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GE Power & Water
Water & Process Technologies

MEMBRANE ELEMENTS - PURE WATER APPLICATIONS

Contents

Membrane Elements

The Four Membrane Processes

Reverse Osmosis (RO) is the tightest possible membrane process in liquid/liquid separation. Water is, in principle, the only material passing through the membrane; essentially all dissolved and suspended material is rejected. The more open types of RO membranes are sometimes confused with nanofiltration (NF).

True NF combines two rejection mechanisms; one based on molecular weight or size and shape of the molecule (regardless of the ionic charge), the other is based on electrical repulsion between the negatively charged membrane and the anionic species of the salt present in solution. NF highly rejects (min 96% rejection) multivalent salts such as magnesium sulfate ($MgSO_4$) regardless of the feed concentration. It will also reject monovalent salts, such as sodium chloride, but only between 0-50% depending on the feed concentration. In contrast, "loose RO" is a RO membrane with reduced salt rejection of all salts (monovalent and multivalent).

Ultrafiltration (UF) is a process where the high molecular weight compounds are purified, such as protein, and undesirable substances (ie salts or amino acids or simple sugars) permeate through the membrane due to their small molecular weight. Ultrafiltration can also be used for pyrogen removal in ultrapure water systems.

Microfiltration (MF) is a clarification process where suspended solids, fats and very large organics are rejected.

Membrane Materials

The selection of membranes offered by the various suppliers in the business may appear to be confusing since many materials may be used to make membranes, and they are provided under an array of trade names. In reality, relatively few materials are actually used in quantity, and only a few basic membrane types form the bulk of the membranes being sold and used.

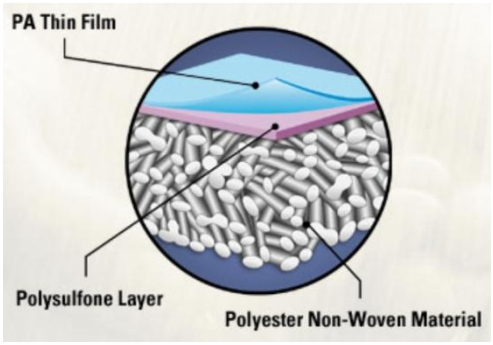
Integral Membranes

Cellulose acetate (CA) is the "original" membrane and is used for RO, NF and UF applications. The material has a number of limitations, mostly with respect to pH and temperature. The main advantage of CA is its low price, and the fact that it is hydrophilic, which makes it less prone to fouling. There are many "die hard" membrane users who insist on buying "the same membrane as last time," and who simply stay with CA because it works for them. An inherent weakness of CA is that is can be eaten by microorganisms.

Polysulfone (PSO) in a number of varieties has been used for UF and MF membrane since 1975. PSO's main advantage is its exceptional temperature and pH resistance. PSO is practically the only membrane material used in high quantity for a number of food and dairy applications. As a rule, PSO membranes do not tolerate oil, grease, fat and polar solvents. However, there is one type of hydrophilic PSO membrane which apparently defies this rule and seems to work well with oil emulsions.

Polyvinylidenedifluoride (PVDF) is a traditional membrane material, but it is not used much because it is difficult to make membranes with good and consistent separation characteristics. Its main advantage is its high resistance to hydrocarbons and oxidizing environments.

Composite Membranes



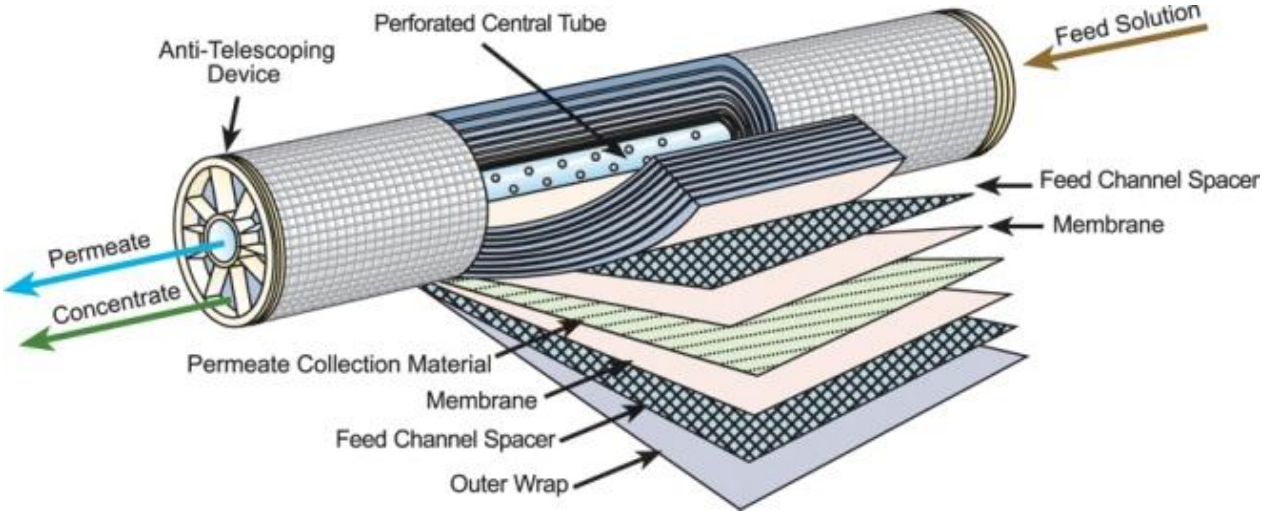
Composites membranes, also called thin-film composite membranes, appear under various acronyms such as TFC (thin-film composite) and TFM (thin-film membrane), and were made to replace cellulose acetate (CA) RO membranes. The main advantage is the combination of relatively high flux and very high salt rejection. Composite RO membranes commonly reject 99.5% NaCl. They also have good temperature and pH resistance, but do not tolerate oxidizing environments. Composite membranes are made in two-layer and three-layer designs, the precise composition of which is proprietary. Generally speaking, a thin-film composite membrane consists of a PS membrane as support for the very thin skin layer which is polymerized in situ on the PS UF membrane. The three layer design has two thin film membranes on top of the PS support membrane.

Membrane Structure

All RO, NF and UF membranes are asymmetric. This differentiates most membranes from common filters, e.g. coffee filters, which are symmetric or, in other words, are identical on both sides of the filter. Membranes have a tight top layer facing the product to be treated. This layer is also called the skin layer. It is thin, typically < 0.1 micron. The membrane itself is approximately 150 - 250 micron where the bulk of the membrane provides structural support for the skin layer. The asymmetric structure means that the pores are wider as you move farther away from the surface, which prevents the pores from plugging. This provides good fouling resistance, since foulants have a tendency to either be totally rejected or to pass all the way through a membrane.

Membrane Module

The spiral wound element type is the workhorse in the membrane world. The spiral wound element design was originally made exclusively for water desalination, but the very compact design and the low price made it attractive to other industries. After a lot of trial and failure, redesigned elements emerged which can be used for a variety of industrial applications in the dairy industry, the pulp and paper industry, for high purity water, and at high temperature and extreme pH. However, the number of membrane companies who really can and will develop and supply spiral wound elements for extreme applications is in many cases limited to one.



Product Information

Nomenclature

Element Nomenclature

The element nomenclature consists of a 6-position base model designation and 2 extra positions providing additional information about element. As an example: **AK8040F-400,WET**

NOMENCLATURE							
1	2	3	4	5	6	7	8
A	K	80	40	F		400	WET
Membrane Type	Membrane Flux	Diameter	Length	Outer wrap	Element Configuration	Membrane Area	Element Style

Position 1 **A**K8040F-400,WET**.** The membrane type is designated by a letter in position 1. In the example shown, the letter A designates A-Series thin-film membrane. Other membrane types are described below.

POSITION 1			
	Membrane	Product	Type
A	RO	A-Series	TFM
C	RO, NF, UF	C-Series	Cellulose Acetate
H	NF	H-Series	TFM
Duratherm	RO, NF,UF	Various	TFM, Polyethersulfone

Position 2 A**K**8040F-400,WET**.** Membrane flux (water permeability constant) is designated by a letter in position 2. Some membrane types, such as cellulose acetate and A-Series, may have multiple flux models and, therefore, several different flux letters. The flux codes range from A to Z, with A representing the lowest water permeability constant.

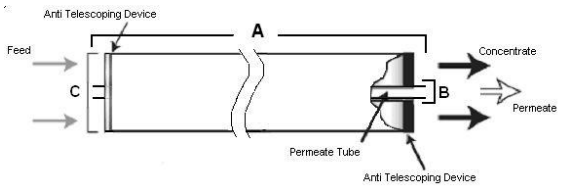
Positions 3 AK**80**40F-400,WET**.** The element diameter in inches is designated by position 3. In the example shown, the A-Series element is 8.0 inches in diameter.

Positions 4 AK80**40**F-400,WET**.** Element length in inches is designated by position 4. In the example shown, element length is 40 inches.

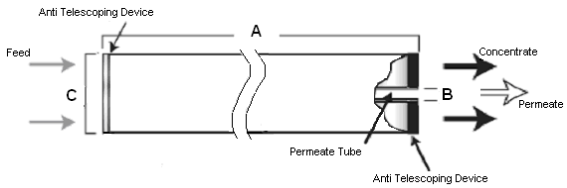
Position 5 AK8040**F**-400,WET**.** Element outer wrap is designated by position 5. In the example shown, F refers to fiberglass. Other possibilities include:

POSITION 5	
	Wrap
F	Fiberglass
N	Net Wrap (or Full-fit)
T	Tape
C	Cage

Position 6 AK8040F_-400,WET. The absence of a sixth character is indicative of female style element (See Figure 1). The letter M in the 6th position indicates elements having an external permeate tube design or male configuration.



Male connection with ATD



Female connection with ATD

Position 7 AK8040F-**400**,WET. Some of our models have similar membrane, dimensions and outerwrap but different active area. The 7th position differentiates the models by providing the nominal active area. An example would be AG8040F and AG8040F400. See specification sheets for active area.

Position 8. AK8040F-400,**WET**. Provides additional information such as eventual certification (i.e.: CERT for NSF 61 certified element or preservation mode (wet versus dried), etc....

Full-fit vs. Fiberglass

Full-Fit is an innovative, polypropylene outer wrap feature that has no bypass around the outside of the element. *Full-Fit* outer wrap is designed to protect the spiral-wound element. It also forms a close fit within the pressure vessel walls without the use of a brine seal. *Full-Fit* outer wrap is a more sanitary design that functionally experiences low pressure drop, which may lead to substantial energy savings. The controlled flow around the element eliminates the voids and dead spaces conducive to bacterial growth and adhesion.

Fiberglass (FRP) element casings are engineered for best use with high pressure, industrial applications where rigorous sanitary limitations do not apply. The fortified durability of FRP provides heightened protection of the spiral-wound element.

Wet vs. Dried

GE elements are shipped tested and preserved either in a dried or wet condition.

The wet elements contain a storage solution preventing biological growth during storage and shipping of elements. They are bagged in sealed plastic bags.
The dried element plastic bag is open but they should remain in their bag until they are used.

Dried membranes and wet preserved membranes, if properly stored, reach the same stabilized performance after a few hours or days of operation. The flow performance of wet membranes is typically stable right from the start, while dried membranes tend to start at a slightly higher flow. The salt rejection of GE membranes in general improves during the first few hours or days of operation and then remains stable. Wet membranes stabilize faster than dried membranes.

Shipping Information

SHIPPING INFORMATION

		Dimension Inches (mm)			Boxed Weight lbs. (kg)	
Size	Connection	A	B[1]	C[2]	Dry	Wet
2540*M	Male	40.00 (1016)	0.75 (19) O.D.	2.40 (61)	5 (2.3)	N/A
4025*	Female	25.00 (635)	0.625 (16)	3.9 (99)	5 (2.3)	N/A
4026*	Female	26.00 (667)	0.625 (16)	3.9 (99)	6 (2.7)	N/A
4040*M	Male	40.00 (1016)	0.75 (19) O.D.	3.9 (99)	8 (3.5)	8 (3.5)
4040*	Female	40.00 (1016)	0.625 (16)	3.9 (99)	8 (3.5)	8 (3.5)
8040*	Female	40.00 (1016)	1.125 (285)	7.9 (201)	32 (14.5)	35 (16)

All elements are shipped dry/dried unless specified wet.
*All shipping information is true for all outerwrap options (fiberglass, tape, net or cage)
1. Internal diameter unless specified OD (outside diameter).
2. The element diameter (dimension C) is designed for optimum performance in GE pressure vessels. Others pressure vessel dimension and tolerance may result in excessive bypass and loss of capacity.

Product Selection Guide

Membrane protection matters – to better protect your membrane treatment system, GE offers a line of the industry's best pre-filters. By providing the whole solution and not just portions of it, GE helps our customers extend membrane life and reduce operating costs. For more information on which GE filters to use with which GE membranes, see below or talk with your GE representative.

SEAWATER

	Material	Rejection	2.5in	4in	8in	Outer wrap	Max temp	Chlorine tolerance
AD HR	TFM	99.75% NaCl	N/A	x	x	Fiberglass	50°C	1,000 ppm-days
AD LE	TFM	99.75% NaCl	N/A	N/A	x	Fiberglass	50°C	1,000 ppm-days
AE HR	TFM	99.8% NaCl	N/A	x	x	Fiberglass	50°C	1,000 ppm-days

TFM: Thin Film Membrane
To protect your GE seawater membranes, use GE SWRO.Zs depth filters

BRACKISH WATER

	Material	Rejection	2.5in	4in	8in	Outer wrap	Max temp	Chlorine tolerance
AG HR	TFM	99.8% NaCl	N/A	x	x	Fiberglass	50°C	1,000 ppm-hours
AG	TFM	99.5% NaCl	x	x	x	Fiberglass, Cage, Net, Tape	50°C	1,000 ppm-hours
AK HR	TFM	99.5% NaCl	N/A	x	x	Fiberglass	50°C	1,000 ppm-hours
AK	TFM	99.0% NaCl	x	x	x	Fiberglass, Cage, Net, Tape	50°C	1,000 ppm-hours
AK LE	TFM	99.3% NaCl	N/A	x	x	Fiberglass	50°C	1,000 ppm-hours
CD	CA	98.5% NaCl	N/A	x	x	Fiberglass, Tape	30°C	1 ppm continuous
CE	CA	97.5% NaCl	x	x	x	Fiberglass, Cage, Net, Tape	30°C	1 ppm continuous
CG	CA	93.0% NaCl	x	x	x	Fiberglass	30°C	1 ppm continuous

TFM: Thin Film Membrane – CA: cellulose acetate - N/A: Not available
To protect your GE brackish water membranes, us GE ROSave.Zs depth filters

WATER SOFTENING

	Material	Rejection	2.5in	4in	8in	Outer wrap	Max temp	Chlorine tolerance
HL	TFM	98.0% $MgSO_4$	x	x	x	Fiberglass, Net, Tape	50°C	1,000 ppm-hours
CK	CA	97.0% $MgSO_4$	x	x	x	Fiberglass, Net	30°C	1 ppm continuous

TFM: Thin Film Membrane – CA: cellulose acetate
To protect your GE water softening membranes, use GE ROSave.Zs depth filter

NSF 61 CERTIFIED ELEMENTS

	Material	Rejection	2.5in	4in	8in	Outer wrap	Max temp	Chlorine tolerance
AG	TFM	99.5% NaCl	N/A	x	x	Fiberglass	50°C	1,000 ppm-hours
AK	TFM	99.0% NaCl	N/A	x	x	Fiberglass	50°C	1,000 ppm-hours
HL	TFM	98.0% $MgSO_4$	N/A	x	N/A	Fiberglass	50°C	1,000 ppm-hours

TFM: Thin Film Membrane - N/A: Not available
To protect your GE NSF 61 certified elements, use GE Muni.Z depth filters.

HIGH TEMPERATURE SANITIZATION

	Material	Rejection	2.5in	4in	8in	Outer wrap	Max temp	Chlorine tolerance
Duratherm RO HF	TFM	99.5% NaCl	N/A	X	x	Cage	70°C 90°C	500 ppm-hours
Duratherm HWS RO HR	TFM	99.5% NaCl	x	X	x	Cage	50°C 90°C	500 ppm-hours
Duratherm HWS RO	TFM	99.0% NaCl	x	X	x	Cage	50°C 90°C	500 ppm-hours
Duratherm HWS NF HF	TFM	98.6% $MgSO_4$	N/A	X	x	Cage	50°C 90°C	500 ppm-hours
Duratherm HWS UF HF	PES	10,000 Da	N/A	X	x	Cage	70°C 90°C	5,000 ppm-days

TFM: Thin Film Membrane – PES: polyethersulfone – N/A: Not available
To protect your GE high temperature membranes, use GE ZCore depth filters.

HIGH FOULANT POTENTIAL WATER

	Material	Rejection	2.5in	4in	8in	Outer wrap	Max temp	Chlorine tolerance
AG LF	TFM	99.8% NaCl	N/A	x	X	Fiberglass	50°C	1,000 ppm-hours

TFM: Thin Film Membrane – N/A: Not available
To protect your GE high foulant potential membranes, use GE ROSave.Zs

Ordering Information

Reverse Osmosis Elements – Seawater Elements

AD HR membrane elements are characterized by a high sodium chloride rejection and excellent Boron rejection. AD HR Seawater Elements feature high-pressure construction.

AD HR ELEMENTS

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
AD-90	1500 (5.7)	99.75%	90 (8.4)	Fiberglass	Male	3056651
AD-365	6000 (22.7)	99.75%	365 (33.9)	Fiberglass	Female	3056652
AD-400	6500 (24.6)	99.75%	400 (37.2)	Fiberglass	Female	3056653
AD-400, 34	6500 (24.6)	99.75%	400 (37.2)	Fiberglass	Female	3056654
AD-440	7100 (26.9)	99.75%	440 (40.9)	Fiberglass	Female	3056655

Testing conditions: 32,000mg/l NaCl & 5mg/l boron solution at 800psi (5,516kPa) operating pressure, 77°F (25°C), pH 8.0 and 7% recovery.
Minimum Boron Rejection = 93.0%
To protect your GE AD HR seawater elements, use GE SWRO.Zs depth filters.

AD LE membrane elements are characterized by a high sodium chloride rejection and good Boron rejection at lower pressure. AD LE Seawater Elements feature high-pressure construction.

AD LE ELEMENTS

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
AD-400 LE	7500 (28.4)	99.75%	400 (37.2)	Fiberglass	Female	3056658
AD-440 LE	8200 (31.0)	99.75%	440 (40.9)	Fiberglass	Female	3056659

Testing conditions: 32,000mg/l NaCl & 5mg/l Boron solution at 800psi (5,516kPa) operating pressure, 77°F (25°C), pH 8.0 and 7% recovery.
Minimum Boron Rejection = 91.0%
To protect your GE AD LE seawater elements, use GE SWRO.Zs depth filters.

AE HR membrane elements are characterized by an excellent sodium chloride rejection and good Boron rejection. AE HR Seawater Elements feature high-pressure construction.

AE HR ELEMENTS

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
AE-90	2000 (7.6)	99.8%	90 (8.4)	Fiberglass	Male	3056660
AE-400	9000 (34.1)	99.8%	400 (37.2)	Fiberglass	Female	3056661
AE-400,34	9000 (34.1)	99.8%	400 (37.2)	Fiberglass	Female	3056662
AE-440	9900 (37.5)	99.8%	440 (40.9)	Fiberglass	Female	3056663

Testing conditions: 32,000mg/l NaCl & 5mg/l Boron solution at 800psi (5,516kPa) operating pressure, 77°F (25°C), pH 8.0 and 10% recovery.
Minimum Boron Rejection = 90.0%
To protect your GE AE HR seawater elements, use GE SWRO.Zs depth filters.

Reverse Osmosis Elements – Brackish Water Elements

The AG HR is designed for use on brackish water when very high rejection of monovalent ions is required while operating at pressures as low as 200psi (1,379kPa).

AG HR Elements

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
AG-90	2200 (8.3)	99.8%	90 (8.4)	Fiberglass	Male	3056665
AG-365	9600 (36.3)	99.8%	365 (33.9)	Fiberglass	Female	3056666
AG-400	10500 (39.7)	99.8%	400 (37.2)	Fiberglass	Female	3056667
AG-400, 34	10500 (39.7)	99.8%	400 (37.2)	Fiberglass	Female	3056668
AG-440	11500 (43.5)	99.8%	440 (40.9)	Fiberglass	Female	3056669

Testing conditions: 2,000ppm NaCl solution at 225psi (1,550kPa) operating pressure, 77°F (25°C), pH7 and 15% recovery.
To protect your GE AG HR membrane elements, use GE ROSave.Zs depth filters.

AG Standard Brackish Water Elements are selected when high rejection and operating pressures as low as 200 psi (1,379 kPa) are desired. These elements allow moderate energy savings, and are considered a standard in the industry.

AG Elements

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part number US[1]	Part number Other plants[2]
AG2540FM	710 (2.7)	99.5%	29 (2.6)	Fiberglass	Male	1206727	N/A
AG2540TM	710 (2.7)	99.5%	29 (2.6)	Tape	Male	1206729	N/A
AG4025T	1,600 (6.0)	99.5%	60 (5.6)	Tape	Female	1206754	N/A
AG4026F	1,600 (6.0)	99.5%	60 (5.6)	Fiberglass	Female	1206756	N/A
AG4040C	2,400 (8.6)	99.5%	90 (8.4)	Cage	Female	1206757	N/A
AG4040CM	2,400 (8.6)	99.5%	90 (8.4)	Cage	Male	1206759	N/A
AG4040FM	2,200 (8.3)	99.5%	85 (7.9)	Fiberglass	Male	1206761	3032513
AG4040FM, WET	2,200 (8.3)	99.5%	85 (7.9)	Fiberglass	Male	3013808	3035659
AG4040NM	2,200 (8.6)	99.2%	85 (7.9)	Net	Male	1231785	N/A
AG4040TM	2,200 (8.3)	99.5%	85 (7.9)	Tape	Male	1206774	3032514
AG8040C	9,900 (37.3)	99.5%	380 (35.3)	Cage	Female	1222546	N/A
AG8040F	9,600 (36.3)	99.5%	365 (33.9)	Fiberglass	Female	1206779	3032515
AG8040F, WET	9,600 (36.3)	99.5%	365 (33.9)	Fiberglass	Female	1239765	3032516
AG8040F-400	10,500 (39.7)	99.5%	400 (37.2)	Fiberglass	Female	1206784	3032518
AG8040F-400, WET	10,500 (39.7)	99.5%	400 (37.2)	Fiberglass	Female	1239764	3032519
AG8040N	9,600 (36.3)	99.2%	365 (33.9)	Net	Female	1231784	N/A
AG8040N-400	10,500 (39.7)	99.2%	400 (37.2)	Net	Female	1231786	N/A

Testing conditions: 2,000 ppm NaCl solution at 225 psi (1,551 kPa) operating pressure, 77°F, pH 7.5 and 15% recovery.
[1]These elements are rolled in US.
[2]These elements are rolled in China, India and Hungary.
To protect your GE AG membrane elements, use GE ROSave.Zs depth filters.

Reverse Osmosis Elements – Low Energy Brackish Water Elements

These elements are recommended for brackish water with salt concentration (TDS) levels up to 1,000 mg/l with significant energy savings since good rejection is achieved at operating pressures as low as 115 psig (689 kPa).. In turn, AK HR elements produce a permeate quality close to a standard brackish membrane element at a much lower pressure.

AK HR Elements

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
AK-90	2200 (8.3)	99.5%	90 (8.4)	Fiberglass	Male	3056678
AK-365	9600 (36.3)	99.5%	365 (33.9)	Fiberglass	Female	3056679
AK-400	10500 (39.7)	99.5%	400 (37.2)	Fiberglass	Female	3056680
AK-440	11500 (43.5)	99.5%	440 (40.9)	Fiberglass	Female	3056681

Testing conditions: 500ppm NaCl solution at 115psi (862kPa) operating pressure, 77°F (25°C), pH7.5 and 15% recovery.
To protect your GE AK HR membrane elements, use GE ROSave.Zs depth filters.

AK elements are selected when high rejection and low operating pressures are desired. These elements allow significant energy savings since good rejection is achieved at low operating pressures.

AK Elements

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number (US)	Part number Other plants[2]
AK2540FM	710 (2.7)	99.0%	29 (2.7)	Fiberglass	Male	1206800	N/A
AK2540TM	710 (2.7)	99.0%	27 (2.5)	Tape	Male	1206802	N/A
AK4040C	2,500 (9.5)	99.0%	95 (8.8)	Cage	Female	1223696	N/A
AK4040FM	2,200 (8.3)	99.0%	85 (7.9)	Fiberglass	Male	1206813	3039082
AK4040FM, WET	2,200 (8.3)	99.0%	85 (7.9)	Fiberglass	Male	3052307	3044157
AK4040NM	2,200 (8.3)	98.5%	85 (7.9)	Net	Male	1231787	N/A
AK4040TM	2,200 (8.3)	99.0%	85 (7.9)	Tape	Male	1206816	N/A
AK8040C	9,900 (37.3)	99.0%	380 (35.3)	Cage	Female	1206819	N/A
AK8040F	9,600 (36.3)	99.0%	365 (33.9)	Fiberglass	Female	1206820	3039160
AK8040F, WET	9,600 (36.3)	99.0%	365 (33.9)	Fiberglass	Female	N/A	3044153
AK8040F-400	10,500 (39.7)	99.0%	400 (37.2)	Fiberglass	Female	1206821	3039161
AK8040F-400, WET	10,500 (39.7)	99.0%	400 (37.2)	Fiberglass	Female	1239766	3039162
AK8040N	9,600 (36.3)	98.5%	365 (33.9)	Net	Female	1231788	N/A
AK8040N-400	10,500 (39.7)	98.5%	400 (37.2)	Net	Female	1231789	N/A

Testing conditions: 500ppm NaCl solution at 115psi (793kPa) operating pressure, 77°F, pH 7.5 and 15% recovery
[1]These elements are rolled in US.
[2]These elements are rolled in China, India and Hungary.
To protect your GE AK membrane elements, use GE ROSave.Zs depth filters.

These elements are recommended for brackish water with salt concentration (TDS) levels up to 1,000 mg/l when maximum energy savings are required. AK LE elements produce good permeate quality with maximum energy savings.

AK LE Elements

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
AK-90 LE	2800 (10.6)	99.3%	90 (8.4)	Fiberglass	Male	3056683
AK-400 LE	12300 (46.6)	99.3%	400 (37.2)	Fiberglass	Female	3056684
AK-440 LE	13500 (51.1)	99.3%	440 (40.9)	Fiberglass	Female	3056685

Testing conditions: 500ppm NaCl solution at 115psi (793kPa) operating pressure, 77°F (25°C), pH7 and 15% recovery.
To protect your GE AK LE membrane elements, use GE ROSave.Zs depth filters.

Nanofiltration Elements

HL Nanofiltration Elements are used for water softening, color removal, and reduction of THM potential.

HL ELEMENTS

Model	Average flow gpd (m^3/day)	Average $MgSO_4$ rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
HL2540FM	780 (3.0)	98.0%	27 (2.5)	Fiberglass	Male	1207230
HL2540TM	780(3.0)	98.0%	27(2.5)	Tape	Male	1207231
HL4040FM	2,400 (9.1)	98.0%	89 (8.2)	Fiberglass	Male	1207236
HL4040TM	2,400 (9.1)	98.0%	89 (8.2)	Tape	Male	1220990
HL8040F	10,800 (40.9)	98.0%	365 (33.9)	Fiberglass	Female	1266702
HL8040F-400	11,500 (43.5)	98.0%	400 (37.2)	Fiberglass	Female	1207240
HL8040N	10,100 (38.2)	97.5%	350 (32.5)	Net	Female	1231793

Testing conditions: 2,000ppm MgSO4 solution at 110psi (760kPa) operating pressure, 77°F, pH 7.5 and 15% recovery.

Cellulose Acetate Membrane Elements

The C-series elements have a higher rejection and better mechanical stability than standard cellulose acetate and they offer a lower cost per element and increased chlorine resistance compared to thin-film elements.

CD Elements

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
CD4025T	1,000 (3.8)	98.5%	55 (5.1)	Tape	Female	1206834
CD4040FM	1,600 (6.1)	98.5%	90 (8.4)	Fiberglass	Female	3050080
CD8040F	6,000 (22.7)	98.5%	390 (36.2)	Fiberglass	Female	1206837

Testing conditions: 2,000ppm NaCl solution at 425psi (2,930kPa) operating pressure, 77°F, pH 6.5 and 15% recovery.

CE Elements

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
CE2540FM	630 (2.4)	97.5 %	27 (2.5)	Fiberglass	Male	1206854
CE4025T	1,300 (4.9)	97.5 %	59 (5.5)	Tape	Female	1206870
CE4026F	1,300 (4.9)	97.5 %	59 (5.5)	Fiberglass	Female	1206875
CE4040FM	2,100 (7.9)	97.5 %	95 (8.4)	Fiberglass	Male	3050079
CE4040C	2,200 (8.3)	97.5 %	90 (8.4)	Cage	Female	1206877
CE4040NM	2,000 (7.6)	97.0 %	85 (7.9)	Net	Male	1231790
CE8040F	8,000 (30.3)	97.5 %	350 (32.5)	Fiberglass	Female	1206880
CE8040N	8,000 (30.3)	97.0 %	350 (32.5)	Net	Female	1231791

Testing conditions: 2,000ppm NaCl solution at 425psi (2,930kPa) operating pressure, 77 °F, pH 6.5 and 15% recovery.

CG Elements

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
CG2540FM	600 (2.3)	93.0%	27 (2.5)	Fiberglass	Male	1206891
CG4040FM	2,000 (7.6)	93.0%	90 (8.4)	Fiberglass	Female	3050078
CG8040F	7,300 (27.6)	93.0%	350 (32.5)	Fiberglass	Female	1206896

Testing conditions: 500 ppm NaCl solution at 210 psi (1,448 kPa) operating pressure, 77°F, pH 6.5 and 15% recovery.

CK Nanofiltration Elements are used for water softening, color removal, and reduction of THM potential when chlorine is required.

CK Elements

Model	Average flow gpd (m^3/day)	Average $MgSO_4$ rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
CK2540FM 30D	600 (2.3)	97.0%	27 (2.5)	Fiberglass	Male	1231009
CK4040FM	2,000 (7.6)	97.0%	90 (8.4)	Fiberglass	Male	1233930
CK8040F	9,000 (34.1)	97.0%	365 (33.9)	Fiberglass	Female	1233927
CK8040N	9,000 (34.1)	97.0%	365 (33.9)	Net	Female	1231792

Testing conditions: 2,000ppm $MgSO_4$ solution at 225psi (1,551kPa) operating pressure, 77°F, pH 6.5 and 15% recovery.

NSF 61 Certified Elements

The National Sanitation Foundation (NSF) provides conformity assessment services in the areas of public health for the food preparation and plumbing water industries. NSF is an organization accredited by the American National Standard Institute (ANSI) to certify products against several ANSI/NSF Standards, including NSF Standard 61. ANSI/NSF Standard 61 is a testing protocol that assures customers and regulators that products do not contribute unsafe levels of contaminants to drinking water.

NSF Certified Elements

Model	Average flow gpd (m^3/day)	Average salt rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
AG4040FM CERT[1]	2,200 (8.3)	99.5% NaCl	85 (7.9)	Fiberglass	Male	1231652
AG8040F CERT[1]	9,200 (34.8)	99.5% NaCl	350 (32.5)	Fiberglass	Female	1231653
AG8040F 400 CERT[1]	10,500 (39.8)	99.5% NaCl	400 (37.2)	Fiberglass	Female	1231654
AK4040FM CERT[2]	2,200 (8.3)	99.0% NaCl	85 (7.9)	Fiberglass	Male	1231655
AK8040F 400 CERT[2]	10,500 (39.8)	99.0% NaCl	400 (37.2)	Fiberglass	Female	1231656
HL4040FM CERT[3]	2,400 (9.1)	98.0% $MgSO_4$	89 (8.2)	Fiberglass	Male	1233081

[1]Testing conditions: 2,000ppm NaCl solution at 225psi (1,551kPa) operating pressure, 77 °F, pH 7.5 and 15% recovery.
[2] Testing conditions: 500ppm NaCl solution at 115psi (790kPa) operating pressure, 77 °F, pH 7.5 and 15% recovery.
[3]Testing conditions: 2,000ppm $MgSO_4$ solution at 110psi (760kPa) operating pressure, 77 °F, pH 7.5 and 15% recovery.
To protect your GE NSF certified membrane elements, use GE Muni.Z depth filters.

Specialty Elements

Low fouling elements

The AG LF is designed for use with fouling-prone water. It is recommended for the desalination of difficult water sources and retrofit existing RO systems to obtain lower fouling, reduced overall energy usage and more operating time between cleanings.

AG LF ELEMENTS

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
AG-90 LF	2200 (8.3)	99.8%	90 (8.4)	Fiberglass	Male	3056674
AG-400 LF, 34	10500 (39.7)	99.8%	400 (37.2)	Fiberglass	Female	3056675
AG-440 LF	11500 (43.5)	99.8%	440 (40.9)	Fiberglass	Female	3056676

Testing conditions: 2,000 ppm NaCl solution at 225 psi (1,551 kPa) operating pressure, 77°F, pH 7.5 and 15% recovery.
To protect your GE AG LF membrane elements, use GE ROSave.Zs depth filters.

Sanitizable elements / High temperature applications

The Duratherm HWS and the Duratherm Series are specifically designed to maximize the benefits of hot water sanitization for industries relying on chemical free sanitization for product quality and/or industry compliance standard.
Separation system sanitization protocol is performed via periodic exposure to temperature as high as 90°C at minimum feed pressure to kill microorganisms by denaturation and coagulation of the proteins chains.

The Duratherm HWS RO and HWS NF are suitable for separation systems purifying water at temperature up to 122°F (50°C), Duratherm HWS UF up to 158°F (70°C) in low crossflow environment and no suspended solids.

DURATHERM HWS ELEMENTS

Model	Average flow gpd (m^3/day)	Average salt rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
DURATHERM HWS RO 2540 HR[1]	620 (2.3)	99.5% NaCl	25 (2.3)	Cage	Male	1263600
DURATHERM HWS RO 4040HR[1]	2,300 (8.7)	99.5% NaCl	88 (8.2)	Cage	Male	1263435
DURATHERM HWS RO 8040 HR[1]	9,900 (37.5)	99.5% NaCl	355 (33.0)	Cage	Female	1263599
DURATHERM HWS RO 2540[2]	760 (2.9)	99.0% NaCl	25 (2.3)	Cage	Male	1228430
DURATHERM HWS RO 4040[2]	2,200 (8.3)	99.0% NaCl	85 (7.9)	Cage	Male	1228459
DURATHERM HWS RO 8040[2]	9,200 (34.8)	99.0% NaCl	355 (33.0)	Cage	Female	1228481
DURATHERM HWS NF 4040[3]	2,100 (7.9)	98.6% $MgSO_4$	88 (8.2)	Cage	Male	1263437
DURATHERM HWS NF 8040[3]	8,500 (32.2)	98.6% $MgSO_4$	355 (33.0)	Cage	Female	1262377
DURATHERM HWS UF 4040	N/A	5,000 Da	360 (3.4)	Cage	Male	1263598
DURATHERM HWS UF 8040 HF	N/A	10,000 Da	380 (35.3)	Cage	Female	1263602

[1]Testing conditions: 2,000ppm NaCl solution at 225psi (1,550kPa) operating pressure, 77°F, pH7.5 and 15% recovery before any hot water sanitization.
[2]Testing conditions: 500ppm NaCl solution at 115psi (790kPa) operating pressure, 77°F, pH7.5 and 15% recovery before any hot water sanitization.
[3]Testing conditions: 2,000ppm MgSO4 solution at 110psi (760kPa) operating pressure, 77°F, pH7.5 and 15% recovery before any hot water sanitization
To protect your GE Duratherm HWS membrane elements, use GE ZCore depth filters.

The Duratherm RO are suitable for separation systems purifying water at temperature up to 158°F (70°C) in low crossflow environment and no suspended solids.

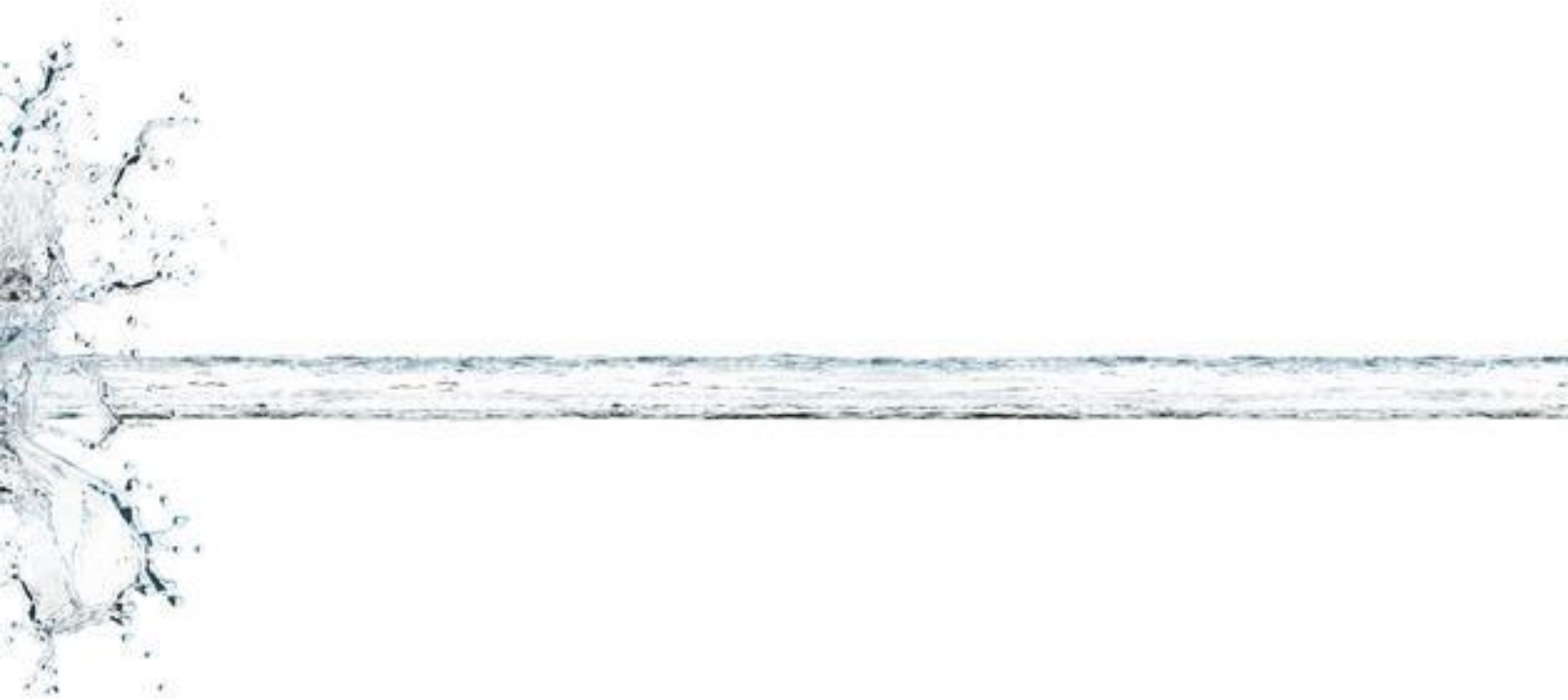
DURATHERM ELEMENTS

Model	Average flow gpd (m^3/day)	Average NaCl rejection	Active Area ft^2 (m^2)	Outer wrap	Connection	Part Number
DURATHERM STD RO4040	2,300 (8.7)	99.5%	90 (8.4)	Cage	Female	1228197
DURATHERM STD RO8040	9,900 (37.5)	99.5%	355 (33.0)	Cage	Female	1228225

Testing conditions: 2,000ppm NaCl solution at 225psi (1,550kPa) operating pressure, 77°F, pH7.5 and 15% recovery before any hot water sanitization.
To protect your GE Duratherm HWS membrane elements, use GE ZCore depth filters.

Loss of permeate flow after repeated 90°C (194°F) sanitization cycles:
At optimum conditions measured in controlled environment with deionized water, between 30% and 50% of the original permeate flow rate was lost before the element performance had stabilized after repeated heat treatments (over 90% of this flow reduction occurred during the first heat treatment). With the loss of permeate flow rate, the salt rejection increases. However the permeate flow reduction depends on several factors including the rate and speed of temperature change.

Spare Parts

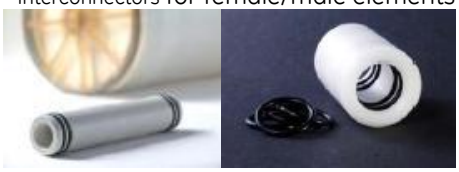


Some membrane elements are not supplied with ATD or an IC kit. Refer to “Product Selection Guide” section to select your element and order these pieces separately if necessary.

Glossary

Interconnector (IC) - The interconnector is used to connect the permeate tubes of adjacent elements.

Interconnectors for female/male elements



Product End Adaptor (PEA) - The product end adaptor is used to connect the permeate tube of the element to the permeate port of the pressure vessel end cap assembly.

This part is supplied by housing manufacturer. Please contact your GE representative for further information.

Product End Adaptors for female/male elements

Spacer Tube - The spacer tube is used as a permeate tube extension to fill space between the upstream element(s) and the permeate port of the pressure vessel end cap assembly. It is often utilized in retrofit situations with a product end adaptor and/or a closed end plug. The spacer tube helps prevent shifting of the elements in the pressure vessel in conjunction with a thrust ring provided by the system manufacturer.

Anti-Telescoping Device (ATD) - The anti-telescoping disc is connected to the element to provide support to the ends of the element preventing displacement of the outer portion relative to the permeate tube (telescoping).

Brine Seal - The brine seal, most often located at the feed end of the element, seals the outer-most part of the element with the inside of the pressure vessel wall and directs the feed solution to the inside of the element. The brine seal minimizes passage of the feed solution around the outside of the element.

Dead End Plugs (DEP) - The dead end plug is used to seal the open end of the permeate tube farthest from the permeate removal end of the pressure vessel when permeate removal is from only one end of the vessel. It is used in retrofit situations where there is space between the upstream element and the pressure vessel end cap.

Dead End Plug for female/male elements

Ordering Parts

Accessory kits

One accessory IC kit is included with each standard membrane element. The accessory kit for fiberglass and tape elements includes one interconnector and two sets of O-rings. The kit for the cage elements includes one interconnector, two flat anti-telescoping discs and two sets of O-rings.

Following kits (DEP or IC) available as a separate item for service maintenance change-outs include:

- one interconnector IC / dead end plug DEP.
- o-rings, number being specified in "o-ring part #" column between brackets.

All elements are supplied with ATDs. Only fiberglass and tape wrap elements are supplied with brine seals. The below parts are for ordering spares.

INTERCONNECTOR KITS

Diameter	Kit #	IC kit Part #	IC Part #	O-ring Part #
Permeate Tube: Stinger style male elements (0.75 in)				
2.5in	6	1206581 CELCON/BUNA-N	1205503 CELCON	(8) 3052771 BUNA-N
2.5in / 4in	113	1224608 PSO/EPDM	1205381 PSO	(8) 3052372 EPDM
4in	70	1226284 CELCON/EPDM	1205503 CELCON	(8) 3052372 EPDM
Permeate Tube: Flush cut female elements				
4in	2	1206577 PSO/BUNA-N	1205423 PSO	(8) 3052189 BUNA-N
8in	24	1206598 NORYL/EPDM	1205451 NORYL	(6) 1118747 EPDM
8in	122	1229989 NORYL/BUNA	1205451 NORYL	(6) 3055547 BUNA-N
8in	67	1206624 PSO/EPDM*	1205428 PSO	(6) 1227634 EPDM
8in	127	1231077 316SS/EPDM**	1231006 316SS	6) 1118747 EPDM

*600psi
**1200psi

DEAD END PLUG KITS

Diameter	Kit #	DEP kit Part #	DEP Part #	O-ring Part #
Permeate Tube: Stinger style male elements (0.75in)				
2.5in / 4in	101	1206575 CELCON/BUNA-N	1205507 CELCON	(4) 3052771 BUNA-N
4in	117	3052016 PSO/EPDM	3052070 PSO	(4) 3052372 EPDM
Permeate Tube: Flush cut female elements				
4in	87	1206534 PSO/BUNA	1205436 PSO	(2) 3052189 BUNA-N
8in	119	1229773 PSO/EPDM	1205439 PSO	(2) 1205593 EPDM

ANTI-TELESCOPING DEVICE KITS

Diameter	Kit #	Outer wrap	ATD Part #	
2.5in		Fiberglass, tape, cage	(2) 1205379 PSO	
4in		Fiberglass, tape	(2) 1117163 ABS	5 Vane
4in		Net	(2) 1117602 ABS	5 Vane
4in	4 & 149	Cage	(2) 1205382 PSO	Flat Disc
8in		Fiberglass, Net	(2) 3031386 ABS	16 Vane
8in		Cage	(2) 1205388 PSO	8 Vane

PEA Kits

Diameter	Kit #	Kit Part #	PEA Part #	O-ring Part #	Membrane Element Manufacturer	Housing Manufacturer / Housing Type
0.625-in female permeate tube						
4in	50	1206614	(1) 1205391 PSO	(4) 3052189 BUNA-N (4) 1205580 BUNA-N	GE	GE/Victaulic
4in		1160110	(2) 1160111 PVC	(2) 1143426 EPDM	GE	GE/Flared
0.75-in male permeate tube						
4in	90	1206539	(1)1205448 PSO	(4) 3052189 BUNA-N	GE	
4in	82	1206525	(1) 1205406 PSO	(2) 1205580 BUNA-N (2) 1205581 BUNA-N	Koch/Fluid Systems	
4in	62	1206619	(1) 1205463 PVC	(4) 1205581 BUNA-N	GE	Pentair 4B
4in		1162524	(2) 1140413 PVC	(4) 1151580 EPDM (4) 1118748 EPDM	GE	GE/Victaulic
4in		1158438	(2) PVC Hydranautics		Hydranautics	
4in		1159435	(1) 1158438 PVC	(4) 1151580 EPDM(	GE	GE/Victaulic
4in		1162142	(2) 1162141 PVC	(4) 1143426EPDM (4) 1118748 EPDM	Trisep, TSA	GE/Victualic
4in		1159435	(1) 1158348 PVC	(1) 1151580 EPDM	GE/Filmtec	GE/Flared
4in		1159437	(2) 1158438 PVC	(2) 1151580 EPDM	Hydranautics MSA	GE/Flared
4in		3051678	Protec	(1) 50400003-1 PVC	Protec	Protec
0.75-in female permeate tube						
4in		1162524	(2) 1140413 PVC	(4) 1151580 EPDM (4) 1118748 EPDM	GE/Filmtec	GE/Victaulic
4in		1160112	(2) 1160113 PVC	(2) 1118748 EPDM	Trisep	GE/Flared
0.775-in female permeate tube						
4in		1162851	(2) 1117167 PVC	(8) 1118748 EPDM	GE	GE/Victaulic – Standard
4in		1163362	(2) 1118737 NORYL	(8) 1118748 EPDM	GE	GE/Victaulic – High Purity
4in		1159436	(2) 1158347 PVC	(2) 1118748 EPDM	GE	GE/Flared
0.830-in male permeate tube						
4in		1162513	(2) 1162496 PVC	(4) 1162468 EPDM (2) 1162503 EPDM	Hydranautics	GE/Victaulic
1.125-in female permeate tube						
8in		1239522	(1) 1223016 NORYL-SOLID	(4) 1118747 EPDM	GE	GE/RC
8in		1231007	(1) 1231006 SS316	(4) 1118747 EPDM	GE	GE/RC
8in		1239474	(1) 1231004 SS316 SOLID	(4) 1118747 EPDM	GE	GE/RC
8in		1239496	(2) 1239475 PVC	(4) 1118747 EPDM (4) 1162525 EPDM	Koch/Fluid Systems	GE/RC
8in		1239491	(2) 1239490 PVC	(2) 1158677 EPDM (4) 1118747 EPDM (3) 1159955 PVC spacer	Hydranautics	GE/RC
8in		1239489	(2) 1239488 PVC	(4) 1162501 EPDM (4) 1118747 EPDM	Trisep	GE/RC
8in	106	1227365	(1) 1205454 NORYL	(4) 1118747 EPDM	GE	Codeline
8in		1239489	(2) 1239488 PVC	(4) 1162501 EPDM (4) 1118747 EPDM	Trisep/Filmtec	GE/RC
1.135-in female permeate tube						
8in		1162504	(2) 1115808 PVC	(8) 1118747 EPDM	GE	GE/Tri-Clamp

Diameter	Kit #	Kit Part #	PEA Part #	O-ring Part #	Membrane Element Manufacturer	Housing Manufacturer / Housing Type
8in		1163363	(2) 1144885 PVC	(4) 1118747 EPDM (4) 1185024 EPDM	GE/Desal	GE/Tri-Clamp
8in		1162521	(2) 1144919 PVC	(8) 1118747 EPDM	GE/Filmtec	GE/Tri-Clamp
8in		1162522	(2) 1144886 PVC	(4) 1118747 EPDM (4) 1162525 EPDM	Koch/Fluid Systems	GE/Tri-Clamp
8in		1162523	(1) 1158676 PVC	(1) 1158677 EPDM (2) 1118747 EPDM (3) 1159955 PVC spacer	Hydranautics	GE/Tri-Clamp
8in		1162514	(2) 1162497 PVC	(4) 1124149 EPDM (4) 1162501 EPDM	Nitto-Denko	GE/Tri-Clamp
8in		1162509	(2) 1162493 PVC	(2) 1162501 EPDM (4) 1185039 EPDM	Trisep	GE/Tri-Clamp
8in	105	122734	(1) 1205444 PSO	(4) 1118747 EPDM	GE	GE/Tri-Clamp
3-inch Ports						
8in		1204557	(2) 1204565 PVC	(8) 1118747 EPDM	GE	GE
8in		1204558	(2) 1204566 PVC	(8) 1118747 EPDM	GE	GE

SPACER TUBES (40IN LENGTH)

Diameter	Part #	Description	Dimensions (in)
0.75-in male permeate tube			
4in	1155164	TUBE, PERM, PVC, BLANK	0.83 x 40
1.125-in female permeate tube			
8in	1221315	SPACER TUBE NORYL	1.125 x 1.125 x 40
8in	1227836	SPACER TUBE PSO	1.125 x 1.125 x 40
1.139-in female permeate tube			
8in	1148066	PVC	1.139 x 1.139 x 40
8in	1118744	NORYL	1.139 x 1.139 x 40

4" WAVE CYBER PARTS

Dwg Ref #	Part #	Quantity	Description
1	3031359	1	SEAL, PORT, 300, WAVE, EPDM 512
2	3031390	1	PIN, SIDE PORT, ANIT-ROTATE, SS304
3	3031391	1	SIDE PORT, SA – 312, SS316L
4	3031392	1	RING, RETAINING, A580, SS316
5	3031393	1	RING, RETAINING, SIDE PORT, A580, SS316
6	3031394	2	BAFFLE, A580, SS304
7	3031395	1	ADPTR, PORT, PERMEATE, ABS
8	3031396	1	SEAL, HEAD, EPDM 512
9	3031397	1	SEAL, MVP, EPDM 512
10	3032878	1	PORT, PERMEATE, 4.0, 300PSI, PP

8" WAVE CYBER PARTS

Dwg Ref #	Part #	Quantity	Description
20	3041838	2	RING, EMBEDDED, PERMEATE, 450, WAVE
19	3041837	8	O-RING, SIDE PORT, 450, WAVE

18	3041836	4	RING, RETAINING, SIDE PORT, 2.0, EXT, WAVE
17	3041835	2	PLATE, BEARING, ALUMINUM, 6061-T651
16	3041834	4	ADPTR, SIDE PORT, 450, 2.0, WAVE, COD
15	3035616	1	PLUG, UNION, H-OPTION, ABS, 1.0, WAVE
14	3035615	1	ADPTR, VIC, V-OPTION, PVC, 1.00, WAVE
13	3035613	2	O-RING, H-OPTION, EPDM, 33MM X 0.31MM, WAVE
12	3035612	2	UNION, NUT, H-OPTION, PVC, C1, 50-11, WAVE
11	3035611	2	PLATE, PERM, H-OPTION, PP-FG,C1, 50-11, WAVE
10	3022445	4	RING, RETAINING, SIDE PORT, 2.0, WAVE
9	3021976	2	RING, LOCKING, 316SS, WAVE
8	3021975	2	LTD, CONE, WAVE
7	3021974	2	RING, RETAINING, PERMEATE, WAVE
6	3021973	4	O-RING, PERMEATE, ADPTR, WAVE
5	3012624	4	SEAL, SIDE PORT, 450, 2.0, WAVE
4	3012623	4	SEAL, SIDE PORT, CURVE, 450, 2.0, WAVE
3	3012621	2	SEAL, PERMEATE PORT, 450, WAVE
2	3012611	2	ADPTR, ENDCAP, 450, WAVE
1	3012610	2	SEAL, HEAD, 450, WAVE

ACCESSORIES

Diameter	Kit #
2.5in	1205611 EPDM
4in	1115762 BUNA-N 1116160 EPDM
8in	1118751 EPDM
8.3in	1118750 EPDM 1118749 BUNA-N

Note: Head gaskets are also considered a critical component. Please work with your equipment supplier to obtain the correct replacement head seals.

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