

# TSW-LE Series

## Super Low-Energy Sea Water Reverse Osmosis (RO) Membrane Element

Toray's reverse osmosis membrane technology applies decades of R&D and precision automated manufacturing under ISO 9001 for consistency in product quality. State-of-the-art cross-linked fully aromatic polyamide composite membranes produce high-quality permeate and robust membrane chemistry for improved performance and longer membrane life.



| Product Specifications | Unit                              | TSW-400LE    |               | TSW-440LE    |               |
|------------------------|-----------------------------------|--------------|---------------|--------------|---------------|
| Membrane Area          | ft <sup>2</sup> (m <sup>2</sup> ) | 400 (37)     |               | 440 (41)     |               |
| Feed spacer thickness  | mil                               | 34           |               | 28           |               |
| Feed water pressure    | psi (MPa)                         | 600 (4.14)   | 800 (5.52)*   | 600 (4.14)   | 800 (5.52)*   |
| Nominal Salt Rejection | %                                 | 99.6         | 99.8          | 99.6         | 99.8          |
| Min. Salt Rejection    | %                                 | 99.3         | 99.6          | 99.3         | 99.6          |
| Product Flow Rate      | gpd (m <sup>3</sup> /d)           | 6,100 (23.0) | 12,100 (45.8) | 6,700 (25.3) | 13,000 (49.2) |
| Min. Product Flow Rate | gpd (m <sup>3</sup> /d)           | 5,200 (19.6) | 10,300 (39.0) | 5,700 (21.5) | 11,000 (41.8) |

\*Referential performance at 800 psi (5.52 MPa)

**Test Conditions:** Feed water temperature 77 °F (25°C); Feed water concentration 32,000 mg/L as NaCl; Recovery rate 8%; Feed water pH 7

**Typical Boron Rejection:** 84% at pH 8 (5 mg/L Boron added to feed water); 90% at pH 8 (5 mg/L Boron added to feed water)\*

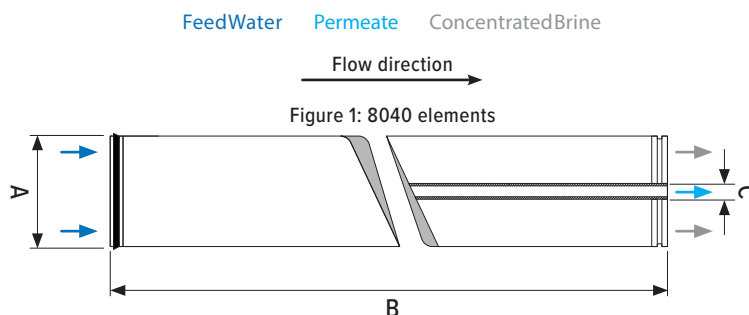
### Applications

Seawater desalination, High salinity feed water, Industrial wastewater, High recovery RO systems



Products manufactured at our U.S. facility (TMUS) are certified to NSF/ANSI 61 for drinking water applications.

| Dimensions in. (mm) |            |
|---------------------|------------|
| A                   | 7.9 (201)  |
| B                   | 40 (1,016) |
| C                   | 1.125 (29) |



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| Operating Limits                        | Unit                 | Value          |
|-----------------------------------------|----------------------|----------------|
| Maximum operating pressure <sup>6</sup> | psi (MPa)            | 1,200 (8.3)    |
| Maximum feed water temperature          | °F (°C)              | 113 (45)       |
| Maximum feed water SDI <sub>15</sub>    |                      | 5              |
| Feed water chlorine concentration       | ppm                  | Not detectable |
| Feed water pH range                     | Continuous operation | 2–11           |
|                                         | Chemical cleaning    | 1–12           |
| Maximum pressure drop per element       | psi (MPa)            | 15 (0.10)      |
| Maximum pressure drop per vessel        | psi (MPa)            | 50 (0.34)      |

### Operating Information

- Please consult the latest Toray technical bulletin, design guidelines, computer design program, or call an application specialist for the recommended design range. Not strictly following the operating limits stated in this bulletin will void and nullify the Limited Warranty.
- All RO elements are wet tested treated with a 1 percent by weight sodium bisulfite storage solution. Afterward, the RO elements are vacuum packed in oxygen barrier bags or treated with a tested feed water solution, and then vacuum sealed in oxygen barrier bags with deoxidant inside. Toray recommends flushing Toray RO elements for 30 to 60 minutes once every two days with sufficient quality flushing water, such as pre-treated feed water, to prevent biological growth during system shutdown. Please refer to the Toray RO Handling Manual for suggested flushing water quality.
- The presence of free chlorine and other oxidizing agents under certain conditions, such as heavy metals that act as oxidation catalysts in the feed water, will cause unexpected oxidation of the membrane. Toray strongly recommends removing these oxidizing agents contained in feed water before operating the RO system.
- Permeate from the first hour of operation shall be discarded.
- The customer is fully responsible for the effects of chemicals that are incompatible with the elements. Their use will void the element Limited Warranty.
- Maximum operating pressure will vary depending on feed temperature. Please ask for detailed information from Toray if needed.

Toray accepts no responsibility for results obtained by the application of this information or the safety or suitability of Toray's products, either alone or in combination with other products. Users are advised to make their own tests to determine the safety and suitability of each product combination for their own purposes.

All data may change without prior notice, due to technical modifications or production changes. Please be sure to inquire about the latest product specifications.

**Toray RO membrane TSW-LE series is only applicable for selected projects.**