.5 (IPA 96)	400 (37.2)	8.0 (203)	40 (1016)	40" BW Standard	
RE8040-UR	5,500 (20.8)	99.7 (IPA 96)	400 (37.2)	8.0 (203)	40 (1016)	40" BW Standard	
RE8040-UL	10,000 (37.9)	99.5 (IPA 92)	400 (37.2)	8.0 (203)	40 (1016)	40" LP Standard	
4 INCH	RE4040-BE	2,400 (9.1)	99.7	85 (7.9)	4.0 (102)	40 (1016)	40" BW Standard
	RE4040-BN	2,000 (7.6)	99.7	75 (7.0)	4.0 (102)	40 (1016)	40" BW Standard
	RE4040-FE <sup>n</sup>	2,400 (9.1)	99.7	85 (7.9)	4.0 (102)	40 (1016)	40" BW Standard
	RE4040-FLR	1,900 (7.2)	99.6	85 (7.9)	4.0 (102)	40 (1016)	40" LP Standard
	RE4040-FL <sup>n</sup>	2,400 (9.1)	99.0	85 (7.9)	4.0 (102)	40 (1016)	40" LP Standard
	RE4040-BLN	2,600 (9.8)	99.2	85 (7.9)	4.0 (102)	40 (1016)	40" LP Standard
	RE4040-BLF	2,500 (9.5)	99.2	85 (7.9)	4.0 (102)	40 (1016)	40" LP High Flux
	RE4040-BLR	1,900 (7.2)	99.6	85 (7.9)	4.0 (102)	40 (1016)	40" LP Standard
	RE4040-TE	2,400 (9.1)	99.5	85 (7.9)	4.0 (102)	40 (1016)	40" BW Standard
	RE4040-TL	2,600 (9.8)	99.2	85 (7.9)	4.0 (102)	40 (1016)	40" LP Standard
	RE4040-SHA	1,400 (5.3)	99.75	74 (6.9)	4.0 (102)	40 (1016)	40" SW Standard
	RE4040-SHF	1,900 (7.2)	99.7	75 (7.0)	4.0 (102)	40 (1016)	40" SW Standard
	RE4021-BE	1,000 (3.8)	99.7	35 (3.3)	4.0 (102)	21 (533)	21" BW Standard
	RE4021-TE	1,000 (3.8)	99.5	35 (3.3)	4.0 (102)	21 (533)	21" BW Standard
	RE4021-BL	1,000 (3.8)	99.2	35 (3.3)	4.0 (102)	21 (533)	21" BW Standard
RE4021-TL	1,050 (4.0)	99.2	35 (3.3)	4.0 (102)	21 (533)	21" LP Standard	
2.5 INCH	RE2540-TE	800 (3.0)	99.5	27 (2.5)	2.5 (64)	40 (1016)	40" BW Standard
	RE2540-TL	850 (3.2)	99.2	27 (2.5)	2.5 (64)	40 (1016)	40" LP Standard
	RE2521-TE	300 (1.1)	99.5	12 (1.1)	2.5 (64)	21 (533)	21" BW Standard
	RE2521-TL	300 (1.1)	99.2	12 (1.1)	2.5 (64)	21 (533)	21" LP Standard

- 40" BW Standard test conditions : NaCl 2,000 mg/L, Pressure 225 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- 40" LP Standard test conditions : NaCl 1,500 mg/L, Pressure 150 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- 40" LP High Flux test conditions : NaCl 500 mg/L, Pressure 100 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- 40" SW Standard test conditions : NaCl 32,000 mg/L, Pressure 800 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 8%
- 21" BW Standard test conditions : NaCl 2,000 mg/L, Pressure 225 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 8%
- 21" LP Standard test conditions : NaCl 1,500 mg/L, Pressure 150 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 8%
- 21" SW Standard test conditions : NaCl 32,000 mg/L, Pressure 800 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 4%
- IPA rejection test conditions : IPA 1,000 mg/L, pressure 225 psig for UE, HUE and 150 psig for UL Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- IPA rejection data were obtained after operating membrane element at the IPA rejection test condition for 2hours.
- The above data were obtained after operating membrane element at the standard test conditions for 30min.

TYPE	Model Name	Performance			Effective Area ft <sup>2</sup> (m <sup>2</sup> )	Dimension		Test Condition
		Permeate Flow rate GPD (m <sup>3</sup> /day)	NaCl Rejection (MgSO <sub>4</sub> ) %	CaCl <sub>2</sub> Rejection %		Dia Inch (mm)	Length Inch (mm)	
NF	NE8040-90	7,500 (28.4)	85~95 (97.0)	90-95	400 (37.2)	8.0 (203)	40 (1016)	NE Standard
	NE4040-90	1,600 (6.0)	85~95 (97.0)	90-95	85 (7.9)	4.0 (102)	40 (1016)	NE Standard
	NE2540-90	500 (1.9)	85~95 (97.0)	90-95	27 (2.5)	2.5 (64)	40 (1016)	NE Standard
	NE8040-70	7,000 (26.5)	40~70 (97.0)	45-70	400 (37.2)	8.0 (203)	40 (1016)	NE Standard
	NE4040-70	1,500 (5.6)	40~70 (97.0)	45-70	85 (7.9)	4.0 (102)	40 (1016)	NE Standard
	NE2540-70	350 (1.3)	40~70 (97.0)	45-70	27 (2.5)	2.5 (64)	40 (1016)	NE Standard

- NE Standard test conditions : NaCl 2,000 mg/L, Pressure 75 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- MgSO<sub>4</sub> rejection test conditions : MgSO<sub>4</sub> 2,000 mg/L, Pressure 75 psig, Temperature 25°C, pH 6.5 ~ 7.0, Recovery 15%
- CaCl<sub>2</sub> rejection test conditions : CaCl<sub>2</sub> 500 mg/L, 75psig, 25°C, pH 6.5 ~ 7.0, Recovery 15%
- The above data were obtained after operating membrane element at the standard test conditions for 30min.

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