

# BRACKISH WATER RO MEMBRANES



## ESPA®

### Performance for Ultra Low Pressure Membranes

Element Type	Min. Salt Rej.,%	Nom. Salt Rej.,%	Permeate Flow GPD	(m3/d)
ESPA1-4040	99.0	99.3	2,600	(9.8)
ESPA2-4040	99.4	99.6	1,900	(7.2)
ESPA3-4040	98.0	98.5	3,000	(11.4)
ESPA4-4040	99.0	99.2	2,500	(9.4)
ESPA1	99.0	99.3	12,000	(45.4)
ESPA2	99.5	99.6	9,000	(34.1)
ESPA2-365	99.5	99.6	8,200	(31.0)
ESPA2+*	99.5	99.6	12,000	(45.4)
ESPA3	98.0	98.5	14,000	(53.0)
ESPA4**	99.0	99.2	12,000	(45.4)
ESPA-B*	99.0	99.2	8,600	(32.6)

\*Boron Rej. @ pH = 10 is 93% for ESPA2+ and 96% for ESPA-B  
\*\*ESPA4 NaCl Solution tested at 500 PPM; tested at 100 psig

### Selected ESPA Project References:

Ulu Pandan, Singapore	44 MGD (167,000 m3/d) of industrial water from a waste water source
Orange County, California	70 MGD (265,000 m3/d) of reclaimed wastewater for a seawater intrusion barrier
Alameda County Water	8 MGD (30,200 m3/d) of potable water from a well water source

## LFC®

### Performance for Low Fouling Membranes

Element Type	Min. Salt Rej.,%	Nom. Salt Rej.,%	Permeate Flow GPD	(m3/d)
LFC1	99.2	99.5	11,000	(41.63)
LFC3	99.5	99.7	9,500	(35.96)
LFC3-LD	99.5	99.7	11,000	(41.6)

### Selected LFC Project References:

Kranji, Singapore	10.5 MGD (40,000 m3/d) of industrial water from a wastewater source
Bedok, Singapore	8.5 MGD (32,000 m3/d) of industrial water from a wastewater source
LaSolana, Spain	1.3 MGD (4,800 m3/d) of industrial water from a surface water source

## CPA

### Performance for High Rejection Membranes

Element Type	Min. Salt Rej.,%	Nom. Salt Rej.,%	Permeate Flow GPD	(m3/d)
CPA2-4040	99.2	99.5	2,250	(8.5)
CPA2	99.5	99.7	10,000	(37.9)
CPA3	99.6	99.7	11,000	(41.6)
CPA4	99.5	99.7	6,000	(22.7)

### Selected CPA Project References:

Kill Devil Hills, NC	2 MGD (7,600 m3/d) of potable water from a brackish well water source
Englewood Water District, FL	4 MGD (15,000 m3/d) of potable water from a brackish well water source
Muznib, KSA	3.2 MGD (12,000 m3/d) of potable water from a brackish ground water source

### Test Conditions for ESPA, LFC and CPA

The stated performance is initial (data taken after 30 minutes of operation), based on the following conditions:

NaCl Solution, PPM*	1500
Applied Pressure, LFC, CPA, psig (MPa)	225 (1.55)
Applied Pressure ESPA, psig (MPa)	150 (1.05)
Applied Pressure ESPA4, psig (MPa)	100 (0.69)
Operating Temperature, °F(°C)	77° (25°)
Permeate Recovery	15%
pH Range	6.5-7.0

### Application Data

Maximum Applied Pressure psig (MPa)	600 (4.16)
Maximum Feed Flow, GPM (m <sup>3</sup> /h)	4 inch -16 (3.6), 8 inch -75 (17.0)
Maximum Operating Temperature, °F(°C)	113° (45°)
Feedwater pH Range**	3.0-10.0
Maximum Feedwater Turbidity, NTU	1.0
Maximum Feedwater SDI (15 mins)	5.0
Maximum Chlorine Concentration, PPM	<0.1
Minimum Ratio of Concentrate to Permeate Flow for any Element	5:1
Maximum Pressure Drop for Each Element, psig	10

\*ESPA4 NaCl Solution tested at 500 PPM

\*\*See technical literature for extended pH tolerance



# Brackish Water Nanofiltration Membranes

# Seawater RO Membranes

## ESNA®

### Performance for Low Fouling Membranes

Element Type	Min. Salt Rej.,%	Nom. Salt Rej.,%	Ca Rej. Brackish Water,%	Permeate Flow GPD	(m3/d)
ESNA1-LF-4040	80-95	89	96.0	1,750	6.6
ESNA1-LF	80-95	89	96.0	8,200	31
ESNA1-LF2	80-92	86	93.0	10,500	39.7

### Test Conditions

CaCl <sub>2</sub> Solution, PPM	500
Applied Pressure, psig (MPa)	75 (0.52)
Operating Temperature, °F(°C)	77° (25°)
Permeate Recovery	15%
pH Range	6.5-7.0

### Application Data

Maximum Applied Pressure, psig (MPa)	600 (4.16)
Maximum Chlorine Concentration, PPM	<0.1
Maximum Operating Temperature, °F(°C)	113° (45°)
Feedwater pH Range	3.0-10.0
Maximum Feedwater Turbidity, NTU	1.0
Maximum Feedwater SDI (15 mins) ESNA1-LF	5.0
Maximum Feedwater SDI (15 mins) ESNA1-LF2	4.0
Maximum Feed Flow, GPM (m <sup>3</sup> /h) - 8 inch	75 (17)
Maximum Feed Flow, GPM (m <sup>3</sup> /h) - 4 inch	16 (3.6)
Minimum Ratio of Concentrate to Permeate Flow for any Element	5:1
Maximum Pressure Drop for Each Element, psi	10

### Selected ESNA Project References:

Boca Raton, Florida	40 MGD (151,500 m3/d) of potable water from a well water source
Hollywood, Florida	18 MGD (68,000 m3/d) of potable water from a well water source
Deerfield Bch., Florida	12 MGD (45,500 m3/d) of potable water from a well water source
Pompano Bch., Florida	10 MGD (37,800 m3/d) of potable water from a well water source
Fort Myers, Florida	12 MGD (45,400 m3/d) of potable water from a well water source



SWC membrane installation, 45 MGD (170,000 m<sup>3</sup>/d) in Fujairah, U.A.E.

## SWC®

### Performance for Seawater Membranes

Element Type	Min. Salt Rej.,%	Nom. Salt Rej.,%	Permeate Flow GPD	(m3/d)
SWC1-4040	99.5	99.6	1,200	(4.6)
SWC3	99.5	99.7	5,900	(22.3)
SWC3+	99.7	99.8	7,000	(26.5)
SWC4+	99.7	99.8	6,500	(24.6)
SWC5	99.7	99.8	9,000	(34)

### Test Conditions

The stated performance is initial (data taken after 30 minutes of operation), based on the following conditions:

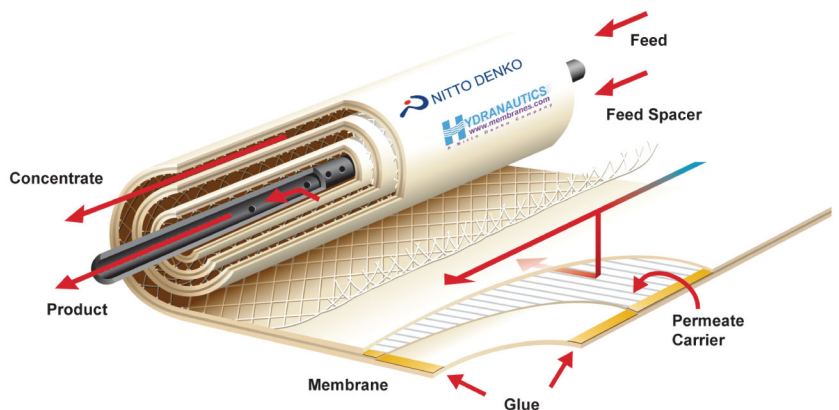
NaCl Solution, PPM	32,000
Applied Pressure, psig (MPa)	800 (5.5)
Operating Temperature, °F(°C)	77° (25°)
Permeate Recovery	10%
pH Range	6.5-7.0

### Application Data

Maximum Applied Pressure, 8 inch - psig (MPa)	1200 (8.27)
Maximum Applied Pressure, 4 inch - psig (MPa)	1000 (6.9)
Maximum Feed Flow, GPM (m <sup>3</sup> /h)	4 inch: 16 (3.6), 8 inch: 75 (17)
Maximum Operating Temperature, °F(°C)	113° (45°)
Feedwater pH Range*	3.0-10.0
Maximum Feedwater Turbidity, NTU	1.0
Maximum Feedwater SDI (15 mins)	5.0
Maximum Chlorine Concentration, PPM	<0.1
Minimum Ratio of Concentrate to Permeate Flow for any 8 inch Element	5:1
Maximum Pressure Drop for Each Element, psig	10
Minimum Recovery for any Element (4 inch)	10%

### Selected SWC Project References:

Beni Saf, Algeria	53 MGD (200,000 m3/d) of potable water from the Mediterranean Sea
Escombreras, Spain	17 MGD (65,000 m3/d) of potable water from the Mediterranean Sea
Fujairah, UAE	45 MGD (170,000 m3/d) of potable water from the Persian Gulf
Carboneras, Spain	32 MGD (120,000 m3/d) of potable water from the Mediterranean Sea
Cartagena, Spain	17 MGD (65,000 m3/d) of potable water from the Mediterranean Sea



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The limitations shown in the Application Data are for general use. The values may be more conservative for specific projects to ensure the best performance and the longest life of the membrane.