

KeenSen[®]
沁森高科

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**RO&NF Membrane
Manual of Product Introduction and
Quality Warranty**



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1. Product Introduction

KeenSen spiral-wound RO and NF membrane products are aromatic polyamide or polypiperazine component membrane flat sheet and element. According to the application industries, it can be divided into industrial, commercial, and residential series. According to the operating pressure, reverse osmosis series membrane products are divided into: extreme low pressure XLP, ultra-low pressure ULP, brackish water BW, fouling resistant FR and sea water desalination SW. Nanofiltration membrane products can be divided into high rejection NF1 and high permeability NF2.

1.1 Membrane Elements and Performance Table

1.1.1) 8 inch Industrial RO Membrane Elements

Membrane Series	Model	Active Area ft ² (m ²)	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Test Condition(Temperature25°C , pH 7.5-8.0)		
					NaCl Solution mg/L	Operating Pressure psi(MPa)	Recovery (%)
Extreme Low Pressure XLP	XLP-8040HF	440(40.9)	13000(49.2)	99.00	500	100(0.69)	15
	XLP-8040	440(40.9)	11000(41.6)	99.20			
Ultra-Low Pressure ULP	ULP-8040MR-2	440(40.9)	10500(39.7)	99.60	1500	150(1.03)	15
	ULP-8040HF	440(40.9)	12500(47.3)	99.50			
	ULP-8040-2	400(37.2)	10000(37.8)	99.50			
	ULP-8040	400(37.2)	11000(41.6)	99.35			
Brackish Water BW	BW-8040-2	400(37.2)	10500(39.7)	99.70	2000	225(1.55)	15
	BW-8040	400(37.2)	10500(39.7)	99.60			
	BW-8040HF	440(40.9)	13000(49.2)	99.50			
	BW-8040-E	400(37.2)	10500(39.7)	99.50			
Fouling Resistant FR	BW-8040XLFR	400(37.2)	11500(43.5)	99.75	2000	225(1.55)	15
	BW-8040LFR	400(37.2)	10500(39.7)	99.75			
	BW-8040FR-2	400(37.2)	10500(39.7)	99.70			
	BW-8040FR	365(33.9)	9500(35.9)	99.70			
Sea Water Desalination SW	SW-8040HR	400(37.2)	6500(24.6)	99.80	32000	800(5.5)	8
	SW-8040MR	400(37.2)	7500(28.3)	99.75			



1.1.2) 4 inch Industrial RO Membrane Elements

Membrane Series	Model	Active Area ft ² (m ²)	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Test Conditions(Temperature25°C , pH 7.5-8.0)		
					NaCl Solution mg/L	Operating Pressure psi(MPa)	Recovery (%)
Extreme Low Pressure XLP	XLP-4040HF	100(9.3)	3000(11.3)	99.00	500	100(0.69)	15
	XLP-4040	90(8.4)	2600(9.8)	99.20			
Ultra-Low Pressure ULP	ULP-4040MR-2	100(9.3)	2400(9.1)	99.60	1500	150(1.03)	15
	ULP-4040HF	100(9.3)	2700(10.2)	99.50			
	ULP-4040-2	85(7.9)	2200(8.3)	99.50			
	ULP-4040	85(7.9)	2600(9.8)	99.35			
Brackish Water BW	BW-4040	85(7.9)	2500(9.5)	99.60	2000	225(1.55)	15
	BW-4040HF	100(9.3)	2900(11.0)	99.50			
	BW-4040-E	85(7.9)	2400(9.1)	99.50			
Fouling Resistant FR	BW-4040XLFR	85(7.9)	2300(8.7)	99.60	2000	225(1.55)	15
	BW-4040FR	78(7.3)	2000(7.6)	99.60			
Sea Water Desalination SW	SW-4040HR	85(7.9)	1500(5.7)	99.75	32000	800(5.5)	8
	SW-4040MR	85(7.9)	1800(6.8)	99.70			

1.1.3) Commercial Membrane Elements

Membrane Series	Model	Active Area ft ² (m ²)	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Test Conditions(Temperature25°C , pH 7.5-8.0)		
					NaCl Solution mg/L	Operating Pressure psi(MPa)	Recovery (%)
Ultra-Low Pressure ULP	ULP-4021	36(3.3)	950(3.6)	99.20	1500	150(1.03)	8
	ULP-2540	27(2.5)	750(2.8)	99.20			15
	ULP-2521	14(1.3)	400(1.5)	99.20			8
Sea Water Desalination SW	SW-4021	36(3.3)	700(2.6)	99.70	32000	800(5.5)	4
	SW-2540	27(2.5)	500(1.9)	99.70			8
	SW-2521	14(1.3)	250(0.9)	99.70			4



1.1.4) Industrial NF Membrane Elements:2540,4040,8040

Membrane Series	Model	Active Area ft ² (m ²)	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Test Conditions(Temperature25°C , pH 7.5-8.0)						
					NaCl Solution mg/L	Operating Pressure psi(MPa)	Recovery (%)	pH			
High Rejection NF1	NF1-2540	27 (2.5)	750 (2.8)	50-70	500 NaCl	70(0.48)	15	7.5-8.0			
			600 (2.3)	> 98	2000 MgSO ₄			6.5-7.0			
	NF1-4040	85 (7.9)	2200 (8.3)	50-70	500 NaCl			7.5-8.0			
			1800 (6.8)	> 98	2000 MgSO ₄			6.5-7.0			
	NF1-8040	400 (37.2)	11000 (41.6)	50-70	500 NaCl			7.5-8.0			
			9000 (34.0)	> 98	2000 MgSO ₄			6.5-7.0			
	NF1-4040R	85 (7.9)	2200 (8.3)	> 85	500 NaCl			7.5-8.0			
			1800 (6.8)	> 99	2000 MgSO ₄			6.5-7.0			
	NF1-8040R	400 (37.2)	11000 (41.6)	> 85	500 NaCl			7.5-8.0			
			9000 (34.0)	> 99	2000 MgSO ₄			6.5-7.0			
	High Permeability NF2	NF2-2540	27 (2.5)	850 (3.2)	30-50			500 NaCl	70(0.48)	15	7.5-8.0
				700 (2.6)	> 97			2000 MgSO ₄			6.5-7.0
NF2-4040		85 (7.9)	2600 (9.8)	30-50	500 NaCl	7.5-8.0					
			2200 (8.3)	> 97	2000 MgSO ₄	6.5-7.0					
NF2-8040		400 (37.2)	13000 (49.2)	30-50	500 NaCl	7.5-8.0					
			11000 (41.6)	> 97	2000 MgSO ₄	6.5-7.0					



1.1.5) Residential Membrane Elements

Model	Active Area ft ² (m ²)	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Test Conditions(Temperature25°C , pH 7.5-8.0)		
				Test Solution mg/L	Operating Pressure psi(MPa)	Recovery (%)
RO-1812-50	4.2(0.39)	50(0.19)	98.5	250mg/L NaCl	60(0.41)	55
RO-1812-75-2	5.0(0.46)	75(0.28)	98.5			
RO-1812-75	4.2(0.39)	75(0.28)	98.0			
RO-2012-100-2	6.3(0.59)	100(0.38)	98.0			
RO-2012-100	6.3(0.59)	100(0.38)	98.5			
RO-2012-150	6.3(0.59)	150(0.57)	98.0		75(0.52)	
RO-2012-100-3	5.0(0.46)	100(0.38)	97.0			
RO-2012-200	8.0(0.75)	200(0.76)	97.0			
RO-2812-200	10.5(0.98)	200(0.76)	98.0		60(0.41)	
RO-3012-400	14.7(1.37)	400(1.51)	98.0		100(0.69)	
RO-3012-500	16.8(1.56)	500(1.89)	98.0			
RO-3012-600	18.9(1.76)	600(2.27)	97.0			
RO-3013-400	16.5(1.53)	400(1.51)	98.0			
RO-3013-600	18.9(1.76)	600(2.27)	97.0			
RO-3020-600	27.0(2.51)	600(2.27)	98.0			

1.1.6) Residential NF Membrane Elements

Model	Active Area ft ² (m ²)	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Test Conditions(Temperature25°C , pH 7.5-8.0)											
				Test Solution mg/L	Operating Pressure psi(MPa)	Recovery(%)	pH								
NF-1812	4.2(0.39)	100(0.38)	30-50	250 NaCl	60(0.41)	15	7.5-8.0								
			> 96	250 MgSO ₄			6.5-7.0								
NF-2012	6.3(0.59)	150(0.57)	30-50	250 NaCl			60(0.41)	15	7.5-8.0						
			> 96	250 MgSO ₄					6.5-7.0						
NF-2812	10.5(0.98)	250(0.95)	30-50	250 NaCl					60(0.41)	15	7.5-8.0				
			> 96	250 MgSO ₄							6.5-7.0				
NF-3012	14.7(1.37)	350(1.32)	30-50	250 NaCl							60(0.41)	15	7.5-8.0		
			> 96	250 MgSO ₄									6.5-7.0		
NF-3013	16.5(1.53)	400(1.51)	30-50	250 NaCl									60(0.41)	15	7.5-8.0
			> 96	250 MgSO ₄											6.5-7.0



1.2 Industrial RO Membrane Elements

1.2.1) Extreme Low Pressure RO Membrane Elements

(1) Benefits

XLP aromatic poly-amide composite elements is specially developed for higher permeate flux. Delivers high quality water at extreme low operating conditions, operating pressure is about half of conventional brackish water membranes, which is able to reduce investment cost for membrane system pipelines, pumps & other equipment and system operation cost to improve the economic benefits.

It is mainly used for treatment of surface water, groundwater and municipal water salinity < 1000mg /L. The application fields include purified water, bottled drinking water, and the second pass of a two-pass membranes system. It has the characteristics as low energy consumption, higher permeate flow, extreme low operating pressure as well as high rejection rate.

(2) Elements Specifications and Parameters

Model	Active Area ft ² (m ²)	Concentrate Channel Spacer mil	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Minimum Salt Rejection (%)
XLP-8040HF	440(40.9)	28	13000(49.2)	99.00	98.00
XLP-8040	440(40.9)	28	11000(41.6)	99.20	99.00
XLP-4040HF	100(9.3)	28	3000(11.3)	99.00	98.00
XLP-4040	90(8.4)	28	2600(9.8)	99.20	99.00

(3) Notes

A. Test conditions :

Solution	Temperature(°C)	pH	Operating Pressure psi(MPa)	Recovery(%)
500mg/L NaCl	25	7.5-8.0	100(0.69)	15

B. Individual flow rate may vary ±15%

C. Operating and cleaning limits :

- Maximum Operating Pressure 600psi(4.14MPa)
- Maximum Feed Flow Rate 17.0m³/h(8040), 3.6m³/h(4040)
- Operating Temperature Range 0-45°C
- Maximum Feed SDI₁₅ 5.0
- Free Chlorine Tolerance 0.1mg/L
- pH Range, Continuous Operation 3-10
- pH Range, Short-Term Cleaning 1-13
- Maximum Element Pressure Drop 15psi(0.1MPa)



1.2.2) Ultra-low Pressure RO Membrane Elements

(1) Benefits

ULP aromatic poly-amide composite elements is specially developed for groundwater and surface water treatment. The operating pressure is about 2/3 of the conventional low-pressure brackish water membranes and the rejection rate can reach 99.5%. With higher salt rejection rate, it can also meet the required permeate flow at very low operating pressure.

It mainly applies to treatment for surface water, groundwater, municipal water ,etc.within salinity<2000mg/L. The application fields include bottled drinking water, dual water supply in residential area or industrial park, food and beverage production, etc. It has the characteristics of higher permeate flow, low operating pressure as well as high rejection rate.

(2) Elements Specifications and Parameters

Model	Active Area ft ² (m ²)	Concentrate Channel Spacer mil	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Minimum Salt Rejection (%)
ULP-8040MR-2	440(40.9)	28	10500(39.7)	99.60	99.50
ULP-8040HF	440(40.9)	28	12500(47.3)	99.50	99.40
ULP-8040-2	400(37.2)	34	10000(37.8)	99.50	99.30
ULP-8040	400(37.2)	28	11000(41.6)	99.35	99.20
ULP-4040MR-2	100(9.3)	28	2400(9.1)	99.60	99.50
ULP-4040HF	100(9.3)	28	2700(10.2)	99.50	99.40
ULP-4040-2	85(7.9)	34	2200(8.3)	99.50	99.30
ULP-4040	85(7.9)	28	2600(9.8)	99.35	99.20

(3) Notes

A.Test conditions :

Solution	Temperature(°C)	pH	Operating Pressure psi(MPa)	Recovery(%)
1500mg/L NaCl	25	7.5-8.0	150(1.03)	15

B.Individual flow rate may vary±15%

C.Operating and cleaning limits :

- Maximum Operating Pressure 600psi(4.14MPa)
- Maximum Feed Flow Rate 17.0m³/h(8040), 3.6m³/h(4040)
- Operating Temperature Range 0-45°C
- Maximum Feed SDI₁₅ 5.0
- Free Chlorine Tolerance 0.1mg/L
- pH Range, Continuous Operation 3-10
- pH Range, Short-Term Cleaning 1-13
- Maximum Element Pressure Drop 15psi(0.1MPa)



1.2.3) Brackish Water Reverse Osmosis Membrane Elements

(1) Benefits

BW aromatic polyamide composite membrane elements is specially developed to widely use for groundwater and surface water treatment. The models are characterized in high rejection rate and high permeate flow.

It mainly applied to desalination treatment of brackish water, surface water, groundwater, tap water, etc. within salinity<5000mg/L, and can also used for waste water reuse , concentration and other projects. The application fields include electronics, electricity, municipal drinking water, chemicals, pharmaceutical and so on. It has the characteristics of high rejection rate, high permeate flux and low operating pressure.

(2) Elements Specifications and Parameters

Model	Active Area ft ² (m ²)	Concentrate Channel Spacer mil	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Minimum Salt Rejection (%)
BW-8040-2	400(37.2)	28	10500(39.7)	99.70	99.60
BW-8040	400(37.2)	28	10500(39.7)	99.60	99.50
BW-8040HF	440(40.9)	28	13000(49.2)	99.50	99.40
BW-8040-E	400(37.2)	28	10500(39.7)	99.50	99.40
BW-4040	85(7.9)	28	2500(9.5)	99.60	99.50
BW-4040HF	100(9.3)	28	2900(11.0)	99.50	99.40
BW-4040-E	85(7.9)	28	2400(9.1)	99.50	99.40

(3) Notes

A. Test conditions :

Solution	Temperature(°C)	pH	Operating Pressure psi(MPa)	Recovery(%)
2000mg/L NaCl	25	7.5-8.0	225(1.55)	15

B. Individual flow rate may vary±15%

C. Operating and cleaning limits :

- Maximum Operating Pressure 600psi(4.14MPa)
- Maximum Feed Flow Rate 17.0m³/h(8040), 3.6m³/h(4040)
- Operating Temperature Range 0-45°C
- Maximum Feed SDI₁₅ 5.0
- Free Chlorine Tolerance 0.1mg/L
- pH Range, Continuous Operation 3-10
- pH Range, Short-Term Cleaning 1-13
- Maximum Element Pressure Drop 15psi(0.1MPa)



1.2.4) Fouling Resistant RO Membrane Elements

(1) Benefits

FR series products are aromatic polyamide reverse osmosis membrane element with anti-fouling property used in complex influent condition. This series membrane adopts special process technology to improve the hydrophilicity, charge characteristic and surface smoothness, and reduces the growth and adsorption of pollutants and surface microorganisms in products running. FR membrane element adopts 34mil wide channel spacer for easy cleaning, and also helps to reduce fouling and pressure difference of membrane system and maintain a longer lifespan.

It mainly used for reclaimed water, reused water, waste water, reverse osmosis concentrated water treatment, etc. within salinity < 10000mg/L. The application fields include electricity, metallurgy, steel, chemical industry, textile and dyeing, municipal sewage etc. It has the characteristics of high-desalination, good restorative after cleaning and low pressure drop (the pressure gap between the feedwater and concentrated water).

(2) Elements Specifications and Parameters

Model	Active Area ft ² (m ²)	Concentrate Channel Spacer mil	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Minimum Salt Rejection (%)
BW-8040XLFR	400(37.2)	34	11500(43.5)	99.75	99.65
BW-8040LFR	400(37.2)	34	10500(39.7)	99.75	99.65
BW-8040FR-2	400(37.2)	34	10500(39.7)	99.70	99.60
BW-8040FR	365(33.9)	34	9500(35.9)	99.70	99.60
BW-4040XLFR	85(7.9)	34	2300(8.3)	99.60	99.50
BW-4040FR	78(7.3)	34	2000(7.6)	99.60	99.50

(3) Notes

A. Test conditions :

Solution	Temperature(°C)	pH	Operating Pressure psi(MPa)	Recovery(%)
2000mg/L NaCl	25	7.5-8.0	255(1.55)	15

B. Individual flow rate may vary ±15%

C. Operating and cleaning limits :

- Maximum Operating Pressure 600psi(4.14MPa)
- Maximum Feed Flow Rate 17.0m³/h(8040), 3.6m³/h(4040)
- Operating Temperature Range 0-45°C
- Maximum Feed SDI₁₅ 5.0
- Free Chlorine Tolerance 0.1mg/L
- pH Range, Continuous Operation 3-10
- pH Range, Short-Term Cleaning 1-13
- Maximum Element Pressure Drop 15psi(0.1MPa)



1.2.5) Sea Water Desalination Membrane Elements

(1) Benefits

Aromatic polyamide composite SW series membrane elements is newly developed for seawater desalination or treatment for raw water with high salinity, with stand high pressure.

It is mainly used for seawater or raw water with high salinity > 10000mg/L; Its application fields include seawater desalination, RO concentrated water reuse, zero liquid discharge for high salinity wastewater, materials concentration and so on. It has the characteristics of high desalination rate, stable performance and high flux.

(2) Elements Specifications and Parameters

Model	Active Area ft ² (m ²)	Concentrate Channel Spacer mil	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Minimum Salt Rejection (%)
SW-8040HR	400(37.2)	28	6500(24.6)	99.80	99.75
SW-8040MR	400(37.2)	28	7500(28.3)	99.75	99.70
SW-4040HR	85(7.9)	28	1500(5.7)	99.75	99.70
SW-4040MR	85(7.9)	28	1800(6.8)	99.70	99.65

(3) Notes

A. Test conditions :

Solution	Temperature(°C)	pH	Operating Pressure psi(MPa)	Recovery(%)
32000mg/L NaCl	25	7.5-8.0	800(5.5)	8

B. Individual flow rate may vary ±15%

C. Operating and cleaning limits :

- Maximum Operating Pressure 1200psi(8.3MPa)
- Maximum Feed Flow Rate 17.0m³/h(8040), 3.6m³/h(4040)
- Operating Temperature Range 0-45°C
- Maximum Feed SDI₁₅ 5.0
- Free Chlorine Tolerance 0.1mg/L
- pH Range, Continuous Operation 3-10
- pH Range, Short-Term Cleaning 1-13
- Maximum Element Pressure Drop 15psi(0.1MPa)



1.2.6) Nanofiltration Membrane Elements

(1) Benefits

The prepared polypiperazine composite NF membrane element had better performance of selection separation. It can remove effectively almost all bacteria, viruses, microorganisms, macromolecular organics, and antibiotics, pesticides, pesticide residues and other small molecular organics, heavy metals and most divalent and multivalent cations from solution and water, while retaining some sodium, potassium, calcium, magnesium, metasilicic acid, other beneficial nutritional minerals and small molecular substances. It is applicable for the preparation of directly drinking water, mineral water, softened water, partial desalination and decolorization treatment of wastewater with high salinity or organic concentration, separation and purification of some inorganic salts and organic materials.

NF membrane products have the advantage of low operating pressure, which can greatly save the operating costs of equipment or system. It is widely used in drinking water, food and beverage, medicine, reuse of treated water, wastewater treatment and other industries.

(2) Elements Specifications and Parameters

Model	Active Area ft ² (m ²)	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Solution Type
NF1-8040	400(37.2)	11000(41.6)	50-70	NaCl
		9000(34.0)	> 98	MgSO ₄
NF1-4040	85(7.9)	2200(8.3)	50-70	NaCl
		1800(6.8)	> 98	MgSO ₄
NF2-8040	400(37.2)	13000(49.2)	30-50	NaCl
		11000(41.6)	> 97	MgSO ₄
NF2-4040	85(7.9)	2600(9.8)	30-50	NaCl
		2200(8.3)	> 97	MgSO ₄
NF1-8040R	400(37.2)	11000(41.6)	> 85	NaCl
		9000(34.0)	> 99	MgSO ₄
NF1-4040R	85(7.9)	2200(8.3)	> 85	NaCl
		1800(6.8)	> 99	MgSO ₄



(3) Notes

A. Test conditions :

Solution	Temperature(°C)	pH	Operating Pressure psi(MPa)	Recovery(%)
500mg/L NaCl	25	7.5-8.0	70(0.48)	15
2000mg/L MgSO ₄	25	6.5-7.0	70(0.48)	15

B. Individual flow rate may vary ±15%

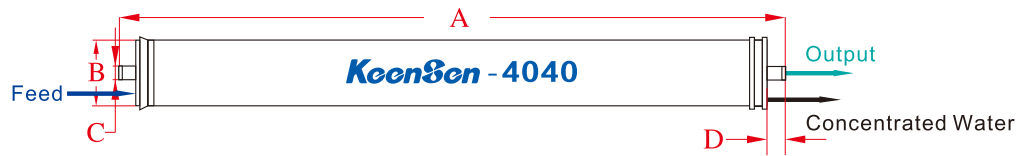
C. Operating and cleaning limits :

- Maximum Operating Pressure 600psi(4.14MPa)
- Maximum Feed Flow Rate 17.0m³/h(8040), 3.6m³/h(4040)
- Operating Temperature Range 0-45°C
- Maximum Feed SDI₁₅ 5.0
- Free Chlorine Tolerance 0.1mg/L
- pH Range, Continuous Operation 3-10
- pH Range, Short-Term Cleaning 1-13
- Maximum Element Pressure Drop 15psi(0.1MPa)

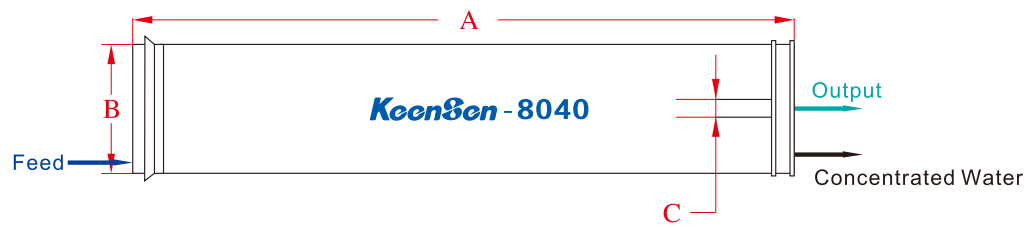


1.2.7) Dimensions of Industrial Membrane Element

(1) 4040 Membrane



(2) 8040 Membrane



Parameter	8040	4040
A	40.0"(1016mm)	40.0"(1016mm)
B	7.9"(201mm)	3.9"(99mm)
C	1.125"(28.6mm)	0.75" (19.0mm)
D	/	1.04" (26.5mm)

1.0 inch=25.4mm



1.3 Commercial Membrane Elements

1.3.1) Ultra Low Pressure RO Membrane Elements

(1) Benefits

Commercial membrane elements are mainly applied to treatment of surface water, groundwater, municipal water, etc. with salinity less than 2000mg/L, which are widely used for vending machines, drinking equipment in office or residential site, and healthy labs pure water preparation .

(2) Elements Specifications and Parameters

Model	Active Area ft ² (m ²)	Concentrate Channel Spacer mil	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Minimum Salt Rejection (%)
ULP-4021	36(3.3)	28	950(3.6)	99.20	99.00
ULP-2540	27(2.5)	28	750(2.8)	99.20	99.00
ULP-2521	14(1.3)	28	400(1.5)	99.20	99.00

(3) Notes

A.Test conditions :

Solution	Temperature(°C)	pH	Operating Pressure psi(MPa)	Recovery(%)
1500mg/L NaCl	25	7.5-8.0	150(1.03)	15(2540) 8(4021/2521)

B.Individual flow rate may vary±15%

C.Operating and cleaning limits :

- Maximum Operating Pressure 600psi(4.14MPa)
- Maximum Feed Flow Rate 3.6 m³/h(4021),1.4 m³/h(2540/2521)
- Operating Temperature Range 0-45°C
- Maximum Feed SDI₁₅ 5.0
- Free Chlorine Tolerance 0.1mg/L
- pH Range, Continuous Operation 3-10
- pH Range, Short-Term Cleaning 1-13
- Maximum Element Pressure Drop 15psi(0.1MPa)



1.3.2) Sea Water Desalination RO Membrane Elements

(1) Benefits

SW commercial membrane elements mainly apply to seawater desalination, subsea water and high salinity concentration water treatment, which are widely used in ships, islands and small desalination systems.

(2) Elements Specifications and Parameters

Model	Active Area ft ² (m ²)	Concentrate Channel Spacer mil	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Minimum Salt Rejection (%)
SW-4021	36(3.3)	28	700(2.6)	99.70	99.60
SW-2540	27(2.5)	28	500(1.9)	99.70	99.60
SW-2521	14(1.3)	28	250(0.9)	99.70	99.60

(3) Notes

A. Test conditions :

Solution	Temperature(°C)	pH	Operating Pressure psi(MPa)	Recovery(%)
32000mg/L NaCl	25	7.5-8.0	800(5.5)	8(2540) 4(4021/2521)

B. Individual flow rate may vary±15%

C. Operating and cleaning limits :

- Maximum Operating Pressure 1200psi(8.3MPa)
- Maximum Feed Flow Rate 3.6 m³/h(4021),1.4 m³/h(2540/2521)
- Operating Temperature Rang 0-45°C
- Maximum Feed SDI₁₅ 5.0
- Free Chlorine Tolerance 0.1mg/L
- pH Range, Continuous Operation 3-10
- pH Range, Short-Term Cleaning 1-13
- Maximum Element Pressure Drop 15psi(0.1MPa)



1.3.3) NF Membrane Elements

(1) Benefits

NF series product is a polypropylene composite nanofiltration membrane element developed by KeenSen, with selective separation characteristics. It has a high removal rate for almost all bacteria, viruses, microorganisms, macromolecular organics, antibiotics, pesticides, pesticide residues and other small molecular organics, heavy metals and most divalent and multivalent ions in water of solutions, while retaining some sodium, potassium, calcium, magnesium, metasilicic acid, other beneficial nutritional minerals and small molecular substances. It is applicable to the preparation of direct drinking water, mineral water, softened water, partial desalination and decolorization of wastewater with high salt concentration and organic concentration, and separation and purification of certain inorganic salts and organic materials.

Nanofiltration series products have extremely low operating pressure, which can greatly save the operating costs of equipment. The membranes are widely used in drinking water, food and beverage, medicine, water reuse, wastewater treatment and other industries.

(2) Elements Specifications and Parameters

Model	Active Area ft ² (m ²)	Permeate Flow Rate GPD(m ³ /d)	Stabilized Salt Rejection (%)	Solution Type
NF1-2540	27(2.5)	750(2.8)	50-70	NaCl
		600(2.3)	> 98	MgSO ₄
NF2-2540	27(2.5)	850(3.2)	30-50	NaCl
		700(2.6)	> 97	MgSO ₄

(3) Notes

A. Test conditions :

Solution	Temperature(°C)	pH	Operating Pressure psi(MPa)	Recovery(%)
500mg/L NaCl	25	7.5-8.0	70(0.48)	15
2000mg/L MgSO ₄	25	6.5-7.0	70(0.48)	15

B. Individual flow rate may vary ±15%

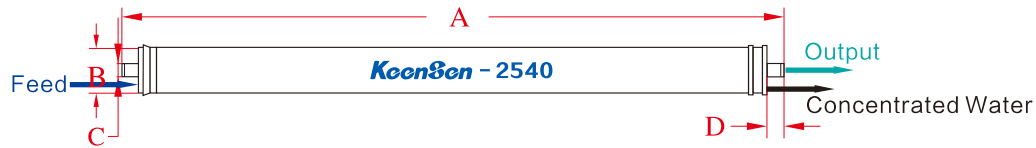
C. Operating and cleaning limits :

- Maximum Operating Pressure 600psi(4.14MPa)
- Maximum Feed Flow Rate 1.4 m³/h
- Operating Temperature Range 0-45°C
- Maximum Feed SDI₁₅ 5.0
- Free Chlorine Tolerance 0.1mg/L
- pH Range, Continuous Operation 3-10
- pH Range, Short-Term Cleaning 1-13
- Maximum Element Pressure Drop 15psi(0.1MPa)

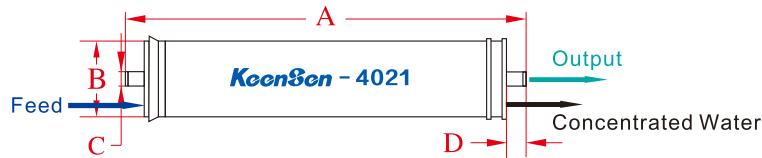


1.3.4) Dimensions of Commercial Series Membrane Element Sizes

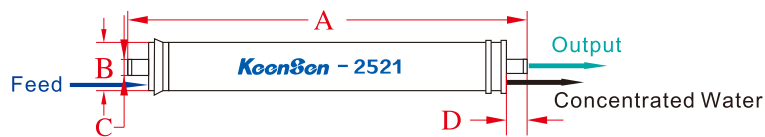
(1) 2540 Membrane



(2) 4021 Membrane



(3) 2521 Membrane



Parameter	2540	4021	2521
A	40.0"(1016mm)	21.0"(533.4mm)	21.0"(533.4mm)
B	2.4"(61mm)	3.9"(99mm)	2.4"(61mm)
C	0.75" (19.0mm)	0.75" (19.0mm)	0.75" (19.0mm)
D	1.125" (28.6mm)	1.04" (26.5mm)	1.125" (28.6mm)

1.0 inch=25.4mm



1.4 Residential Membrane Elements

1.4.1) Reverse Osmosis Membrane Elements

(1) Benefits

Residential reverse osmosis membrane elements are rolled with ultra-low pressure aromatic polyamide composite reverse osmosis membrane flat sheets .

The membranes are suitable for treatment of raw water with salinity less than 1000mg/L. It has the characteristics of high rejection rate and low operating pressure. It is mainly used in small direct drinking water devices at home or office. The product meets the water efficiency requirements of grade 2 and above in the "Restricted Value and Water Efficiency Grade of Reverse Osmosis Water Purifiers" in GB34914-2021.

Model	Active Area ft ² (m ²)	Permeate Flow GPD(m ³ /d)	Stable Rejection Rate (%)	
			Test Method A	Test Method B
RO-1812-50	4.2(0.39)	50(0.19)	96.0	98.5
RO-1812-75-2	5.0(0.46)	75(0.28)	96.0	98.5
RO-1812-75	4.2(0.39)	75(0.28)	95.0	98.0
RO-2012-100-3	5.0(0.46)	100(0.38)	95.5	98.0
RO-2012-100-2	6.3(0.59)	100(0.38)	96.0	98.5
RO-2012-100	6.3(0.59)	100(0.38)	95.0	98.0
RO-2012-150	6.3(0.59)	150(0.57)	94.0	97.0
RO-2012-200	8.0(0.75)	200(0.76)	93.0	97.0
RO-2812-200	10.5(0.98)	200(0.76)	95.0	98.0
RO-3012-400	14.7(1.37)	400(1.51)	95.0	98.0
RO-3012-500	16.8(1.56)	500(1.89)	95.0	98.0
RO-3012-600	18.9(1.76)	600(2.27)	94.0	97.0
RO-3013-400	16.5(1.53)	400(1.51)	95.0	98.0
RO-3013-600	18.9(1.76)	600(2.27)	94.0	97.0
RO-3020-600	27.0(2.51)	600(2.27)	94.0	98.0



(3) Notes

A. Test conditions :

Test Methods	Solution	Temperature (°C)	pH	Operating Pressure psi(MPa)	Recovery (%)	Applicable for membrane element model
A	500mg/L (NaHCO ₃ , CaCl ₂ , NaCl, MgSO ₄)	25	7.5-8.0	60(0.41)	55	RO-1812-50 RO-1812-75/75-2 RO-2012-100/100-2 RO-2012-150 RO-2812-200
		25	7.5-8.0	75(0.52)	55	RO-2012-100-3 RO-2012-200
		25	7.5-8.0	100(0.69)	55	RO-3012-400/500/600 RO-3013-400/600 RO-3020-600
B	250mg/L NaCl	25	7.5-8.0	60(0.41)	20-30	RO-1812-50 RO-1812-75/75-2 RO-2012-100/100-2 RO-2012-150 RO-2812-200
		25	7.5-8.0	75(0.52)	20-30	RO-2012-100-3 RO-2012-200
		25	7.5-8.0	100(0.69)	20-30	RO-3012-400/500/600 RO-3013-400/600 RO-3020-600

B. Individual flow rate may vary ±15%

C. Operating and cleaning limits :

- Maximum Operating Pressure 300psi(2.07MPa)
- Operating Temperature Range 0-45°C
- Maximum Feed SDI₁₅ 5.0
- Free Chlorine Tolerance 0.1mg/L
- pH Range, Continuous Operation 3-10
- pH Range, Short-Term Cleaning 2-12
- Maximum Element Pressure Drop 10psi(0.07MPa)



1.4.2) NF Membrane Elements

(1) Benefits

Residential nanofiltration membrane elements are generally suitable for treatment of raw water sources with a salinity less than 500mg/L. It has a high removal rate for almost all bacteria, viruses, microorganisms, macromolecular organics, antibiotics, pesticides, pesticide residues and other small molecular organics, heavy metals and most divalent and multivalent ions in water of solutions, while retaining some sodium, potassium, calcium, magnesium, metasilicic acid, other beneficial nutritional minerals and small molecular substances.

Nanofiltration series products have extremely low operating pressure, which can greatly save the operating costs of equipment. It is mainly used for small water purification devices such as household water purification, drinking water in community office areas.

(2) Elements Specifications and Parameters

Model	Active Area ft ² (m ²)	Permeate Flow GPD(m ³ /d)	Rejection Rate(%)	Solution
NF-1812	4.2(0.39)	100(0.38)	30-50	NaCl
			> 96	MgSO ₄
NF-2012	6.3(0.59)	150(0.57)	30-50	NaCl
			> 96	MgSO ₄
NF-2812	10.5(0.98)	250(0.95)	30-50	NaCl
			> 96	MgSO ₄
NF-3012	14.7(1.37)	350(1.32)	30-50	NaCl
			> 96	MgSO ₄
NF-3013	16.5(1.53)	400(1.51)	30-50	NaCl
			> 96	MgSO ₄

(3) Notice

A. Test conditions :

Solution	Temperature(°C)	pH	Operating Pressure psi(MPa)	Recovery(%)
250mg/L NaCl	25	7.5-8.0	60(0.41)	15
250mg/L MgSO ₄	25	6.5-7.0	60(0.41)	15

B. Individual flow rate may vary ±15%

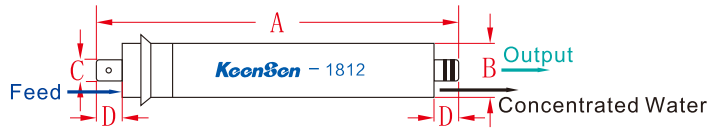
C. Operating and cleaning limits :

- Maximum Operating Pressure 300psi(2.07MPa)
- Operating Temperature Range 0-45°C
- Maximum Feed SDI₁₅ 5.0
- Free Chlorine Tolerance 0.1mg/L
- pH Range, Continuous Operation 3-10
- pH Range, Short-Term Cleaning 2-12
- Maximum Element Pressure Drop 10psi(0.07MPa)



1.4.3) Dimensions of Residential Membrane Elements

(1) 1812 Membrane



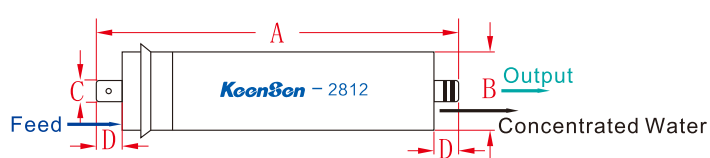
A	298mm
B	43mm
C	17.0mm
D	21.5mm

(2) 2012 Membrane



A	298mm
B	47mm
C	17.0mm
D	21.5mm

(3) 2812 Membrane



A	298mm
B	67mm
C	17.0mm
D	21.5mm

(4) 3012-400 Membrane



A	298mm
B	69mm
C	17.0mm
D	21.5mm

(5) 3012-500/600 Membrane



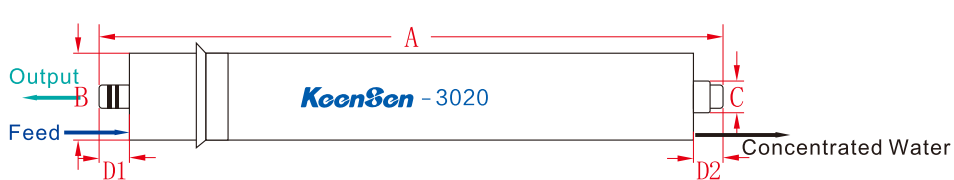
A	298mm
B	73mm
C	17.0mm
D	21.5mm

(6) 3013 Membrane



A	333mm
B	69mm
C	17.0mm
D	21.5mm

(7) 3020 Membrane

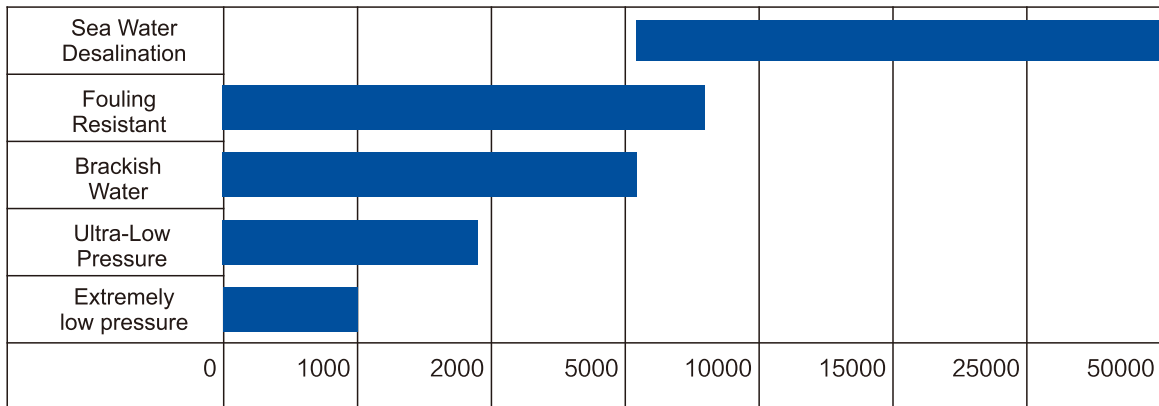


A	512mm
B	75mm
C	26.0mm
D1	25.5mm
D2	23.5mm



2. Guideline For Membrane Elements Selection

2.1 Selection According to Total Dissolved Solids (TDS) of Feedwater



(Feed Water TDS : mg/L)

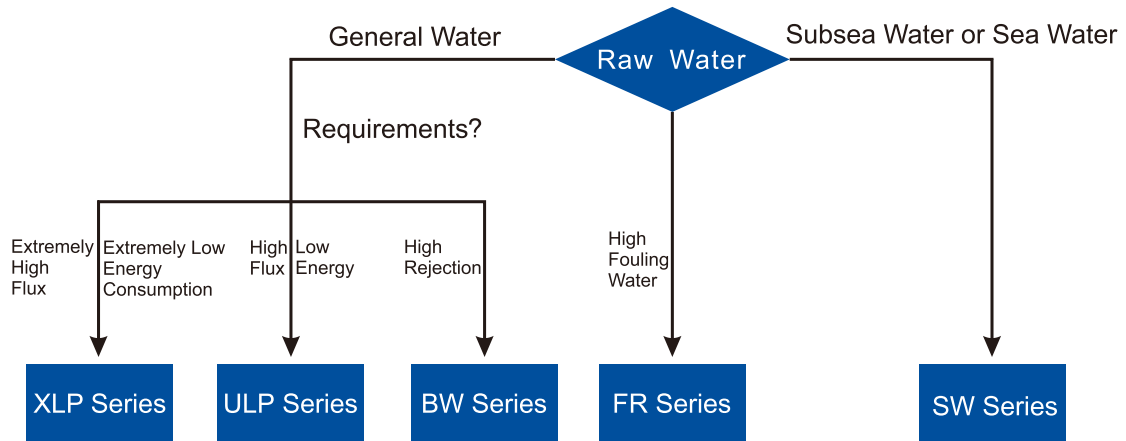
2.2 Selection According to Design Index Requirements of Membrane System

Index	Requirement	Model
System Rejection Rate	20-70%	NF1/NF2
	≥95%	XLP
	≥98%	ULP/BW/FR
	≥99%	SW
Feed Water Pressure	≤4.1MPa(600psi)	XLP/ULP/BW/FR
	≤8.3MPa(1200psi)	SW
Permeate Flow	< 4.0m ³ /h	4" membrane elements
	≥4.0m ³ /h	8" membrane elements

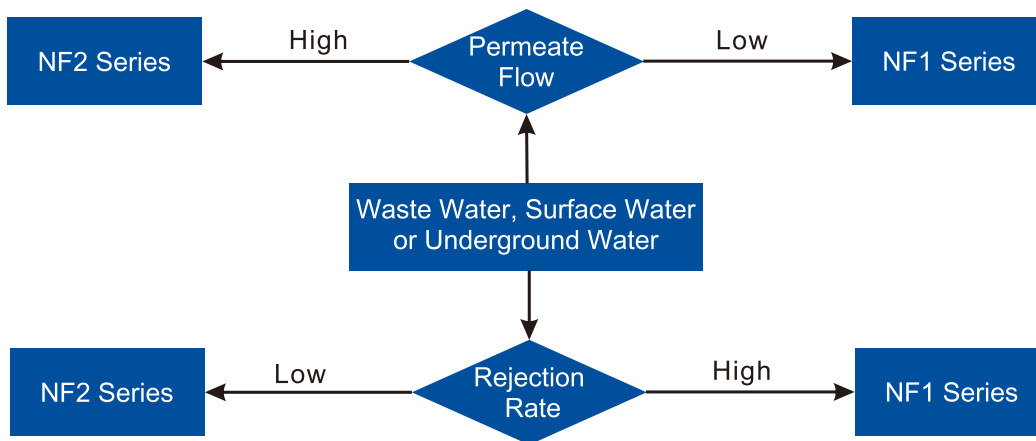


2.3 Selection According to Feedwater Type

2.3.1) Reverse Osmosis Membrane Elements:



2.3.2 Nanofiltration Membrane Elements

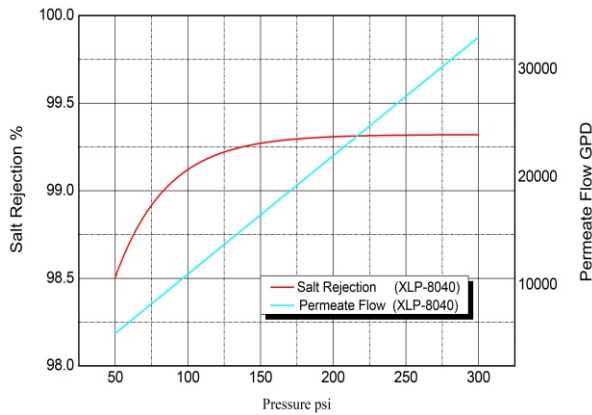




3. Factors Affecting RO Membrane Performance

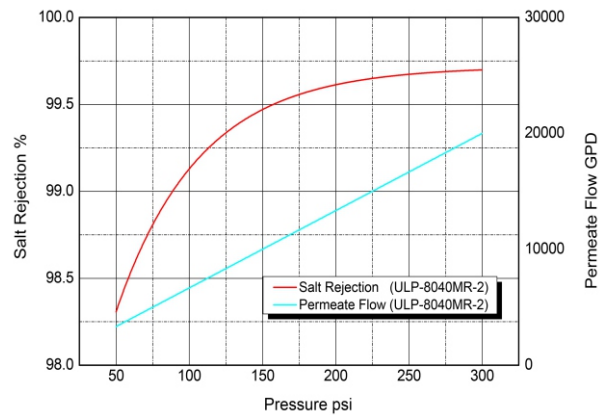
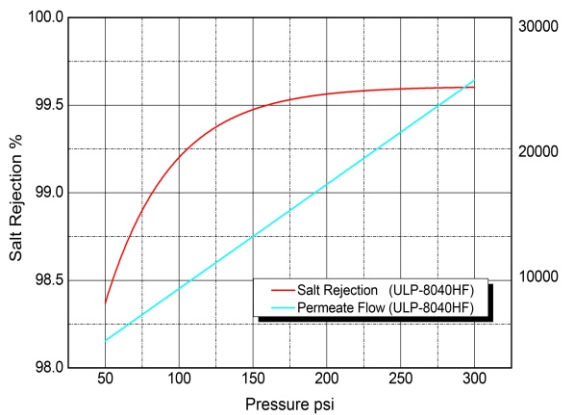
3.1 Feedwater Pressure

3.1.1) Feedwater Pressure VS. Permeate Flow and Salt Rejection on XLP Membranes



Test conditions: 25°C, 500mg/L NaCl, pH 7.5, Recovery rate 15%

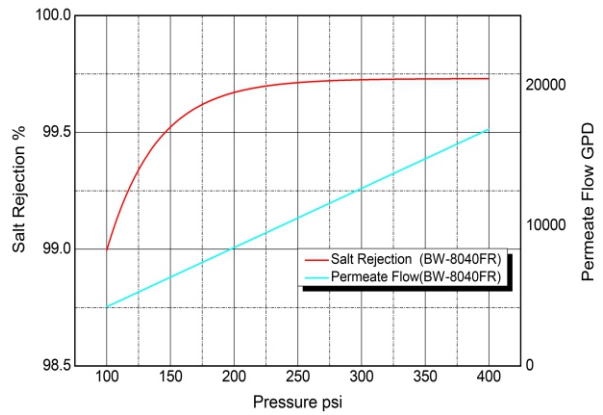
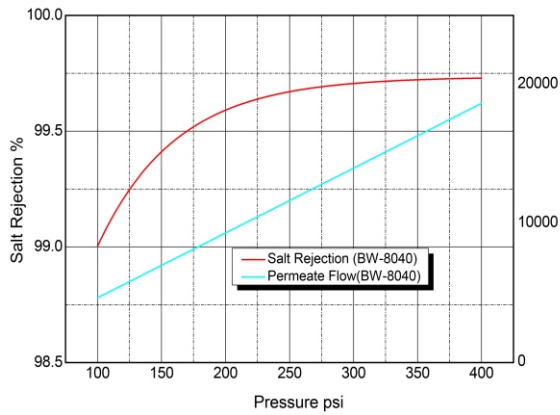
3.1.2) Feedwater Pressure VS. Permeate Flow and Salt Rejection on ULP Membranes



Test conditions: 25°C, 1500mg/L NaCl, pH 7.5, Recovery rate 15%

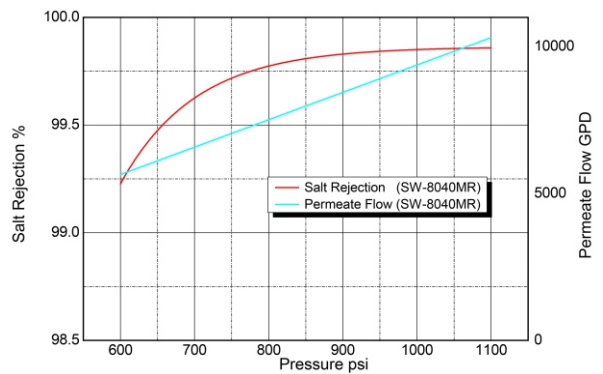
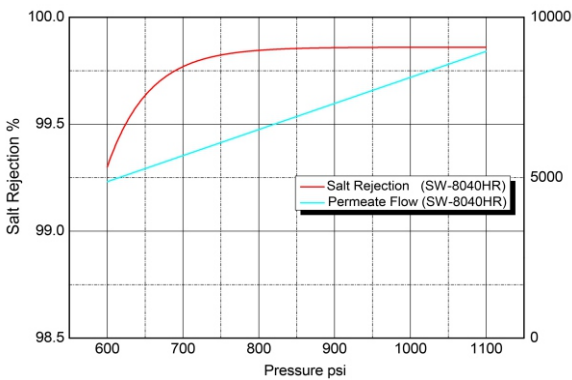


3.1.3) Feedwater Pressure VS. Permeate Flow and Salt Rejection on **BW Membranes**



Test conditions: 25°C, 2000mg/L NaCl, pH 7.5, Recovery rate 15%

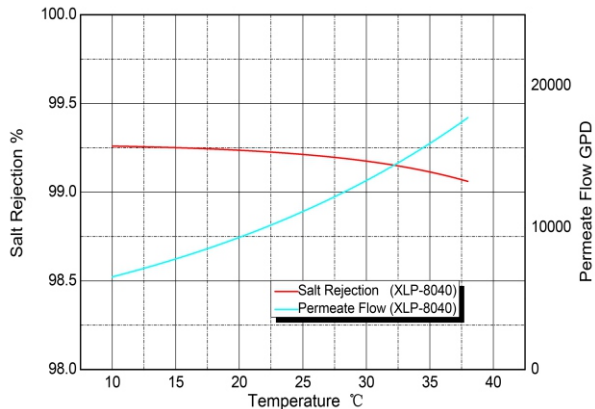
3.1.4) Feedwater Pressure VS. Permeate Flow and Salt Rejection on **SW Membranes**



Test conditions: 25°C, 32000mg/L NaCl, pH 7.5, Recovery rate 8%

3.2 Feedwater Temperature

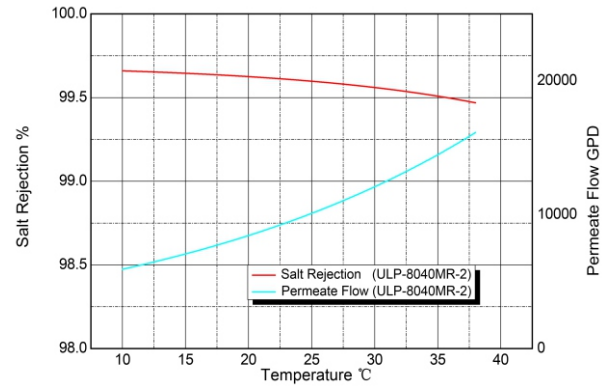
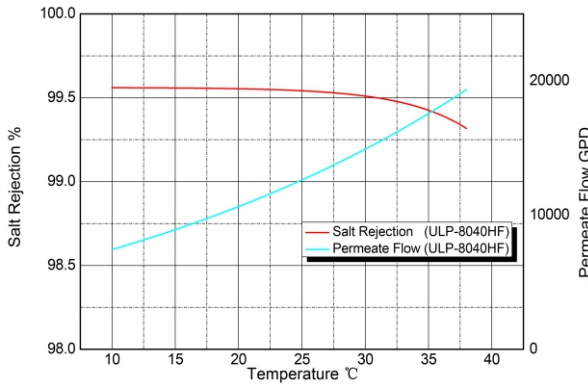
3.2.1) Feedwater Temperature VS. Permeate Flow and Salt Rejection on **XLP Membranes**



Test conditions: 100psi, 500mg/L NaCl, pH 7.5, Recovery rate 15%

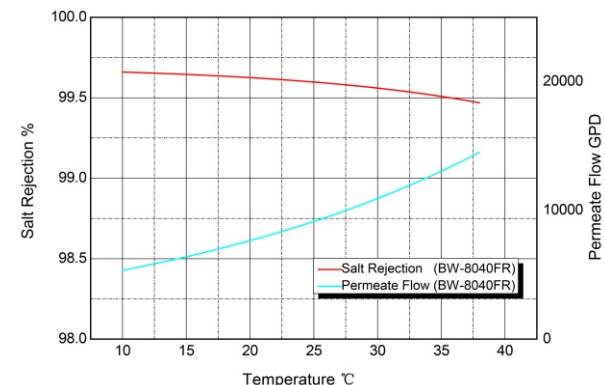
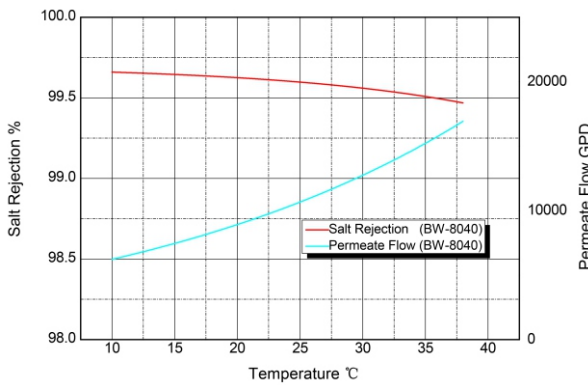


3.2.2) Feedwater Temperature VS. Permeate Flow and Salt Rejection on **ULP Membranes**



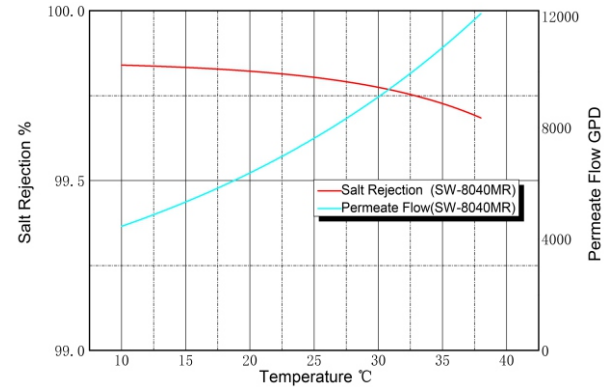
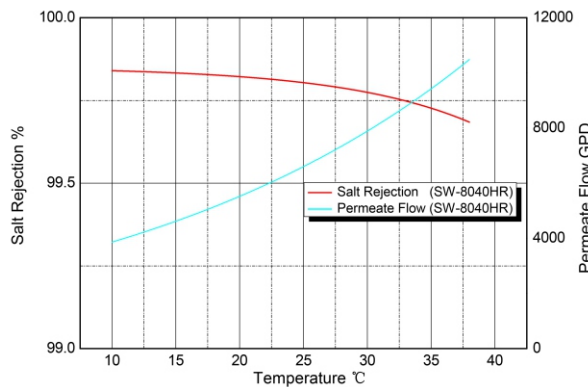
Test conditions: 150psi, 1500mg/L NaCl, pH 7.5, Recovery rate 15%

3.2.3) Feedwater Temperature VS. Permeate Flow and Salt Rejection on **BW Membranes**



Test conditions: 225psi, 2000mg/L NaCl, pH 7.5, Recovery rate 15%

3.2.4) Feedwater Temperature VS. Permeate Flow and Salt Rejection on **SW Membranes**

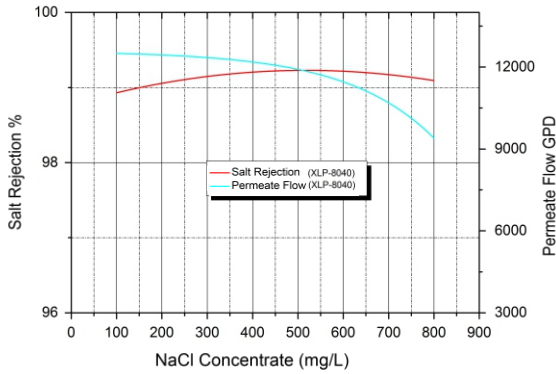


Test conditions: 800psi, 32000mg/L NaCl, pH 7.5, Recovery rate 8%



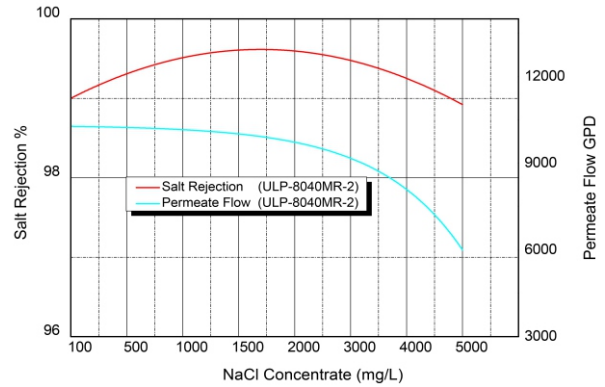
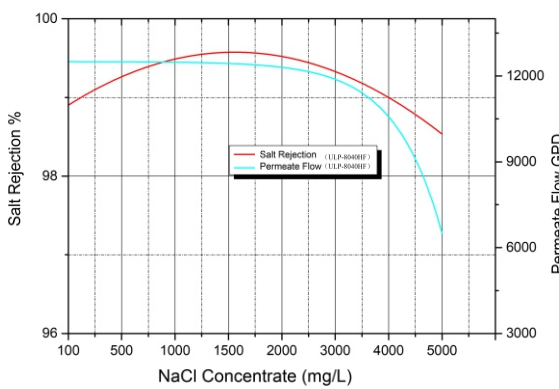
3.3 Feedwater Salt Concentration

3.3.1) Feedwater Salt Concentration VS. Permeate Flow and Salt Rejection on XLP Membranes



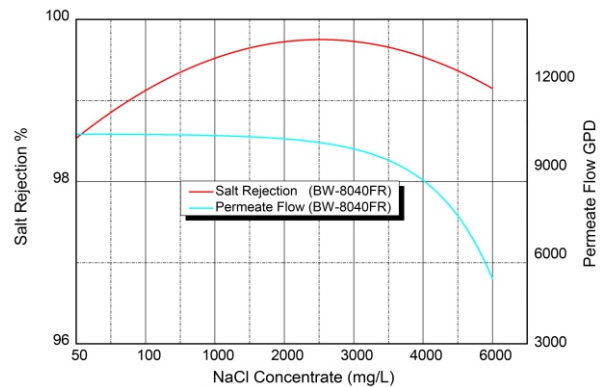
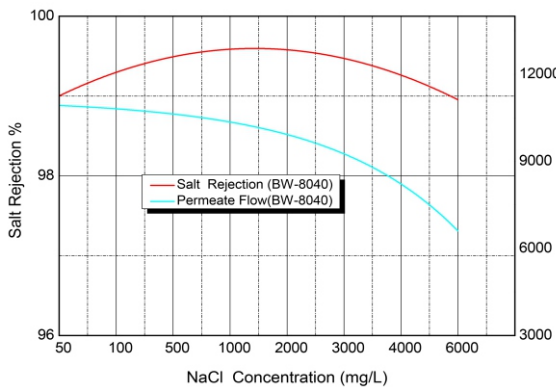
Test conditions: 100psi, 25°C, pH 7.5, Recovery rate 15%

3.3.2) Feedwater Salt Concentration VS. Permeate Flow and Salt Rejection on ULP Membranes



Test conditions: 150psi, 25°C, pH 7.5, Recovery rate 15%

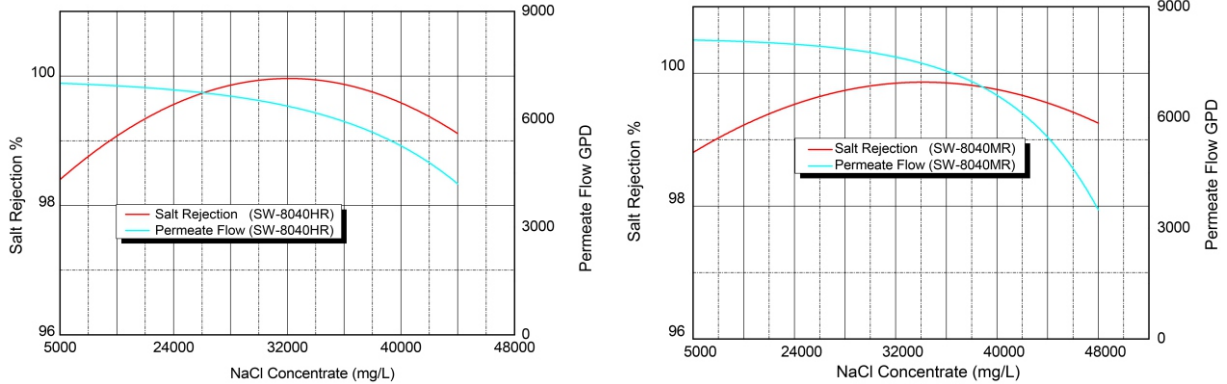
3.3.3) Feedwater Salt Concentration VS. Permeate Flow and Salt Rejection on BW Membranes



Test conditions: 225psi, 25°C, pH 7.5, Recovery rate 15%



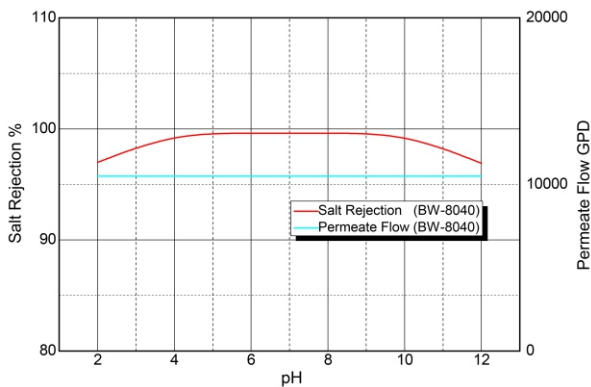
3.3.4) Feedwater Salt Concentration VS. Permeate Flow and Salt Rejection on SW Membranes



Test conditions: 800psi, 25°C, pH 7.5, Recovery rate 8%

3.4 Feedwater pH

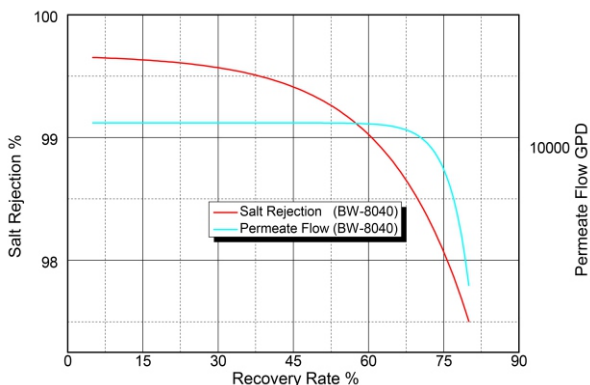
pH Value VS. Permeate Flow and Salt Rejection on BW Membranes



Test conditions: 225psi, 25°C, 2000mg/L NaCl, Recovery rate 15%

3.5 Recovery Rate

Recovery Rate VS. Permeate Flow and Salt Rejection on BW Membranes



Test conditions: 225psi, 25°C, 2000mg/L NaCl, pH 7.5



4. Guideline for RO Membrane System Design Software

KeenSen RO system design software comprised five major sections: "Project Info", "Feed Data", "Scaling", "RO Design(System Configuration)", and "Report". To introduce the usage of each section, herein taking a groundwater treatment project as an example.

Information about the groundwater treatment project:

(1) Raw water :groundwater SDI<3, pH7.6, Temp.18°C, Feedwater data showing as below:

Ions	Concentration (mg/L)	Ions	Concentration (mg/L)	Ions	Concentration (mg/L)
K ⁺	0.22	Ca ²⁺	530.6	Cl ⁻	439.5
Na ⁺	10.8	HCO ₃ ⁻	175.7	F ⁻	0.65
Mg ²⁺	180	NO ₃ ⁻	18.5	SO ₄ ²⁻	1253.3

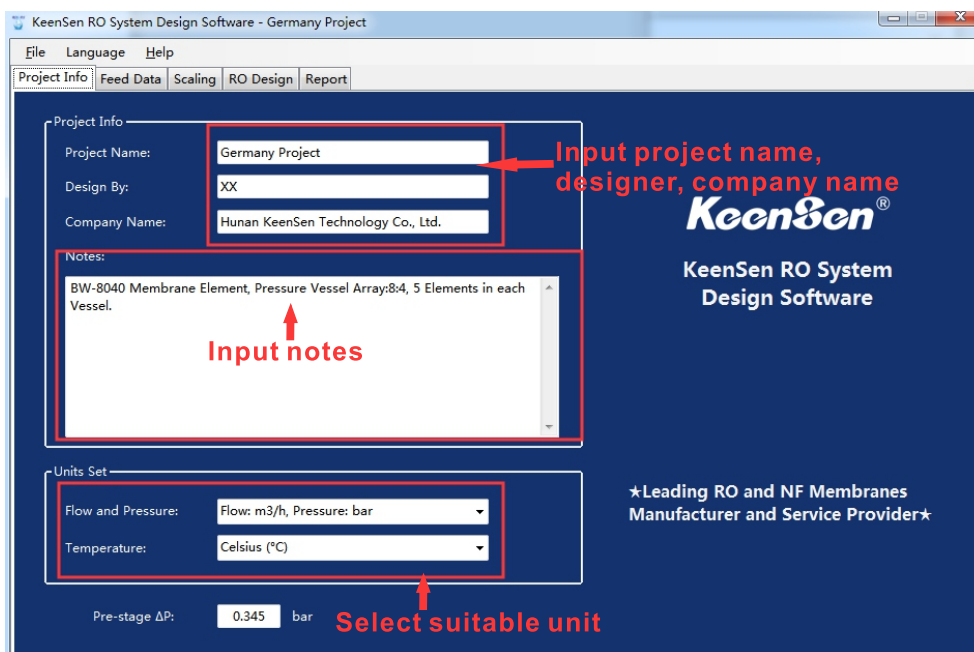
(2) System design requirements: Permeate flow 50m³/h, Recovery rate75%.

4.1 Project Information

4.1.1) Input project name, designer, company name and notes;

4.1.2) Select suitable unit for flow (gpm、gpd、m³/h、m³/d)、pressure (psi、bar) and temp. (°C、°F)

4.1.3) Pre-stage pressure default as 0.345 bar :



4.2 Feedwater Data

4.2.1) Select feed water type based on raw water(RO Permeate, Ground water, Surfacewater, Municipal water, Tertiary waste water, Seawater). Herein taking ground water with SDI<3 as an example.



- 4.2.2) Input temp. 18°C and pH Value 7.6;(Input temp. 25°C if temp. unspecified)
- 4.2.3) Tick "Specified Individual Solutes" and fill corresponding values if detailed water data available. Then click "Balance".
- 4.2.4) If there is no feedwater data, and just having the total dissolved solids (TDS) value, then unchecking the box of "Specify Individual Solutes", just filling the TDS value.

Note: Any composition changes of raw feedwater will affect scaling calculations. Please review scaling calculations.

3.Tick
 Specify Individual Solutes

TDS: 2,611 mg/l
 Temperature: 28.0 °C
 pH: 7.6

2.Input Temp. And pH

Charge Balance
 Cations: 41.76
 Anions: 41.76
 Balance: 0.00

1.Select feedwater type
 Water Type: Well Water SDI < 3

Ions	mg/l	ppm CaCO3	meq/l
Ammonium (NH4+ + NH3)	0	0.000	0.000
Potassium (K)	0.22	0.281	0.006
Sodium (Na)	10.903	23.712	0.474
Magnesium (Mg)	180	740.375	14.808
Calcium (Ca)	530.6	1323.852	26.477
Strontium (Sr)	0	0.000	0.000
Barium (Ba)	0	0.000	0.000
Carbonate (CO3)	1.302	2.169	0.043
Bicarbonate (HCO3)	175.7	144.005	2.880
Nitrate (NO3)	18.5	14.918	0.298
Chloride (Cl)	440.758	621.609	12.432
Fluoride (F)	0	0.000	0.000
Sulfate (SO4)	1253.3	1305.521	26.110
Silica (SiO2)	0	n.a.	n.a.
Boron (B)	0	n.a.	n.a.

5.Click "Balance"
4.Fill corresponding values

4.3 Scaling

- 4.3.1) Scaling calculations options include :“ No chemicals added ”,“User-adjusted pH values”and “Ion-exchange softening ”

1.Adjust pH or Ca., Mg. ion content
 Scaling Calculations Options
 No chemicals added
 User-adjusted pH values
 Ion-exchange softening

Recovery and Temperature
 Recovery: 75.00 (%) Temperature: 28.0 °C

2.Select dosing chemical
 Adjusted pH Values
 Dosing Chemical: HCl
 pH: 7.0 Calc
 Concentrate S&DSI: 1.458 Calc

3.Input expected pH value
 Ion-exchange Softening
 Ca Leakage: 0.1 (mg/L)
 Mg Leakage: 0.1 (mg/L)

4.Feedwater index change accordingly after adjustment
 Antiscalants are required. Consult your antiscalant manufacturer for dosing and maximum allowable system recovery.

	Feed	Adj. Feed	Concentrate
pH	7.6	7.0	7.6
LSI	0.991	0.354	2.131
Stiff & Davis Index	0.849	0.212	1.458
TDS (mg/l)	2,611	2,615	10,460
Ionic Strength (molal)	0.076	0.076	0.306
HCO3 (mg/l)	175.700	161.513	646.052
CO2 (mg/l)	4.119	15.076	15.076
CO3 (mg/l)	1.302	0.301	1.202
CaSO4 Saturation (%)	70.77	70.70	386.78
BaSO4 Saturation (%)	0.0	0.0	0.0
SrSO4 Saturation (%)	0.0	0.0	0.0
CaF2 Saturation (%)	0.0	0.0	0.0
SiO2 Saturation (%)	0.0	0.0	0.0
Mg(OH)2 Saturation (%)	0.0098	0.00062	0.039



4.4 RO Design

- 4.4.1) Set system passes, 1 pass or 2 passes (this project designed 1 pass only);
- 4.4.2) Select current pass ;
- 4.4.3) Set system stages (This project designed 2 stages)
- 4.4.4) Input flow and recovery

- 4.4.5) Set the model and number of elements so that the permeate flow is in the appropriate range, as shown below:



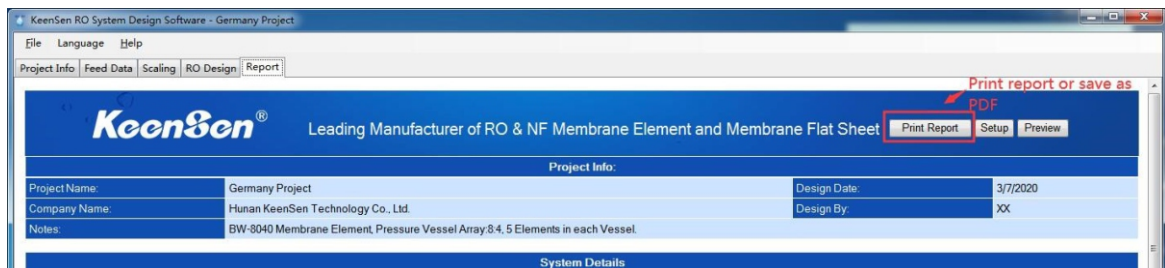
4.4.6) The requirements of system design average permeate flux are different for different types feedwater. For the design permeate flux, please refer to the following table.

(Reference range of system permeate flux):

Raw Water Type	Municipal Tap Water		Surface Water		Ground Water		/
Pretreatment	Conventional Pretreatment	UF	Conventional Pretreatment	UF	Conventional Pretreatment	UF	/
System Average Permeate Flux (LMH)	25-30	28-32	23-27	25-30	25-28	27-32	/
Raw Water Type	Municipal Wastewater		Industrial Sewage		Seawater		RO Permeate
Pretreatment	Conventional Pretreatment	UF	Conventional Pretreatment	UF	Conventional Pretreatment	UF	/
System Average Permeate Flux (LMH)	14-18	18-23	14-20	17-23	11-15	13-18	30-35

4.5 Report

Click "Report" to generate a projection report, or click "Print Report" save as PDF file.





5. Quality Warranty Of KeenSen Membrane Elements

KeenSen Technology Co., Ltd. (Here in after referred to “KeenSen”) provides customers with the following limited quality guarantee for its reverse osmosis and nanofiltration products, including flat sheet and membrane elements.

5.1 Manufacturing Process And Material Warranty

KeenSen ensures that the RO and NF membrane element without defects on raw material and manufacturing process. KeenSen provides 12 months quality guarantee from the date of cargo receipt abiding by the correct operation and maintenance of the membrane element technical documents. If there is any quality problems caused by the manufacturing process or raw material, after KeenSen or a third party quality testing institution's inspection. KeenSen will provide replacement or free repair service.

5.2 Initial Performance Warranty

According to the test conditions on KeenSen brochures, KeenSen RO and NF membrane element ensure has the same specified initial permeate flow and rejection rate as the brochures described. If any membrane element can not achieve the described initial performances, after KeenSen or a third party quality testing institution's inspection. KeenSen will provide replacement or free repair service, meanwhile, bearing the freight.

5.3 Performance Warranty

Within the three-year guarantee period, according to the test conditions stipulated in the latest KeenSen brochure, KeenSen provides the following performance guarantees for RO and NF membrane elements :

- 1) Salt Passage **【Salt Passage = (1 - Rejection Rate) *100%】** doesn't exceed double of value described in product manual (RO membranes are subject to standard NaCl solution, NF membranes are subject to standard MgSO₄ solution).
- 2) The average permeate flow is not lower than 70% of initial permeate flow (RO and NF series are subject to standard NaCl solution).

If any membrane element has above performance problems within the warranty period, after KeenSen or a third party quality testing institution's inspection. KeenSen will provide replacement or free repair service.

5.4 Warranty Period

KeenSen provide 36 months performance warranty of RO and NF membrane element. The warranty expiry period shall be any following condition coming first.

- 1) From the date of membrane element initial operating, that means, the output water from pretreatment system enter into RO and NF membrane system.



- 2) From 180 days after the date of shipment of membrane element.
- 3) Within 7 working days after customer receipt membrane flat sheet.

5.5 Conditions of Warranty

If any following items can't be satisfied, the above warranty shall be invalid.

- 1) Before installing and operation, the membrane element shall be stored in original packing box (the storage of wet membrane element should follow KeenSen “product brochure” chapter one 3.2 “membrane element storage”), keeping the membrane element sealed in the package, keeping the package away from direct sunlight, the optimal storage temperature shall not exceed 45°C or 113°F for dry type and between 0- 45 °C or 32-113 °F for wet type.
- 2) Feed Water Temperature shall not exceed 45°C , turbidity shall not exceed 1.0NTU、SDI15≤5 (15min、30psi) .
- 3) During installing, operating, or cleaning, the membrane element shall not be subjected to any physical impact that may damage the membrane element, such as load shock, vibration, pulsation, air or water hammer etc. Under any circumstances, the back-pressure that exerted on the membrane element should not be more than 0.03MPa(4.35psi) ,which means the pressure of permeate flow higher than feed or concentrate water.
- 4) pH range of feed water for membrane element during continuous operation should between 3-10, pH range of feed water for membrane element during chemical cleaning should between 1-13 (the value subject to the KeenSen latest product manual) .
- 5) NO harmful substance that may cause physical and chemical damage to the membrane element, such as :
 - A) Nonionic or cationic surfactants, coagulants, organic solvents, oils, lipids, polymers, scratch solids, etc.
 - B) Chlorine, ozone, potassium permanganate, hypochlorite ions and other oxidizing substances.
- 6) Can not be polluted by particles, precipitates, suspended solids, microorganisms, colloidal substances, chemical agents and other substances that may affect the performance of membrane element.
- 7) The failure of the chemical dosing system or the ineffective antiscaling measures (for example: Ca, Ba or Sr scaling) or the soluble silicon content in the concentrated water of the membrane system is higher than 150mg/L at 25°C, which makes the scaling difficult to clean chemically off.
- 8) Due to the influence of membrane element or membrane system feed water quality (including but not limited to: solution, feed liquid, solvent, etc.), such as: one or more indicators exceed the allowable range (see KeenSen “product brochure” Chapter 5 "Membrane System Feed Water Quality Requirements") or other chemical substances, make the components or accessories of the membrane element (including but not limited to: effective functional layer of the membrane element, end cover, center pipe, glass fiber outer layer, concentrated water sealing ring, central pipe connector, etc.) are deformed, detached or damaged, resulting in the failure of normal use of the membrane element.
- (9) In the standard conditions, if the performance of membrane system or membrane element (such as



permeate flow, rejection rate etc.) lower down 10%, or the contamination or scaling occurs, the membrane element should be chemical cleaned immediately in accordance with correct method.

10) Max working pressure (Subject to the Keensen latest product manual)

Industrial and Commercial membrane element	XLP、ULP、BW、FR、NF	4.1MPa(600psi)
	SW	8.3MPa(1200psi)
Residential membrane element		2.1MPa(300psi)

- 11) System configuration and design parameters such as membrane array, recovery rate, instrument and meter configuration shall be consistent with reasonable engineering design, and ensure the effectiveness and accuracy of instruments.
- 12) The sellers shall be responsible for providing the latest Keensen product manual to the users, It's necessary to have a good training before their actual operation, the user or operators must have the general knowledge about performance of membrane system or membrane element, they are required to master the necessary knowledge of use, operating the membrane systems or membrane elements, and have the ability of maintenance and accident diagnosis.
- 13) The users or operators shall systematically record the standardized operating data of whole membrane system or membrane element regularly, ensure that these data are true, complete and continuous, and keep these data on file, for future analyzing the cause of the fault, and enjoying the quality warranty.
- 14) Membrane sheet should be stored in a dry and dark environment, and the storage temperature must be controlled at (5-30) °C.
- 15) Membrane sheet should be used up within 90 days after receipt. If it exceeds 90 days, the performance and color of the membrane sheet may change.
- 16) During use and testing, it is strictly forbidden to touch or squeeze the front side of the RO flat to avoid physical damage to the ultra-thin separation layer of the RO flat, resulting in performance degradation.

