



RELIABLE
SAFE &
DEDICATED FOR YOU





We have been the biggest manufacturer for the RO water purifier in China and now our share in national market is over half of the Chinese market.

We insist on the sale with multiband, multichannel and multimode. We export the products to more than 50 countries and regions and offer OEM service for many biggest companies in the world with good reputation.

We adopt some kinds of membrane sheet which are from some world-class manufacturers. We can produce the RO membrane except for seawater. We ensure the first-class performance of the membrane elements in the world and the goods quality of each of the membrane because we test strictly each of the membranes before delivery.

We can produce the membrane with the diameter from 1.8 inch to 8.0 inch, with the length from 12 inch to 40 inch. And we adopt the standard dimension in the world in order to ensure the replacement between different kinds of membrane. Besides, we can produce them by different need to order special membrane elements with special dimension and specification.





**RO MEMBRANE ELEMENTS WITH HIGHER QUALITY
MORE FLEXIBLE AND PRACTICAL STRATEGY MORE
PROFESSIONAL TECHNICS BETTER SERVICE**

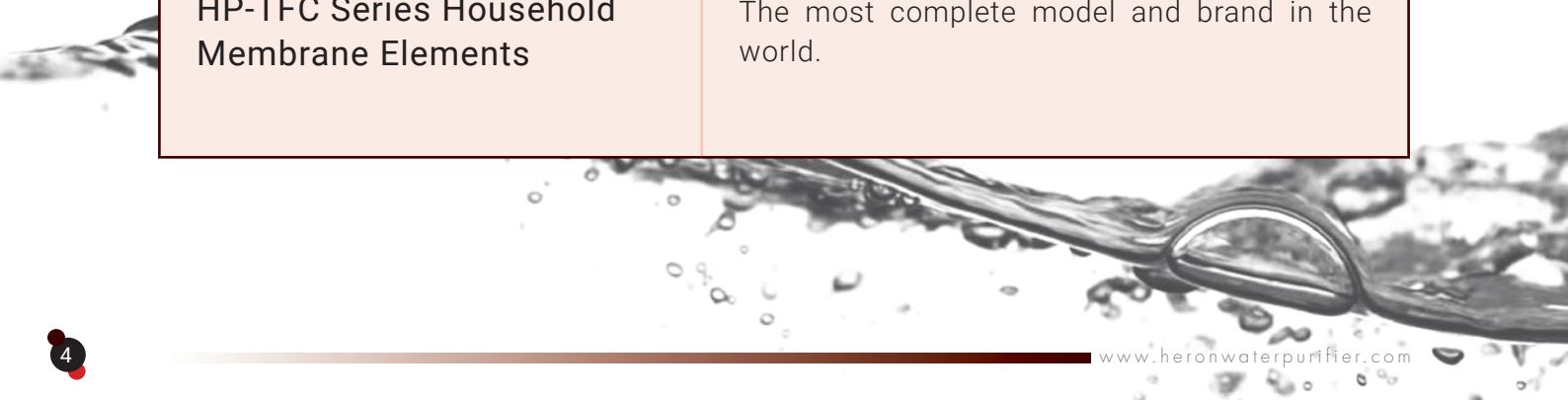


CHARACTERISTICS

- ▶ We ensure the good quality of our membrane by the world class membrane sheet
- ▶ With five series, it is complete for the specification
- ▶ With high quality and competitive price
- ▶ With our powerful R&D ability, we can offer order service by your requirements
- ▶ We can offer our customers OEM service



| | |
|---|---|
| <p>BW series Brackish Water Reverse Osmosis Membrane Elements</p> | <p>With rejection of over 99.5% on average and stable performance, it is fit for brackish water.</p> |
| <p>LP series Low Pressure Brackish Water Reverse Osmosis Membrane Elements</p> | <p>Pressure in operation and wasting energy are reduced by 30% in contrast to BW series, on the basis of enough high rejection.</p> |
| <p>TW Series Super Low Pressure Tap Water Reverse Osmosis Element</p> | <p>The best balance between high rejection and high water production; it is specially fit for the civil water treatment.</p> |
| <p>XLE Series Extreme Low Energy & large productive reverse osmosis membrane element</p> | <p>20% higher water production than common membrane with the same membrane area, but 30% lower pressure in operation, and with perfect combination between extra low energy and large water production.</p> |
| <p>ECO series Low Pressure Reverse Osmosis Membrane Elements</p> | <p>The most economical 4 inch membrane elements, it is best for diminutive commercial system.</p> |
| <p>Smart RO Series Household Membrane Elements</p> | <p>With high performance in domestic use.</p> |
| <p>HP-TFC Series Household Membrane Elements</p> | <p>The most complete model and brand in the world.</p> |





BW SERIES

Brackish Water Reverse Osmosis Membrane Elements

FEATURES:

Heron BW Series brackish water reverse osmosis membrane elements are made with the most high-tech super low pressure composite polyamide membrane available combining with decades of knowledge and experience in manufacturing reverse osmosis. LP Series of elements offer high rejection when feed water TDS value is lower than 8000ppm. They provide consistent, outstanding system performance in treating with brackish water, under ground water and surface water.



- ☺ High rejection, esp. for SiO₂ rejection. They enable operational and maintenance cost saving of post-treatments equipment such as resin and EDI.
- ☺ Consistent, outstanding performance, improved element structure, wide flow path and short membrane leaf design. TW series of elements stand for the super reliable operation and most effective cleaning.
- ☺ Wide range and complete sets of products. There is 2.5 inch and 4.0 inch in diameter; 14 inch, 21inch and 40inch in length which can meet different system requirements about productive. Moreover, we can also design different size and specifications membrane elements according to clients requirements.

PRODUCT SPECIFICATIONS:

| Model | Active Membrane Area ft ² (m ²) | Operate Pressure Psi (MPa) | Average Flow GPD (m ³ /d) | Rejection (%) | Recover Y(%) |
|---------|--|----------------------------|--------------------------------------|---------------|--------------|
| BW-2540 | 28 (2.6) | 225 (1.55) | 750 (2.8) | 98.5 | 15 |
| BW-4021 | 36 (3.3) | 225 (1.55) | 900 (3.4) | 98.5 | 8 |
| BW-4040 | 78 (7.5) | 225 (1.55) | 2400 (9.1) | 98.8 | 15 |
| BW-8365 | 365 (34) | 225 (1.55) | 9600 (36) | 99.5 | 15 |
| BW-8400 | 400 (37) | 225 (1.55) | 10600 (40) | 99.5 | 15 |

Note: Test Conditions

- A. Permeate flow and salt rejection based on the following test conditions: 2000 ppm NaCl, 225 psi (1.55Mpa), 77°F (25°C), pH 7.5, and above recovery.
- B. Permeate flow rates for individual elements may vary +/-15%.

C. Minimum rejection is 99.0%.

OPERATING LIMITS:

| | |
|--------------------------------|------------------|
| Maximum Operating Pressure | 600psi (4.2 MPa) |
| Maximum Feed Water Temperature | 113 °F (45 °C) |
| Maximum Feed SDI | SDI 5 |
| Free Chlorine | <0.1ppm |
| PH Range Continuous Operation | 3~10 |
| PH Range Short-Term Cleaning | 2~11 |
| Maximum Pressure Drop | 15Psi (0.1MPa) |

LP SERIES

Low Pressure Brackish Water Reverse Osmosis Membrane Elements

FEATURES:

Heron LP Series low pressure brackish water reverse osmosis membrane elements are made with the most high-tech super low pressure composite polyamide membrane available in the world combining with decades of knowledge and experience in manufacturing reverse osmosis. LP Series of elements offer high rejection when feed water TDS value is lower than 5000ppm. They provide consistent, outstanding system performance in treating with brackish water, under ground water and surface water.

- ☺ High rejection, super large productive. Their operational pressure is no more than 70% of normal brackish membrane. LP series of elements can lower your operating and maintenance costs a lot by lowering the requirement of pumps, pressure vessels, piping and other components.

- ☺ Consistent, outstanding performance, improved element structure, wide flow

path and short membrane leaf design. TW series of elements stand for the super reliable operation and most effective cleaning.

- ☺ Wide range and complete sets of products. There is 2.5 inch and 4.0 inch in diameter; 14





inch, 21inch and 40inch in length which can meet different system requirements about productive. Moreover, we can also design different size and specifications membrane elements according to clients requirements.

PRODUCT SPECIFICATIONS:

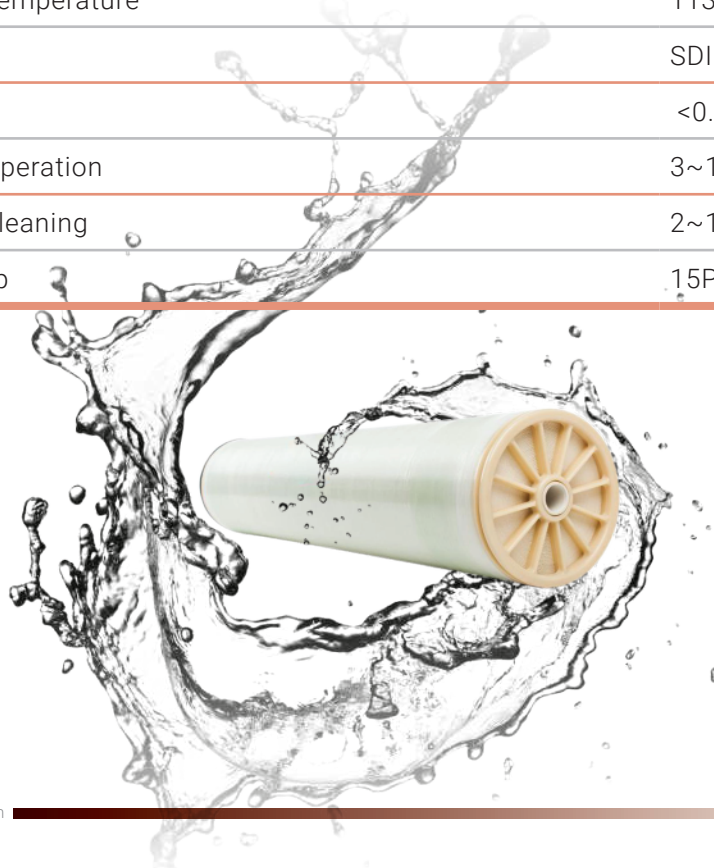
| Model | Active Membrane Area ft ² (m ²) | Operate Pressure Psi (MPa) | Average Flow GPD (m ³ /d) | Rejection (%) | Recovery Y(%) |
|---------|---|-------------------------------|---|------------------|------------------|
| LP-2540 | 28 (2.6) | 150 (1.05) | 800 (3.0) | 98.3 | 15 |
| LP-4021 | 36 (3.3) | 150 (1.05) | 1000 (3.8) | 98.5 | 8 |
| LP-4040 | 78 (7.5) | 150 (1.05) | 2700 (10) | 98.5 | 15 |
| LP-8365 | 365 (34) | 150 (1.05) | 11000 (40) | 99.5 | 8 |
| LP-8400 | 400 (37) | 150 (1.05) | 12000 (45) | 99.5 | 15 |

Note: Test Conditions

- A. Permeate flow and salt rejection based on the following test conditions: 2000 ppm NaCl, 150 psi (1.05Mpa), 77°F (25°C), pH 7.5, and above recovery.
- B. Permeate flow rates for individual elements may vary +/-15%.
- C. Minimum rejection is 99.0%.

OPERATING LIMITS:

| | |
|--------------------------------|-------------------|
| Maximum Operating Pressure | 600 psi (4.2 MPa) |
| Maximum Feed Water Temperature | 113 °F (45°C) |
| Maximum Feed SDI | SDI 5 |
| Free | <0.1ppm |
| PH Range Continuous Operation | 3~10 |
| PH Range Short-Term Cleaning | 2~11 |
| Maximum Pressure Drop | 15Psi (0.1MPa) |

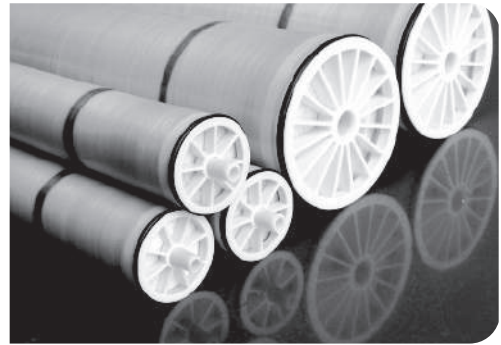


TW SERIES

Super Low Pressure Tap Water Reverse Osmosis Element

FEATURES:

Heron TW Series Super low pressure tap water reverse osmosis element are made with super low pressure composite polyamide membrane combining with long-term experience in manufacturing reverse osmosis. TW Series of elements offer high rejection when feed water TDS value is lower than 2000ppm. They provide consistent, outstanding system performance in drinking water production.



- ☺ High rejection, They provide high rejection in treating with pesticides, chlorine and other byproducts of disinfection of water.
- ☺ Consistent, outstanding performance, improved element structure, wide flow path and short membrane leaf design. TW series of elements stand for the super reliable operation and most effective cleaning.
- ☺ Wide range and complete sets of products. There is 2.5 inch and 4.0 inch in diameter; 14 inch, 21inch and 40inch in length which can meet different system requirements about productive. Moreover, we can also design different size and specifications membrane elements according to clients requirements.

PRODUCT SPECIFICATIONS:

| Model | Active Membrane Area ft ² (m ²) | Operate Pressure Psi (MPa) | Average Flow GPD (m ³ /d) | Rejection (%) | Recovery Y(%) |
|---------|---|-------------------------------|---|---------------|---------------|
| TW-2514 | 8 (0.7) | 110 (0.76) | 250 (0.9) | 98.0 | 5 |
| TW-2521 | 13 (1.2) | 110 (0.76) | 350 (1.3) | 98.0 | 8 |
| TW-2540 | 28 (2.6) | 110 (0.76) | 800 (3.0) | 98.3 | 15 |
| TW-4021 | 36 (3.3) | 110 (0.76) | 1000 (3.8) | 98.3 | 8 |
| TW-4040 | 85 (8.3) | 110 (0.76) | 2600 (9.8) | 98.3 | 15 |
| TW-8365 | 365 (34) | 110 (0.76) | 10000 (38) | 99.0 | 15 |
| TW-8400 | 400 (37) | 110 (0.76) | 11000 (42) | 99.0 | 15 |

Note: Test Conditions

- A. Permeate flow and salt rejection based on the following test conditions: 2000 ppm NaCl, 110psi (0.76Mpa), 77°F (25°C), pH 7.5, and above shown recovery.
- B. Permeate flow rates for individual elements may vary +/-15%.



C. Minimum rejection is 98.0%.

OPERATING LIMITS:

| | |
|--------------------------------|-------------------|
| Maximum Operating Pressure | 600 psi (4.2 MPa) |
| Maximum Feed Water Temperature | 113 °F (45 °C) |
| Maximum Feed SDI | SDI 5 |
| Free Chlorine | <0.1 ppm |
| PH Range Continuous Operation | 3~10 |
| PH Range Short-Term Cleaning | 2~11 |
| Maximum Pressure Drop | 15 Psi (0.1 MPa) |

XLE SERIES Extreme Low Energy & Large Productive Reverse Osmosis Membrane Element

FEATURES:

Heron XLE Series extreme low energy & large productive reverse osmosis membrane elements are made with the largest productive composite polyamide membrane available combining with decades of knowledge and experience in manufacturing reverse osmosis. XLE Series of elements provide consistent, outstanding system performance when feed water TDS value is lower than 2000 ppm.

- ☺ Super large productive. It can provide much larger productive when the operational pressure is 100psi. Reduce system operating costs and design difficulties. They can help to reduce pressure vessel quantity and investment and the later operation and maintenance costs.
- ☺ Consistent, outstanding performance, improved element structure, wide flow path and short membrane leaf design. XLE series of elements stand for the super reliable operation and most effective cleaning.
- ☺ Wide range and complete sets of products. There is 2.5 inch and 4.0 inch and 8.0 inch in diameter; 14 inch, 21 inch and 40 inch in length which can meet different system requirements about productive. Moreover, we can also design different size and specifications membrane elements according to clients requirements.



PRODUCT SPECIFICATIONS:

| Model | Active Membrane Area ft ² (m ²) | Operate Pressure Psi (MPa) | Average Flow GPD (m ³ /d) | Rejection (%) | Recovery Y(%) |
|----------|---|-------------------------------|---|------------------|------------------|
| XLE-2514 | 8 (0.7) | 100 (0.69) | 400 (1.5) | 98.5 | 5 |
| XLE-2521 | 13 (1.2) | 100 (0.69) | 500 (1.9) | 98.5 | 8 |
| XLE-2540 | 28 (2.6) | 100 (0.69) | 1100 (4.2) | 99.0 | 15 |
| XLE-4021 | 36 (3.3) | 100 (0.69) | 1300 (4.9) | 99.0 | 8 |
| XLE-4040 | 78 (7.5) | 100 (0.69) | 3000 (11.3) | 99.0 | 15 |
| XLE-8365 | 365 (33) | 100 (0.69) | 12000 (45) | 99.0 | 15 |
| XLE-8400 | 400 (37) | 100 (0.69) | 13200 (50) | 99.0 | 15 |

Note: Test Conditions

- A. Permeate flow and salt rejection based on the following test conditions: 500 ppm NaCl, 100psi (0.69Mpa), 77°F (25°C), pH 7.5, and above shown recovery.
- B. Permeate flow rates for individual elements may vary +/-15%.
- C. Minimum rejection is 98.0%.

OPERATING LIMITS:

| | |
|--------------------------------|------------------|
| Maximum Operating Pressure | 600psi (4.2 MPa) |
| Maximum Feed Water Temperature | 113 °F (45°C) |
| Maximum Feed SDI | SDI 5 |
| Free Chlorine | <0.1ppm |
| PH Range Continuous Operation | 3~10 |
| PH Range Short-Term Cleaning | 2~11 |
| Maximum Pressure Drop | 15 Psi (0.1 MPa) |





ECO SERIES

Low Pressure Reverse Osmosis Membrane Elements

FEATURES:

Heron ECO Series low pressure reverse osmosis membrane elements are made with the most high-tech super low pressure composite polyamide membrane available in the world combining with decades of knowledge and experience in manufacturing reverse osmosis. ECO Series of elements offer high rejection when feed water TDS value is lower than 5000ppm.



- ☺ High rejection, super large productivity. The operation pressure is no more than 70% of normal brackish membrane. ECO series of elements can lower your operation and maintenance costs a lot by lowering the requirement of pumps, pressure vessels, piping and other components.
- ☺ Consistent, outstanding performance, improved element structure, wide feed spacer channel and short membrane leaf design. Under the condition of ensuring adequate area of the membrane, wider spacer channel will help to discharge contaminants of feed water. The stress-tolerant required of pretreatment and quality required of feed water will be relatively higher when working under Off-Normal condition. ECO series membrane elements have more effective cleaning than normal elements. It can maintain a relatively low Pressure Drop and prolong the span-life of membrane element when the quality of feed water is not good.
- ☺ So far, there is only 4.0 inch in diameter and 40inch in length. One model is high rejection type and the other is large productive type. We will also design different size and specifications membrane elements according to clients requirements in the future.

PRODUCT SPECIFICATIONS:

| Model | Active Membrane Area ft ² (m ²) | Operate Pressure Psi (MPa) | Average Flow GPD (m ³ /d) | Rejection (%) | Recovery (%) |
|-----------|---|-------------------------------|---|------------------|-----------------|
| ECO1-4040 | 75 (7.3) | 150 (1.05) | 2400 (9.1) | 99.5 | 15 |
| ECO2-4040 | 75 (7.3) | 150 (1.05) | 2800 (10.6) | 99.0 | 15 |
| ECO3-4040 | 85 (8.3) | 75 (0.53) | 2200 (8.3) | 98.0 | 15 |

Note: Test Conditions

- A. Permeate flow and salt rejection based on the following test conditions: 1500 ppm NaCl, 77°F (25°C), pH 7.5, and above recovery.
- B. Permeate flow rates for individual elements may vary +/-15%.

C. Minimum rejection is 98.5%.

OPERATING LIMITS:

| | |
|--------------------------------|------------------|
| Maximum Operating Pressure | 600 psi (4.2MPa) |
| Maximum Feed Water Temperature | 113 °F (45°C) |
| Maximum Feed SDI | SDI 5 |
| Free Chlorine | <0.1ppm |
| PH Range Continuous Operation | 3~10 |
| PH Range Short-Term Cleaning | 2~11 |
| Maximum Pressure Drop | 15 Psi (0.1 MPa) |

SMART RO SERIES Household Membrane Elements

FEATURE:

Smart RO series dry membrane element from Heron is made by the most advance technique Polyamide RO membrane sheets and combined with the experience on the process of rolling membrane these years, Heron produced the series membrane elements which can be used by treating the water from municipal supply.

- ☺ All made with 5 inch 2 membrane sheet area and its diameter is 48mm. The area of the membrane sheet is 20% bigger than the most products in the market.
- ☺ All designed as high flow membrane elements. Its flow is higher 20% than standard one. It can be used on the lower operate pressure, so its consumption is less and life span is longer.
- ☺ All as dry membrane elements are kept easily in the course of storage and transportation. It can be kept over 1 year under any circumstances and the performance is still same.





PRODUCT SPECIFICATIONS:

| Model | Active Membrane Area ft2 (m2) | Operate Pressure Psi (MPa) | Average Flow GPD (L/d) | Rejection (%) | Recovery Y(%) |
|--------------|----------------------------------|-------------------------------|---------------------------|---------------|---------------|
| TFC-2012-50 | 5 (0.5) | 65 (0.45) | 65 (247) | 98.0 | 15 |
| TFC-2012-75 | 5 (0.5) | 65 (0.45) | 80 (304) | 97.0 | 15 |
| TFC-2012-100 | 5 (0.5) | 65 (0.45) | 110 (418) | 97.0 | 15 |

Note: Test Conditions

- Test under the condition that the water temperature is 25°C the concentration of NaCl is 500 ppm, pH is 7.5 and the above recovery and operate pressure
- The water production of one membrane is on the balance of $\pm 15\%$ of the average water production
- The least rejection is 96.0%

HP-TFC SERIES Household Membrane Elements

PRODUCT SPECIFICATIONS:

| Model | Active Membrane Area ft2 (m2) | Operate Pressure Psi (MPa) | Average Flow GPD (L/d) | Rejection (%) | Recovery Y(%) |
|--------------|----------------------------------|-------------------------------|---------------------------|---------------|---------------|
| HP-1812-50 | 4 (0.5) | 65 (0.45) | 60 (204) | 97.0 | 15 |
| HP-1812-75 | 4 (0.5) | 65 (0.45) | 75 (283) | 97.0 | 15 |
| HP-1812-90 | 4 (0.5) | 65 (0.45) | 90 (340) | 97.0 | 15 |
| HP-2012-100 | 5 (0.5) | 65 (0.45) | 100 (378) | 97.0 | 15 |
| HP-2012-125 | 5 (0.5) | 65 (0.45) | 125 (473) | 97.0 | 15 |
| HP-2512-200 | 10 (1.0) | 65 (0.45) | 200 (757) | 97.0 | 15 |
| HP-2512-250 | 12 (1.2) | 65 (0.45) | 250 (947) | 97.0 | 15 |
| TFC-3012-200 | 10 (1.0) | 65 (0.45) | 200 (757) | 97.0 | 10 |
| HP-3012-250 | 12 (1.2) | 65 (0.45) | 250 (947) | 97.0 | 10 |
| HP-3012-300 | 14 (1.4) | 65 (0.45) | 300 (1135) | 97.0 | 10 |

Note: Test Conditions



- A. Test under the condition that the water temperature is 25°C, the concentration of NaCl is 500 ppm, pH is 7.5, and the above recovery and operate pressure
- B. The water production of one membrane is on the balance of $\pm 15\%$ of the average water production
- C. The least rejection is 95.0%

OPERATING LIMITS:

| | |
|--------------------------------|------------------|
| Maximum Operating Pressure | 600 psi (4.2MPa) |
| Maximum Feed Water Temperature | 113 °F (45 °C) |
| Maximum Feed SDI | SDI 5 |
| Free Chlorine | <0.1ppm |
| PH Range Continuous Operation | 3~10 |
| PH Range Short-Term Cleaning | 2~11 |
| Maximum Pressure Drop | 15 Psi (0.1MPa) |



PERFORMANCE SHEET

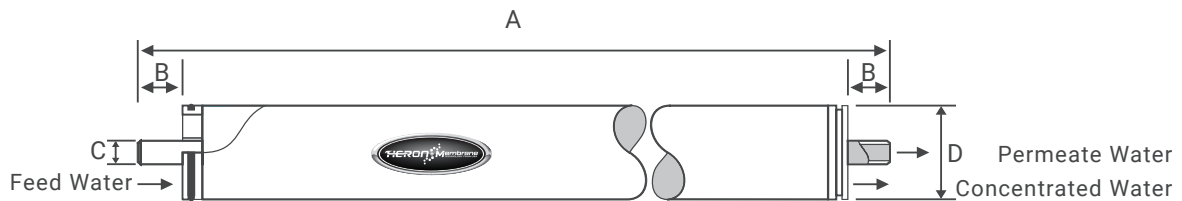
2540, 4040 and 8040 Membranes

| Series | Model | Rejection (%) | Permeate | | | | Test Pressure | | |
|---------------------------|-----------|---------------|----------|-------------------|------|------|---------------|-----|--------------------|
| | | | GPD | M ³ /D | LPM | LPH | Psi | MPa | Kg/cm ³ |
| Brackish Series | BW-4021 | 99.2 | 900 | 3.4 | 2.4 | 142 | 225.0 | 1.6 | 15.6 |
| | BW-4040 | 99.5 | 2400 | 9.1 | 6.3 | 379 | 225.0 | 1.6 | 15.6 |
| | BW-8365 | 99.5 | 9600 | 36.3 | 25.2 | 1514 | 225.0 | 1.6 | 15.6 |
| | BW-8400 | 99.5 | 10600 | 40.1 | 27.9 | 1672 | 225.0 | 1.6 | 15.6 |
| Low Pressure Series | LP-4021 | 99.0 | 1000 | 3.8 | 2.6 | 158 | 150.0 | 1.0 | 10.4 |
| | LP-4040 | 99.5 | 2700 | 10.2 | 7.1 | 426 | 151.0 | 1.0 | 10.5 |
| | LP-8365 | 99.5 | 11000 | 41.6 | 28.9 | 1735 | 152.0 | 1.1 | 10.5 |
| | LP-8400 | 99.5 | 12100 | 45.8 | 31.8 | 1908 | 153.0 | 1.1 | 10.6 |
| Tap Water Series | TW-4021 | 99.0 | 1000 | 3.8 | 2.6 | 158 | 110.0 | 0.8 | 7.6 |
| | TW-4040 | 99.0 | 2600 | 9.8 | 6.8 | 410 | 110.0 | 0.8 | 7.6 |
| | TW-8365 | 99.0 | 10000 | 37.9 | 26.3 | 1577 | 111.0 | 0.8 | 7.7 |
| | TW-8400 | 99.0 | 11000 | 41.6 | 28.9 | 1735 | 112.0 | 0.8 | 7.8 |
| Extreme Low Energy Series | XLE-4021 | 99.0 | 1300 | 4.9 | 3.4 | 205 | 100.0 | 0.7 | 6.9 |
| | XLE-4040 | 99.0 | 3000 | 11.4 | 7.9 | 473 | 100.0 | 0.7 | 6.9 |
| | XLE-8365 | 99.0 | 12000 | 45.4 | 31.5 | 1893 | 101.0 | 0.7 | 7.0 |
| | XLE-8400 | 99.0 | 13200 | 50.0 | 34.7 | 2082 | 102.0 | 0.7 | 7.1 |
| ECO Series | ECO1-4040 | 99.5 | 2400 | 9.1 | 6.3 | 379 | 150.0 | 1.0 | 10.4 |
| | ECO2-4040 | 99.0 | 2800 | 10.6 | 7.4 | 442 | 150.0 | 1.0 | 10.4 |
| | ECO3-4040 | 98.0 | 2200 | 8.3 | 5.8 | 347 | 75.0 | 0.5 | 5.2 |

DIMENSION OF Membrane Elements

2.5 INCH AND 4.0 INCH SERIES

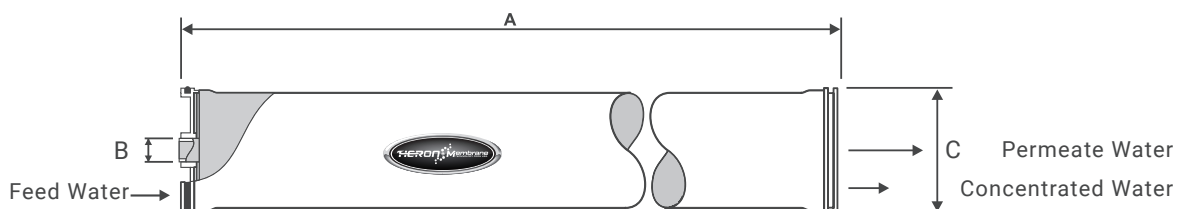
UNIT: mm (inch)



| Model | A | B | C | D |
|-------|---------------|------------|-------------|--------------|
| 2514 | 356.0 (14.0) | 25.4 (1.0) | 19.1 (0.75) | 61.0 (2.40) |
| 2521 | 533.4 (21.0) | 25.4 (1.0) | 19.1 (0.75) | 61.0 (2.40) |
| 2540 | 1016.0 (40.0) | 25.4 (1.0) | 19.1 (0.75) | 61.0 (2.40) |
| 4014 | 356.0 (14.0) | 25.4 (1.0) | 19.1 (0.75) | 100.1 (3.94) |
| 4021 | 533.4 (21.0) | 25.4 (1.0) | 19.1 (0.75) | 100.1 (3.94) |
| 4040 | 1016.0 (40.0) | 25.4 (1.0) | 19.1 (0.75) | 100.1 (3.94) |

8.0 INCH SERIES

UNIT: mm (inch)

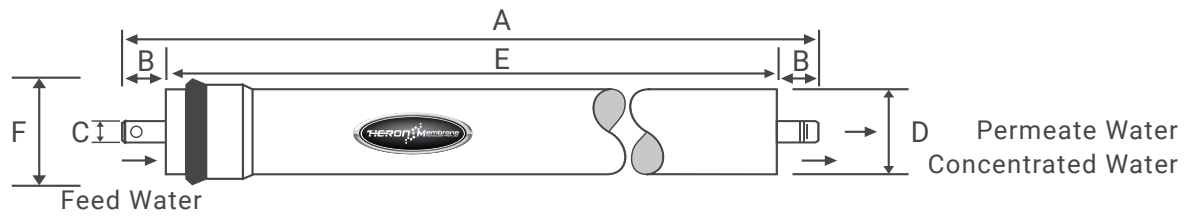


| Model | A | B | C |
|-------|---------------|------------|-----------|
| 8040 | 1016.0 (40.0) | 29.0 (1.1) | 201 (7.9) |



HOUSEHOLD SERIES

UNIT: mm (inch)



| Model | A | B | C | D | E | F |
|-------|------------|------------|-------------|------------|--------------|------------|
| 1812 | 298 (11.7) | 20.0 (0.8) | 19.1 (0.75) | 45.0 (1.8) | 264.8 (10.4) | 53.5 (2.1) |
| 2012 | 298 (11.7) | 20.0 (0.8) | 19.1 (0.75) | 48.0 (1.9) | 264.8 (10.4) | 53.5 (2.1) |
| 2512 | 298 (11.7) | 20.0 (0.8) | 19.1 (0.75) | 62.0 (2.5) | 264.8 (10.4) | 71.5 (2.8) |
| 3012 | 298 (11.7) | 20.0 (0.8) | 19.1 (0.75) | 75.0 (3.0) | 264.8 (10.4) | 81.5 (3.2) |

COMPARISON CHART OF Different Elements Models

| Heron | Filmtec | Toray | Hydranautics |
|---------|------------|------------|--------------|
| BW-2540 | TW/BW-2540 | -- | -- |
| BW-4021 | TW/BW-4021 | -- | -- |
| BW-4040 | TW/BW-4040 | TM710 | CPA2-4040 |
| BW-8365 | BW30-365 | TM720-370 | CPA2-8040 |
| BW-8400 | BW30-400 | TM720-400 | CPA3-8040 |
| LP-2540 | LP-2540 | -- | -- |
| LP-4021 | LP-4021 | -- | -- |
| LP-4040 | LP-4040 | TMG10 | ESPA2-4040 |
| LP-8365 | -- | -- | -- |
| LP-8400 | LE-400 | TMG720-400 | ESPA2-8040 |
| TW-2514 | -- | -- | -- |
| TW-2521 | -- | -- | -- |
| TW-2540 | -- | -- | -- |
| TW-4021 | -- | -- | -- |
| TW-4040 | -- | TMH10 | ESPA3-4040 |

| Heron | Filmtec | Toray | Hydranautics |
|-----------|----------|------------|--------------|
| TW-8365 | -- | TMH720-370 | -- |
| TW-8400 | -- | TMH720-400 | ESPA3-8040 |
| XLE-2514 | -- | -- | -- |
| XLE-2521 | XLE-2521 | -- | -- |
| XLE-2540 | XLE-2540 | -- | -- |
| XLE-4021 | XLE-4021 | -- | -- |
| XLE-4040 | XLE-4040 | -- | ESPA4-4040 |
| XLE-8365 | -- | -- | -- |
| XLE-8400 | XLE-440 | -- | ESPA4-8040 |
| ECO1-4040 | -- | -- | ESPA2-4040 |
| ECO2-4040 | -- | -- | ESPA1-4040 |
| ECO3-4040 | -- | -- | -- |

Note: The data above is for reference and may be not exactly the same as the actual performance because of the complicated and many influences on the membranes when used may be not exactly the same as the data in the actual performance.

BRIEF DESIGN Manual

I. Pretreatment requirements, remove mud and sand and residual chlorine

The purpose of RO pretreatment is to make the inlet water quality meet requirements of membrane elements. Pretreatment system with good design, as well as maintain and operation correctly, can farthest assure stable operation of RO system, it can reduce system maintenance frequency and operation costs.

RO pretreatment usually mainly control the following facets:

Remove particle: particle matters in water include and other sand colloid and other various .The standard that measure the quantity of particulate matters is SDI and turbines, and SDI is the most used standard. The SDI is lower, the silt contamination is lower.

The requirements of the inlet water: $SDI_{15} \leq 5$, Turbines ≤ 1 NTU

Use multi-media filter to remove particle in water. Multiple-media filter can reduce SDI to below 5, and multi-media filter with good maintenance, and flocculant put in, can reduce SDI to 3. However, when using Ultrafiltration as pretreatment, SDI is less than 2. Under the condition of the permit of investment budget, we suggest using Ultrafiltration as pretreatment, and it can effectively extend the life of RO membrane.



Remove residual free chlorine: In order to disinfect municipal water or surface water, germicide was put in usually, which was oxidized form (such as chlorine, ClO₂ etc.). These oxidants easily cause the decomposition of membrane surface desalination layer, and should be removed in the RO pretreatment.

The requirement of the inlet water: Residual free chlorine ≤ 0.1mg/L

Residual chlorine removal usually using activated carbon adsorption technology or putting reducer in. Activated carbon filter must assure the contact time and the filtration speed of the inside filter, and filtration speed is limited at 8~12m/h.

Reducer can react with the residual free chlorine and remove it in a short time. We usually use SBS or SMBS, which is not activated by cobalt, as reducer, and the concentration of the reducer in the inlet water is three times than that of residual chlorine.

Control scale tendency: The concentration of insoluble salt in in feed water will saturate after the concentrated effect of membrane elements, forming inorganic salt crystal and sediment on the surface of RO membrane. The scale or sediment will cause the rapid decline of the membrane elements performance. The best way to control scale tendency are softening the feed water or putting the antiscalen in.

Feed water softening use the positive ion exchange resin to remove the hardness of water, so that prevent the inorganic scale forming. It's the best way to control feed water scale formation tendency. However, ion softening needs periodical regeneration, so it demands more for system maintenance. At the same time, large and super huge RO system softening cost is too high.

Putting antiscalen in fits for RO systems of various scales. Antiscalen with high quality can make insoluble salt ion at its two to three times of saturation concentration not crystallize, and thus prevent the scale formation of inorganic salt. Regarding idiographic operating requirements of the antiscalen, please ask for antiscalen suppliers.

II. Recovery

Recovery is an important parameter of RO system design, and is also an important standard to measure the economic benefit of RO system. Under general conditions, the recovery of single membrane element cannot exceed 15%. However, according to the different feed water quality and system design, the recovery of single membrane element may exceed 15%. If the feed water quality is unstable, we suggest appropriately reducing the recovery of single membrane element to assure the stable operation of the system and extend the life of membrane elements.

The recovery of system will be higher than that of single membrane element, and accurate membrane elements array can gain better economic benefit. Even if the recovery of the single element is less than 15%, as for pressure vessel of multi-elements installed, the recovery of the system can reach to 75% and even more. For recovery of multi-elements in one pressure vessel, please refer to the following table:

| Quantity Per Pressure Vessel | 1 | 2 | 3 | 4 | 5 | 6 |
|--|----|----|----|----|----|----|
| Average recovery of single element (%) | 15 | 12 | 11 | 10 | 9 | 8 |
| RO system recovery (%) | 15 | 25 | 33 | 40 | 45 | 50 |

When it's designed, we will see the recovery of single element in pressure vessel decline gradually along with the water flow direction. Therefore, we must pay attention to whether the recovery of the first element and the last element in the same vessel exceed the most limitation.

III. GFD and water flux of single membrane element

GFD is one of the most important parameters in the RO system design. we can estimate the contamination rate and cleaning period of RO membrane elements by that parameter. The higher GFD is, the more the water is get, but the faster contamination rate is. Meanwhile the more water flux of membrane element is, the lower direct operation cost of system is. However, the maintenance cost of membrane elements is more higher. The calculation formula of GFD is in the following table:

$$\text{Water flux per unit (GFD)} = \text{Water flux (GPD)} \div \text{Active membrane area (ft}^2\text{)}$$

| Feed water type | | RO water (Two Pass System) | Ground-water after soften | Municipal water after soften | Surface water after soften | Waste water (UF as pretreatment) | Waste water (Traditional technology) |
|------------------------------|--------------------|----------------------------|---------------------------|------------------------------|----------------------------|----------------------------------|--------------------------------------|
| SDI | | SDI <1 | SDI <3 | SDI <3 | SDI <5 | SDI <3 | SDI <5 |
| Suggest design flux | GFD | 22 | 18 | 16 | 14 | 13 | 11 |
| | L/m ² h | 37 | 30 | 27 | 24 | 22 | 19 |
| Maximum recovery of elements | | 30 | 18 | 16 | 15 | 14 | 12 |
| Flux of 4040 elements | GPD | 1716 | 1404 | 1248 | 1092 | 1014 | 858 |
| | L/h | 271 | 221 | 197 | 172 | 160 | 135 |
| Flux of 8365 elements | GPD | 8030 | 6570 | 5840 | 5110 | 4745 | 4015 |
| | L/h | 1266 | 1036 | 921 | 806 | 748 | 633 |
| Flux of 8400 elements | GPD | 8800 | 7200 | 6400 | 5600 | 5200 | 4400 |
| | L/h | 1388 | 1136 | 1009 | 883 | 820 | 694 |

Because GFD directly affects the life and contamination rate, we suggest the design staff refer to the following table, choosing appropriate membrane flux according to different feed water quality to reach the best balance of the maintenance cost and system investment.

IV. Operation pressure

Operation pressure directly affects the water flux of membrane elements and system energy consumption. Generally, the operation pressure of membrane elements were determined when system was designed. Because the temperature affects the water flux of



RO membrane (The water flux in winter may be only 50%~60% of that in summer), the pump capacity of RO system should be considered to assure when the feed water temperature is low, enhancing operation pressure to ensure system can work effectively. Meanwhile, regular decline of membrane elements performance should be considered too. We suggest the design staff must consider the seasonal change of feed water temperature during the operation, and choose appropriate boost pump.

XLE series and ECO3 membrane elements produced by Heron are the lowest operation pressure membrane elements of the same size and permeate flux in the world. Using the two series elements can reduce the cost of system operation pressure, energy consumption and system operation greatly, and get more economic benefit.

V. Feed water temperature

Feed water temperature directly affects water flux and rejection of RO membrane, especially water flux. Normally, the water temperature drops 1°C, the flux declines 3%. The water flux at 5°C is only 48% of the flux at 25°C. The water flux marked by RO membrane elements suppliers is on the test condition of 25°C. Therefore, the water flux of RO system declines along with water temperature drop, and now we need to enhance operation pressure to compensate the lost water flux owing to feed water temperature drop.

XLE series extreme low energy consumption membrane elements produced by Heron have the greatest water flux in the world, and can reduce the influence of water flux drop by the feed water temperature drop.

VI. Back pressure and water hammer

We must prevent back pressure and water hammer happening in the RO system. Back pressure means pure water pressure exceeds that of inlet water, causing pure water permeate to the another side, damage the ultrathin desalting coating on the RO membrane surface. That will damage membrane elements seriously during RO system operation. Back pressure seldom happen during normal system operation, but it often happen during system startup and shut-off. The solution is to design a one-way valve or a explosion-valve in pure water pipeline.

Water hammer means when the boost pump starts, the flow and pressure increase abruptly, causing huge water power attack. Serious water hammer can result in the damage of end cap of RO membrane elements and the crack of membrane elements FRP, directly causing the membrane elements destroy. When the boost pump of RO system starts, it's required to reach normally operational flow and pressure in 2~3 minutes. When it is shut, the same process is require to unload pressure and flow.

VII. Inlet water flow and concentrated water flow

Inlet water flow is an important parameter to control the recovery of membrane elements. Under normal situation, we must limit the maximum inlet water flow of RO membrane elements to prevent overlarge inlet water flow causing membrane elements inside water flow too fast, and making elements pressure dropping increase. Membrane elements are damaged under its inside stress.

Concentrated water flow is an important parameter to judge scale tendency. We often limit the minimum concentrated water flow of RO membrane elements. Ultra-low concentrated water flow should result in water flow speed of inside membrane elements decline, and part of contaminations couldn't be flushed out along with water flow, and sediment on the RO membrane surface, thus foul RO membrane elements. Meanwhile, Ultra-low concentration water flow shall result in membrane elements recovery over limit. As for membrane elements of different diameters,

please refer to the data contained in the following table:

| Membrane elements type and active membrane area | | Maximum feed water flow (M ³ /h) | Minimum concentration water flow (M ³ /h) |
|---|---------------------|--|---|
| 2.5 inch series membrane elements | | 1.4 | 0.2 |
| 4.0 inch series membrane elements | | 3.6 | 0.9 |
| 8.0 inch series membrane elements | 365 ft ² | 13.6 | 3.2 |
| | 400 ft ² | 14.0 | 3.4 |
| | 440 ft ² | 14.0 | 3.4 |

Note: 8.0 inch series membrane elements of active membrane area 440 ft² is not listed in the product data. We can produce 8440 membrane elements according to your demands. If you need more information, please contact us.

VIII. Other notices needed attention

Generally, in RO system design, recovery, GFD, operation pressure, inlet water flow and concentrated water flow, investment cost, operation or maintenance cost and other parameters are closely related and restricted to each other. The destination of design a RO system is looking for the best balance between all of the parameters, and reach it, that design assures RO system a long-term and stable operation and make users gain the best benefit.

IMPORTANT NOTE

- ▶ Please refer to the update manual, guide or other information in Heron about the data and parameter. Heron will not undertake outcomes if the customers don't strictly follow the conditions in operation provided by our company.
- ▶ Each of our membrane should be strictly tested before delivery, stocked by 1.0% NaHSO₃ (10% glycerin in winter), vacuum packaged and with hard carton. We recommend 1.0% NaHSO₃ (or SMBS) to preserve the membrane in order to prevent microbe in storage, delivery or system pause.
- ▶ We recommend to drain the pure water which is produced in one hour after the first operation.



- ▶ When the membrane is in storage, installation and operation, it is prohibited to add any other chemical. Please use pure water or glycerin as lubricant if needed in installation. Please refer to the cleansing method and chemicals we suggested. We will be free of obligation if you are against our suggestion.
- ▶ For the 4040 and 8040 membrane elements, we adopt the material of FRP (Fiberglass-Reinforced Plastics), it can take maximum 15 Psi of pressure dropping.
- ▶ We adopt the standard dimension in the world in order to ensure the replacement between different brands of membrane. 25 series of membrane refers to the pressure vessel with the inner diameter 2.5 inch, 40 series refers to the pressure vessel with the inner diameter 4.0 inch, 80 series refers to the pressure vessel with the inner diameter 8.0 inch.

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