Product Datasheet

TORAY
Innovation by Chemistry

TS SU Type

Heat-Sanitized Brackish Water Reverse Osmosis Membrane Element with Outer Permeate Tube Connection

Toray's Heat-sanitized RO membrane elements provide superior permeate quality for applications requiring hot water sanitization. Using heat-sanitized RO elements eliminates the need for chemical sanitization, further reducing maintenance costs. RO elements use cross-linked fully aromatic polyamide composite membranes.

Product Specifications	Unit	SU-710T	SU-720TS
Size		4040	8040
Membrane Area	ft^2 (m^2)	75 (7)	
Nominal Salt Rejection	%	99.4	99.4
Min. Salt Rejection	%	99.0	99.0
Nominal Product Flow Rate	gpd (m^3/d)	1,720 (6.5)	6,900 (26.0)
Min. Product Flow Rate	gpd (m^3/d)	1,450 (5.5)	5,810 (22.0)

Test Conditions: Feed water pressure 220 psi (1.5 MPa); Feed water temperature 77 °F (25°C); Feed water concentration 1,500 mg/L as NaCl; Brine flow rate 20 l/min (5.3 gpm) for SU-710T, 80 l/min (21.1 gpm) for SU-720TS; Feed water pH 6.5

Applications

Municipal drinking water, Industrial process water

Dimensions in. (mm)		
Size	4040	8040
A	4.0 (101)	7.9 (201)
B	40 (1,016)	40 (1,016)
C	0.83 (21)	1.26 (32)
D	0.59 (15)	0.43 (11)

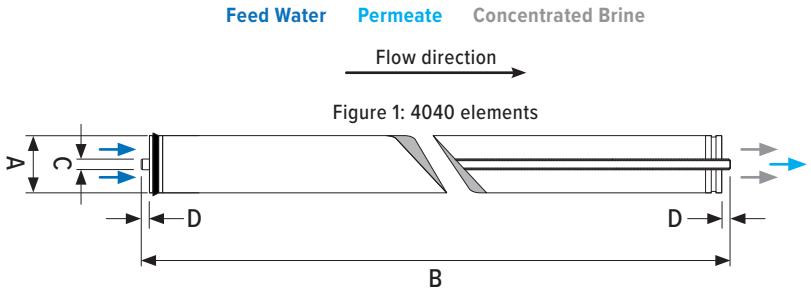

Figure 1: 4040 elements

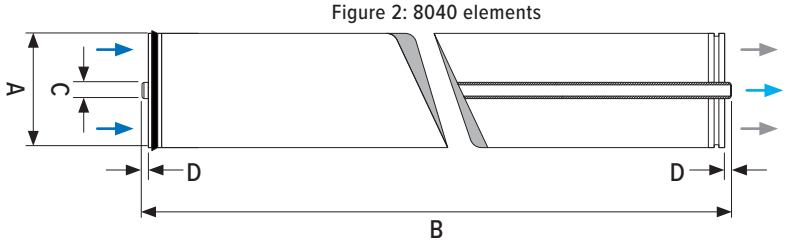

Figure 2: 8040 elements

Product Datasheet

TORAY
Innovation by Chemistry

TS SU Type

Heat-Sanitized Brackish Water Reverse Osmosis Membrane Element with Outer Permeate Tube Connection

Design Conditions		Unit	Recommended[1]	
Model			SU-710T	SU-720TS
Feed water pressure[2,3]		MPa (psi)	< 2.0 (286)	
Feed water temperature[4]		°C (°F)	< 35 (95)	
Feed water turbidity (SDI)[2,5]			< 4	
Feed water pH range	Continuous operation[6]		3–9	
	Chemical cleaning[7]		2–10	2–11
Feed flow rate per vessel		l/min (gpm)	<50 (13)	<200 (52.8)
Brine flow rate per vessel[9]		l/min (gpm)	>10 (2.6)	>40 (10.6)
Brine/Permeate flow ratio[8,9]			> 6	
Pressure drop per element[10]		MPa (psi)	< 0.1 (14)	
Pressure drop per vessel[10]		MPa (psi)	< 0.2 (29)	

1. The recommended design range is operational and design conditions under not so much fouling and scaling. If the SU-series element are operated outside of the recommended design range, the effective membrane life may be reduced. Refer to Toray's membrane manuals on our website (www.water.toray), or contact Toray or a local distributor for design guidelines and further information.
2. High flux operation (under high permeate flow rate per single element) on feed water turbidity greater than 3 or 4 SDI generally results in frequent cleaning requirements. Operating pressure should be selected to maintain the flux rate, or permeate flow rate per single element.
3. Maximum Feed Water Pressure 4.1 MPa (600 psi)
4. Maximum Sanitization Temperature is 90 °C (194 °F) for SU-710T and 85 °C (185 °F) for SU-720TS.
5. SDI = Silt Density Index measured according to ASTM D4189.
6. Feed and brine water must meet these range.
7. Cleaning chemicals shall be followed to Toray's technical bulletins.
8. Ratio at last element.
9. This figure is reducible when there is less possibility of fouling and scaling.
10. Element(s) must be cleaned when pressure drop increases up to 1.5 times of initial value.

Sanitization must follow guidances in Toray's membrane manuals on our website (www.water.toray)

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Product Datasheet

TORAY
Innovation by Chemistry

TS SUL Type

Heat-Sanitized Brackish Water Reverse Osmosis Membrane Element with Outer Permeate Tube Connection

Toray's Heat-sanitized RO membrane elements provide superior permeate quality for applications requiring hot water sanitization. Using heat-sanitized RO elements eliminates the need for chemical sanitization, further reducing maintenance costs. RO elements use cross-linked fully aromatic polyamide composite membranes.

Product Specifications	Unit	SUL-G10TS	SUL-G20TS	SUL-G20FTS
Size		4040	8040	8040
Membrane Area	ft^2 (m^2)	75 (7.0)		
Nominal Salt Rejection	%	99.5	99.5	99.5
Min. Salt Rejection	%	99.0	99.0	99.0
Nominal Product Flow Rate	gpd (m^3/d)	1,300 (5.0)	7,900 (30.0)	9,500 (36.0)
Min. Product Flow Rate	gpd (m^3/d)	1,100 (4.3)	6,320 (24.0)	7,660 (29.0)

Test Conditions: Feed water pressure 110 psi (0.75 MPa); Feed water temperature 25°C (77 °F); Feed water concentration 500 mg/L as NaCl; Brine flow rate 20 l/min (5.3 gpm) for SUL-G10TS, 80 l/min (21.1 gpm) for SUL-G20TS and SUL-G20FTS; Feed water pH 6.5

Applications

Municipal drinking water, Industrial process water

Dimensions in. (mm)		
Size	4040	8040
A	4.0 (101)	7.9 (201)
B	40 (1,016)	40 (1,016)
C	0.83 (21)	1.26 (32)
D	0.59 (15)	0.43 (11)

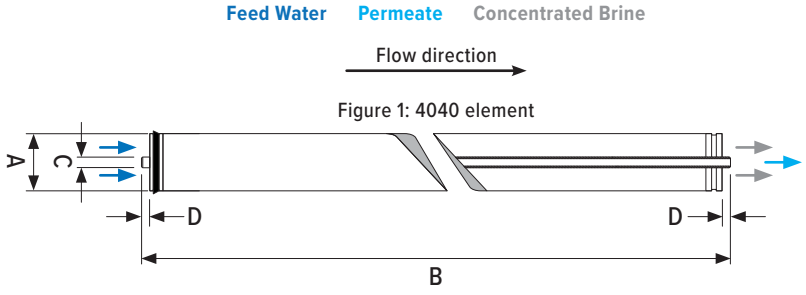

Figure 1: 4040 element

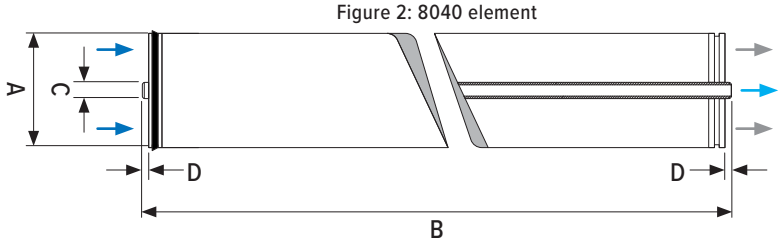

Figure 2: 8040 element

Product Datasheet

TORAY
Innovation by Chemistry

TS SUL Type

Heat-Sanitized Brackish Water Reverse Osmosis Membrane Element with Outer Permeate Tube Connection

Design Conditions		Unit	Recommended[1]		
Model			SUL-G10TS	SUL-G20TS	SUL-G20FTS
Feed water pressure[2,3]		MPa (psi)		< 1.0 (150)	
Feed water temperature[4]		°C (°F)		< 35 (95)	
Feed water turbidity (SDI)[2,5]				< 4	
Feed water pH range	Continuous operation[6]			3–9	
	Chemical cleaning[7]			2–11	
Feed flow rate per vessel		l/min (gpm)	<50 (13)	<200 (52.8)	
Brine flow rate per vessel [9]		l/min (gpm)	>10 (2.6)	>40 (10.6)	
Brine/Permeate flow ratio [8,9]				> 6	
Pressure drop per element [10]		MPa (psi)		< 0.1 (14)	
Pressure drop per vessel [10]		MPa (psi)		< 0.2 (29)	

1. The recommended design range is operational and design conditions under not so much fouling and scaling. If the SUL-series element are operated outside of the recommended design range, the effective membrane life may be reduced. Refer to Toray's membrane manuals on our website (www.water.toray), or contact Toray or a local distributor for design guidelines and further information.
2. High flux operation (under high permeate flow rate per single element) on feed water turbidity greater than 3 or 4 SDI generally results in frequent cleaning requirements. Select the operating pressure to maintain the flux or permeate flow rates per single element.
3. The maximum Feed Water Pressure is 4.1 MPa (600 psi)
4. The maximum Sanitization Temperature is 85 °C (185 °F).
5. SDI = Silt Density Index measured according to ASTM D4189.
6. Feed and brine water must meet these ranges.
7. Only use cleaning chemicals that adhere to Toray's technical bulletins.
8. The ratio at last element.
9. This figure is reducible when there is less possibility of fouling and scaling.
10. Element(s) must be cleaned when the pressure drop increases to 1.5 times of initial value.

Sanitization must follow guidances in Toray's membrane manuals on our website (www.water.toray)

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Product Datasheet

TORAY
Innovation by Chemistry

TLF Series

Ultra Low-Pressure and Low-Fouling Reverse Osmosis Membrane Element

Toray's TLF reverse osmosis membrane features an improved cross-linked hydrophilic polymer layer that minimizes the accumulation of foulants on the membrane surface. The membrane coating helps RO plants reduce frequent chemical cleanings while converting wastewater into a reusable water source by producing high-quality permeate at low energy.

Product Specifications	Unit	TLF-400DG
Membrane Area	ft^2 (m^2)	400 (37)
Nominal Salt Rejection	%	99.5
Minimum Salt Rejection	%	99.2
Product Flow Rate	gpd (m^3/d)	11,500 (43.5)
Min. Product Flow Rate	gpd (m^3/d)	9,300 (35.2)
Feed spacer thickness	mil	34

Test Conditions: Feed water pressure 150 psi (1.05 MPa); Feed water temperature 77 °F (25°C); Feed water concentration 2,000 mg/L as NaCl; Recovery rate 15%; Feed water pH 7

C SA US

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

Applications

High fouling tendency feed water, Municipal drinking water, Industrial process water, Water reuse

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

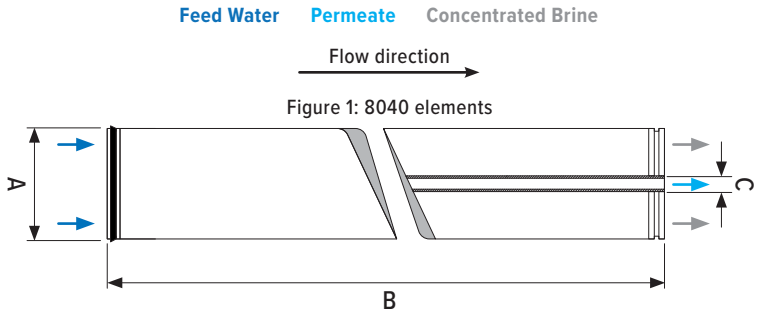

Figure 1: 8040 elements

Product Datasheet

TORAY
Innovation by Chemistry

TLF Series

Ultra Low-Pressure and Low-Fouling Reverse Osmosis Membrane Element

Operating Limits		Unit	Value
Maximum operating pressure[6,7]		psi (MPa)	600 (4.1)
Maximum fee water temperature		°F (°C)	113 (45)
Maximum feed water SDI_{15}			5
Feed water chlorine concentration[3]		ppm	< 0.1
Feed water pH range	Continuous operation		2–11
	Chemical cleaning		1–13
Maximum pressure drop per element		psi (MPa)	15 (0.10)
Maximum pressure drop per vessel		psi (MPa)	50 (0.34)

Operating Information

1. 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.
2. 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. Please refer to the Toray RO Handling Manual for suggested flushing water quality.
3. 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 recommends flushing Toray RO elements for 30 to 60 minutes with sufficient quality flushing water, such as pre-treated feed water, to prevent biological growth during system shutdown. Please refer to Toray's RO Element Three-Year Prorated Limited Warranty.
4. Permeate from the first hour of operation shall be discarded.
5. The customer is fully responsible for the effects of chemicals that are incompatible with the elements. Their use will void the element Limited Warranty.
6. Recommended process / operation pressure is < 2.0 MPa (for details, and in special cases, please consult the projection design guideline or contact your membrane supplier).
   a) Ultra low-pressure elements will perform best with low salinity brackish water
   b) Maintain the above pressure range at low temperatures.
7. Maximum operating pressure will vary depending on feed temperature. Please ask for detailed information from Toray if needed.

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Product Datasheet

TORAY
Innovation by Chemistry

TM700D Series

High-Rejection Brackish Water Reverse Osmosis Membrane Element with Enhanced Chemical Tolerance

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	TM710D	TM720D-400	TM720D-440
Size		4040	8040	8040
Membrane Area	ft^2 (m^2)	87 (8)	400 (37)	440 (41)
Nominal Salt Rejection	%	99.8	99.8	99.8
Minimum Salt Rejection	%	99.65	99.65	99.65
Product Flow Rate	gpd (m^3/d)	2,600 (9.8)	11,000 (41.6)	12,100 (45.8)
Minimum Product Flow Rate	gpd (m^3/d)	2,150 (8.2)	8,900 (33.6)	9,800 (37.0)
Feed spacer thickness	mil	31	34	28

Test Conditions: Feed water pressure 225 psi (1.55 MPa); Feed water temperature 77 °F (25°C); Feed water concentration 2,000 mg/L as NaCl; Recovery rate 15%; Feed water pH 7

Applications

Municipal drinking water, Industrial process water, Water reuse

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

Feed Water → Permeate → Concentrated Brine

Flow direction →

Dimensions in. (mm)		
Size	4040	8040
A	4.0 (101)	7.9 (201)
B	40 (1,016)	40 (1,016)
C	0.75 (19)	1.125 (29)
D	1.05 (26)	—

Figure 1: 4040 elements

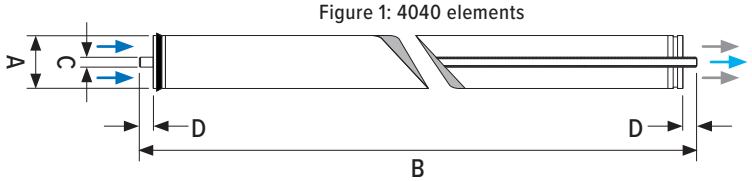
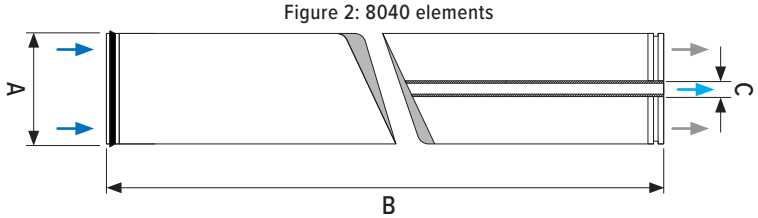


Figure 2: 8040 elements



Product Datasheet

TORAY
Innovation by Chemistry

TM700D Series

High-Rejection Brackish Water Reverse Osmosis Membrane Element with Enhanced Chemical Tolerance

Operating Limits		Unit	Value
Maximum operating pressure[6]		psi (MPa)	600 (4.1)
Maximum fee water temperature		°F (°C)	113 (45)
Maximum feed water SDI_{15}			5
Feed water chlorine concentration		ppm	< 0.1
Feed water pH range	Continuous operation		2–11
	Chemical cleaning		1–13
Maximum pressure drop per element		psi (MPa)	15 (0.10)
Maximum pressure drop per vessel		psi (MPa)	50 (0.34)

Operating Information

1. 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.
2. 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.
3. 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.
4. Permeate from the first hour of operation shall be discarded.
5. The customer is fully responsible for the effects of chemicals that are incompatible with the elements. Their use will void the element Limited Warranty.
6. Maximum operating pressure will vary depending on feed temperature. Please ask for detailed information from Toray if needed.

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Product Datasheet

TORAY
Innovation by Chemistry

TM800K Series

Highest Rejection 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	TM820K-400	TM820K-440
Membrane Area	ft^2 (m^2)	400 (37)	440 (41)
Nominal Salt Rejection	%	99.86	99.86
Minimum Salt Rejection	%	99.50	99.50
Product Flow Rate	gpd (m^3/d)	5,800 (21.9)	6,400 (24.2)
Min. Product Flow Rate	gpd (m^3/d)	4,600 (17.4)	5,100 (19.3)
Feed spacer thickness	mil	34	28

C SA US

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

Test Conditions: Feed water pressure 800 psi (5.52 MPa); 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: 96% at pH 8 (5 mg/L Boron added to feed water)

Applications

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

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

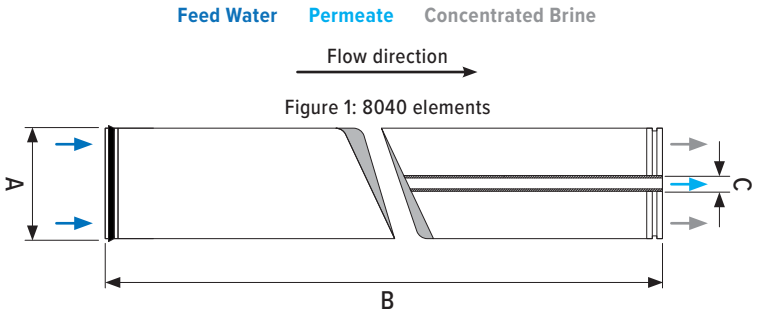

Figure 1: 8040 elements

Product Datasheet

TORAY
Innovation by Chemistry

TM800K Series

Highest Rejection Sea Water Reverse Osmosis (RO) Membrane Element

Operating Limits		Unit	Value
Maximum operating pressure[6]		psi (MPa)	1,200 (8.3)
Maximum fee water temperature		°F (°C)	113 (45)
Maximum feed water SDI_{15}			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

1. 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.
2. 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.
3. 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.
4. Permeate from the first hour of operation shall be discarded.
5. The customer is fully responsible for the effects of chemicals that are incompatible with the elements. Their use will void the element Limited Warranty.
6. Maximum operating pressure will vary depending on feed temperature. Please ask for detailed information from Toray if needed.

Toray RO membrane TM800K series is only applicable for selected projects.

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Product Datasheet

TORAY
Innovation by Chemistry

TM800M Series

Standard 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	TM820M-400	TM820M-440
Membrane Area	ft^2 (m^2)	400 (37)	440 (41)
Nominal Salt Rejection	%	99.8	99.8
Minimum Salt Rejection	%	99.50	99.50
Product Flow Rate	gpd (m^3/d)	7,000 (26.5)	7,700 (29.2)
Min. Product Flow Rate	gpd (m^3/d)	5,600 (21.2)	6,200 (23.5)
Feed spacer thickness	mil	34	28

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

Test Conditions: Feed water pressure 800 psi (5.52 MPa); 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: 95% at pH 8 (5 mg/L Boron added to feed water)

Applications

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

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

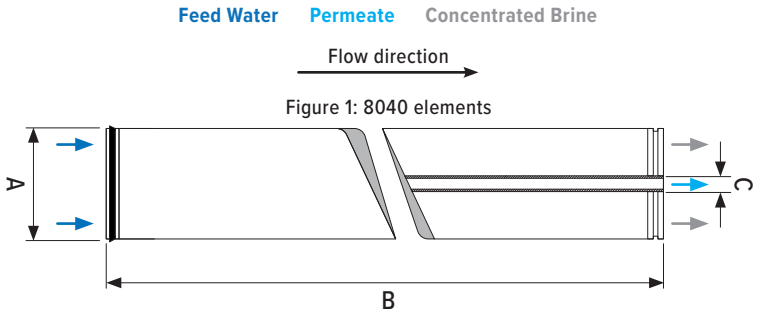

Figure 1: 8040 elements

Product Datasheet

TORAY
Innovation by Chemistry

TM800M Series

Standard Sea Water Reverse Osmosis (RO) Membrane Element

Operating Limits		Unit	Value
Maximum operating pressure[6]		psi (MPa)	1,200 (8.3)
Maximum fee water temperature		°F (°C)	113 (45)
Maximum feed water SDI_{15}			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

1. 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.
2. 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.
3. 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.
4. Permeate from the first hour of operation shall be discarded.
5. The customer is fully responsible for the effects of chemicals that are incompatible with the elements. Their use will void the element Limited Warranty.
6. Maximum operating pressure will vary depending on feed temperature. Please ask for detailed information from Toray if needed.

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Product Datasheet

TORAY
Innovation by Chemistry

TM800V Series

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	TM810V	TM820V-400	TM820V-440
Size		4040	8040	8040
Membrane Area	ft^2 (m^2)	87 (8)	400 (37)	440 (41)
Nominal Salt Rejection	%	99.8	99.8	99.8
Minimum Salt Rejection	%	99.50	99.50	99.50
Product Flow Rate	gpd (m^3/d)	1,900 (7.2)	9,000 (34.1)	9,900 (37.5)
Min. Product Flow Rate	gpd (m^3/d)	1,550 (5.9)	7,500 (28.4)	8,250 (31.2)
Feed spacer thickness	mil	28	34	28

Test Conditions: Feed water pressure 800 psi (5.52 MPa); 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: 92% 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)		
Size	4040	8040
A	4.0 (101)	7.9 (201)
B	40 (1,016)	40 (1,016)
C	0.75 (19)	1.125 (29)
D	1.05 (26)	

Feed Water Permeate Concentrated Brine

Flow direction

Figure 1: 4040 elements

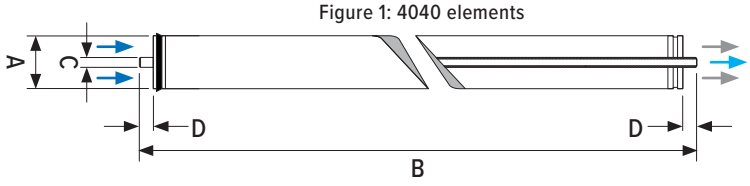
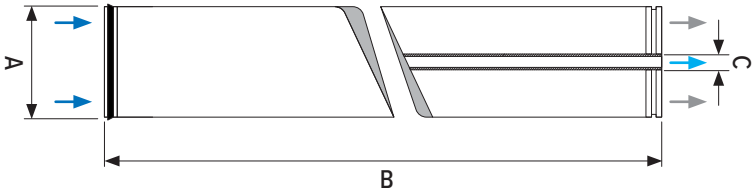


Figure 2: 8040 elements



Product Datasheet

TORAY
Innovation by Chemistry

TM800V Series

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

Operating Limits		Unit	Value
Maximum operating pressure[6]		psi (MPa)	1,200 (8.3)
Maximum fee water temperature		°F (°C)	113 (45)
Maximum feed water SDI_{15}			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

1. 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.
2. 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.
3. 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.
4. Permeate from the first hour of operation shall be discarded.
5. The customer is fully responsible for the effects of chemicals that are incompatible with the elements. Their use will void the element Limited Warranty.
6. Maximum operating pressure will vary depending on feed temperature. Please ask for detailed information from Toray if needed.

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Product Datasheet

TORAY
Innovation by Chemistry

TMG(D) Series

Low-Pressure Brackish Water Reverse Osmosis (RO) Membrane Element with Enhanced Chemical Tolerance

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	TMG10D	TMG20D-400	TMG20D-440
Size		4040	8040	8040
Membrane Area	ft^2 (m^2)	87 (8)	400 (37)	440 (41)
Nominal Salt Rejection	%	99.7	99.7	99.7
Minimum Salt Rejection	%	99.5	99.5	99.5
Product Flow Rate	gpd (m^3/d)	2,650 (10.0)	12,100 (45.8)	13,300 (50.3)
Minimum Product Flow Rate	gpd (m^3/d)	2,120 (8.0)	10,300 (39.0)	11,200 (42.4)
Feed spacer thickness	mil	34	34	28

Test Conditions: Feed water pressure 150 psi (1.03 MPa); Feed water temperature 77 °F (25°C); Feed water concentration 2,000 mg/L as NaCl; Recovery rate 15%; Feed water pH 7

Applications

Municipal drinking water, Industrial process water, Water reuse

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

Dimensions in. (mm)		
Size	4040	8040
A	4.0 (101)	7.9 (201)
B	40 (1,016)	40 (1,016)
C	0.75 (19)	1.125 (29)
D	1.05 (26)	—

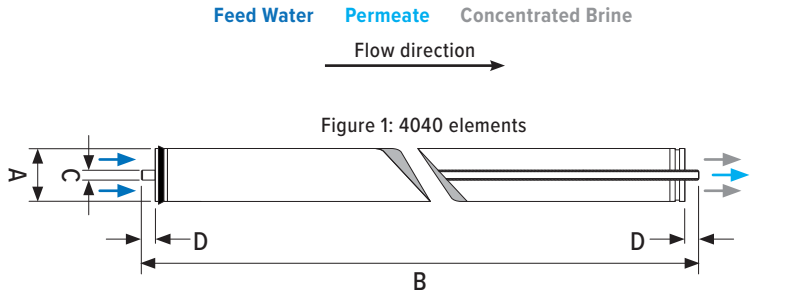

Figure 1: 4040 elements

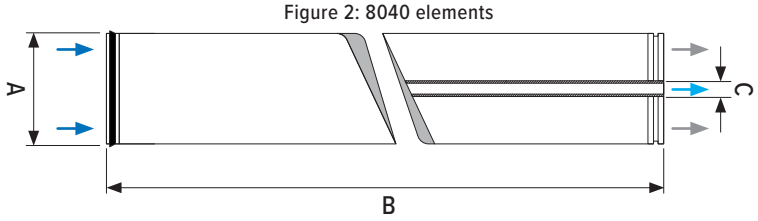

Figure 2: 8040 elements

Product Datasheet

TORAY
Innovation by Chemistry

TMG(D) Series

Low Pressure Brackish Water Reverse Osmosis (RO) Membrane Element with Enhanced Chemical Tolerance

Operating Limits		Unit	Value
Maximum operating pressure[6,7]		psi (MPa)	600 (4.1)
Maximum fee water temperature		°F (°C)	113 (45)
Maximum feed water SDI_{15}			5
Feed water chlorine concentration		ppm	< 0.1
Feed water pH range	Continuous operation		2–11
	Chemical cleaning		1–13
Maximum pressure drop per element		psi (MPa)	15 (0.10)
Maximum pressure drop per vessel		psi (MPa)	50 (0.34)

Operating Information

1. 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.
2. 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.
3. 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.
4. Permeate from the first hour of operation shall be discarded.
5. The customer is fully responsible for the effects of chemicals that are incompatible with the elements. Their use will void the element Limited Warranty.
6. Recommended process / operation pressure is < 2.0 MPa (for details, and in special cases, please consult the projection design guideline or contact your membrane supplier).
   a) Low-pressure elements will perform best with low salinity brackish water
   b) Maintain the above pressure range at low temperatures.
7. Maximum operating pressure will vary depending on feed temperature. Please ask for detailed information from Toray if needed.

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Product Datasheet

TORAY
Innovation by Chemistry

TMHA Series

Ultra-Low Pressure Brackish 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	TMH10A	TMH20A-400C	TMH20A-440C
Size		4040	8040	8040
Membrane Area	ft^2 (m^2)	87 (8)	400 (37)	440 (41)
Nominal Salt Rejection	%	99.3	99.3	99.3
Minimum Salt Rejection	%	99.0	99.0	99.0
Product Flow Rate	gpd (m^3/d)	2,400 (9.1)	11,000 (41.6)	12,100 (45.7)
Min. Product Flow Rate	gpd (m^3/d)	1,900 (7.2)	8,800 (33.3)	9,700 (36.7)
Feed spacer thickness	mil	31	34	28

Test Conditions: Feed water pressure 100 psi (0.69 MPa); Feed water temperature 77 °F (25°C); Feed water concentration 500 mg/L as NaCl; Recovery rate 15%; Feed water pH 7

Applications

Municipal drinking water, Industrial process water, Water reuse

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

Dimensions in. (mm)		
Size	4040	8040
A	4.0 (101)	7.9 (201)
B	40 (1,016)	40 (1,016)
C	0.75 (19)	1.125 (29)
D	1.05 (26)	

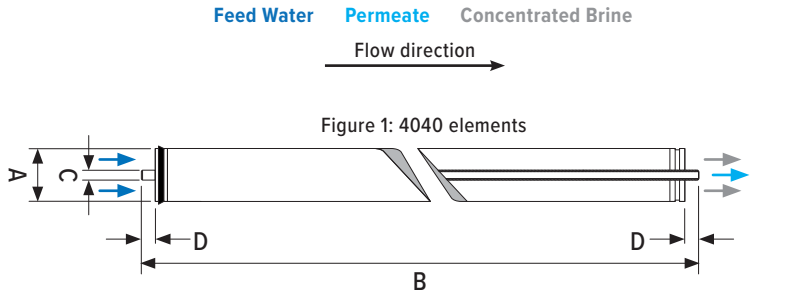

Figure 1: 4040 elements

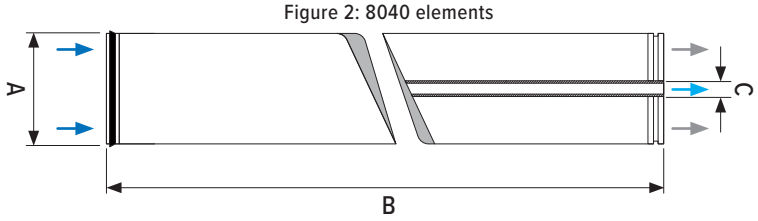

Figure 2: 8040 elements

Product Datasheet

TORAY
Innovation by Chemistry

TMHA Series

Ultra-Low Pressure Brackish Water Reverse Osmosis Membrane Element

Operating Limits		Unit	Value
Maximum operating pressure[6]		psi (MPa)	365 (2.5)
Maximum fee water temperature		°F (°C)	113 (45)
Maximum feed water SDI_{15}			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

1. 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.
2. 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.
3. 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.
4. Permeate from the first hour of operation shall be discarded.
5. The customer is fully responsible for the effects of chemicals that are incompatible with the elements. Their use will void the element Limited Warranty.
6. Maximum operating pressure will vary depending on feed temperature. Please ask for detailed information from Toray if needed.

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Product Datasheet

TORAY
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TML(D) Series

Low-Fouling Reverse Osmosis Membrane Element with High Chemical Tolerance

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	TML10D	TML20D-400
Size		4040	8040
Membrane Area	ft^2 (m^2)	73 (7)	400 (37)
Nominal Salt Rejection	%	99.8	99.8
Minimum Salt Rejection	%	99.65	99.65
Product Flow Rate	gpd (m^3/d)	1,900 (7.2)	10,500 (39.7)
Min. Product Flow Rate	gpd (m^3/d)	1,500 (5.7)	8,400 (31.8)
Feed spacer thickness	mil	34	34

Test Conditions: Feed water pressure 225 psi (1.55 MPa); Feed water temperature 77 °F (25°C); Feed water concentration 2,000 mg/L as NaCl; Recovery rate 15%; Feed water pH 7

C SA US

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

Applications

Feed water sources with high fouling tendency, Municipal drinking water, Industrial process water, Water reuse

Dimensions in. (mm)		
Size	4040	8040
A	4.0 (101)	7.9 (201)
B	40 (1,016)	40 (1,016)
C	0.75 (19)	1.125 (29)
D	1.05 (26)	

Feed Water Permeate Concentrated Brine

Flow direction

Figure 1: 4040 elements

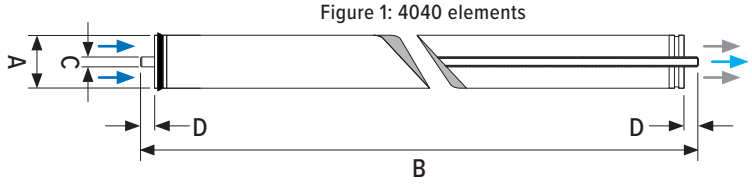
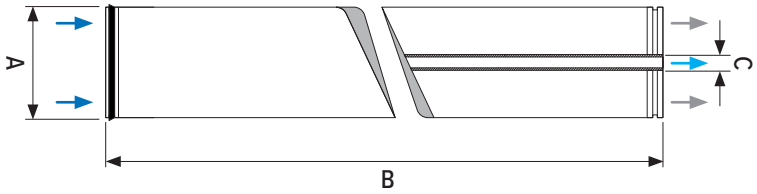


Figure 2: 8040 elements



Product Datasheet

TORAY
Innovation by Chemistry

TML(D) Series

Low-Fouling Reverse Osmosis Membrane Element with High Chemical Tolerance

Operating Limits		Unit	Value
Maximum operating pressure[6,7]		psi (MPa)	600 (4.1)
Maximum fee water temperature		°F (°C)	113 (45)
Maximum feed water SDI_{15}			5
Feed water chlorine concentration[3]		ppm	< 0.1
Feed water pH range	Continuous operation		2–11
	Chemical cleaning		1–13
Maximum pressure drop per element		psi (MPa)	15 (0.10)
Maximum pressure drop per vessel		psi (MPa)	50 (0.34)

Operating Information

1. 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.
2. 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.
3. 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. Please refer to Toray's RO Element Three-Year Prorated Limited Warranty.
4. Permeate from the first hour of operation shall be discarded.
5. The customer is fully responsible for the effects of chemicals that are incompatible with the elements. Their use will void the element Limited Warranty.
6. Recommended process / operation pressure is < 2.0 MPa (for details, and in special cases, please consult the projection design guideline or contact your membrane supplier).
   a) Low-fouling brackish water elements will perform best with low salinity brackish water
   b) Maintain the above pressure range at low temperatures.
7. Maximum operating pressure will vary depending on feed temperature. Please ask for detailed information from Toray if needed.

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Product Datasheet

TORAY
Innovation by Chemistry

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^2 (m^2)	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^3/d)	6,100 (23.0)	*12,100 (45.8)*	6,700 (25.3)	*13,000 (49.2)*
Min. Product Flow Rate	gpd (m^3/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)

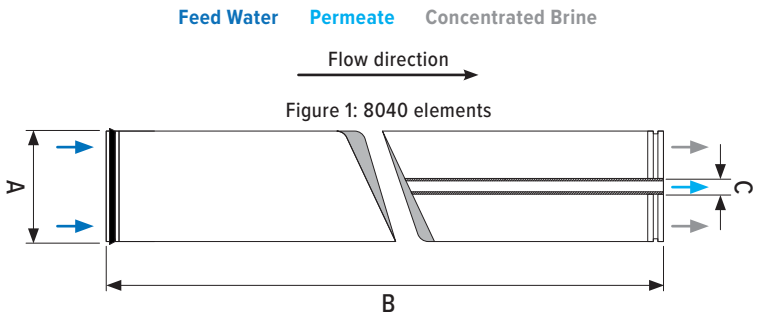

Figure 1: 8040 elements

Product Datasheet

TORAY
Innovation by Chemistry

TSW-LE Series

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

Operating Limits		Unit	Value
Maximum operating pressure[6]		psi (MPa)	1,200 (8.3)
Maximum fee water temperature		°F (°C)	113 (45)
Maximum feed water SDI_{15}			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

1. 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.
2. 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.
3. 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.
4. Permeate from the first hour of operation shall be discarded.
5. The customer is fully responsible for the effects of chemicals that are incompatible with the elements. Their use will void the element Limited Warranty.
6. Maximum operating pressure will vary depending on feed temperature. Please ask for detailed information from Toray if needed.

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

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