



Membrane CareSM Program

Products and Services for Membrane Systems

Water Technologies

SIEMENS

Membrane Product Guide

8" Membranes

Manufacturer	Siemens Catalog No	Manufacturer's Catalog No	Approx GPD	% Reject
lonpure	06/PL32364-04R	PWS PFC-8	9000	99.6
lonpure	06/PL32364-06R	PWS HS2-8	11200	99.6
Filmtec	CDRC30365	BW30-365	9500	99.5
Filmtec	CDRC8X40D	BW30-400	10500	99.5
Filmtec	CDRC8X40LE	BW30LE-440	11500	99.2
Filmtec	CDRC30365FR	BW30-365FR	9500	99.5
Filmtec	CDRCBW30400/34I	BW30-400/34i	10500	99.5
Filmtec	CDRCBW30440I	BW30-440i	11500	99.5
Filmtec	CDRCLE440I	LE-440i	12650	99.3
Filmtec	CDRC30365FR	SW30XLE-400i	9000	99.7
Filmtec	CDRC30365FR	SW30HR-LE400i	7500	99.8
Filmtec	CDRC30365FR	SW30HR-380	6000	99.7
Filmtec	CDRC30365FR	SW30HR-LE400	7500	99.8
Filmtec	CDRCF8040LH39X	RO-390-FF	10,800	98.0
Filmtec	CDRCHSRO390FF	HSRO-390-FF	9000	99.5
Hydranautics	ROLSY8040	CPA2	10000	99.2
Hydranautics	CDHYCPA3	CPA3	11000	99.6
Hydranautics	CDHYCPA4	CPA4	6000	99.7
Hydranautics	CDHYESPA1	ESPA1	12000	99.0
Hydranautics	CDHYESPA2	ESPA2	9000	99.5
Hydranautics	CDHYESPA3	ESPA3	15000	98.0
Hydranautics	CDHYESPA4	ESPA4	12000	99.2
Hydranautics	CDHYSWC3	SWC3	5900	99.6
Hydranautics	CDHYSWC3PLUS	SWC3+	7000	99.8
Hydranautics	CDHYSWC4PLUS	SWC4	6500	99.8
Hydranautics	CDHYSWC5	SWC5	9000	99.8

4" Membranes

Manufacturer	Siemens Catalog No	Manufacturer's Catalog No	Approx GPD	% Reject
lonpure	06/PL32364-01R	PWS PFC-4	2300	99.6
lonpure	06/PL32364-02R	PWS HS2-4	2800	99.6
Filmtec	ROSTW4040	TW30-4040	2400	99.5
Filmtec	CDRCLP4040	LP-4040	3200	99.2
Filmtec	CDRCXLE4040	XLE-4040	2600	99.0
Filmtec	CDRC4X40B	BW30-4040	2400	99.5
Filmtec	CDRCLE4X40B	BW30LE-4040	2300	99.2
Filmtec	CDRC4X40L	RO-4040-FF	2650	99.5
Filmtec	CDRCF4040L379P	HSRO-4040-FF	1900	99.5
Filmtec	CDRC30365FR	SW30-4040	1500	99.2
Hydranautics	ROLSA4040	CPA2-4040	2250	99.2
Hydranautics	CDHYESPA14040	ESPA1-4040	2600	99.0
Hydranautics	CDHYESPA24040	ESPA2-4040	1900	98.0
Hydranautics	CDHYESPA34040	ESPA3-4040	3000	98.0
Hydranautics	CDHYESPA44040	ESPA4-4040	2500	99.2
Hydranautics	CDHYSWC14040	SWC1-4040	1100	99.6

Note: items in font color orange are stocked by Siemens. For availability of other items, please contact your local Siemens office.

Standard Elements Cross-Reference Guide

8" Membranes

Type	Filmtec	Hydranautics	Koch/Fluid Systems	Toray	Desal	GE Osmonics	Saehan	TriSep
TFC - 365 sq. ft.	BW30-365	CPA2	8822HR-365	TM720-370	AG8040F	Muni RO 350	RE8040-BN	8040-ACM2-TSA
TFC - 400 sq. ft.	BW30-400	CPA3	8822HR-400	TM720-400	AG8040F400	Muni RO 400	RE8040-BE	8040-ACM2-UWA
TFC - 400+ sq. ft.	BW30-440i	CPA3	9822HR-400	TM720-430	AK8040F400			
TFC - LP - 400 sq. ft.	LE-400	ESPA1	8822ULP-400	TM820H-370		Muni LE-RO-400	RE8040-BL	8040-ACM4-UWA
TFC - LP - 400+ sq. ft.	LE-440i	ESPA1	8822ULP-400	TMG20-430			RE8040-BL(N)	ACM5-UWA
TFC - XLP - 400+ sq. ft.	XLE-440	ESPA4	8823UPP-400	TMH20-400			RE8040-BLF	8040-ACM5-UWA
TFC - LF - 365 sq. ft.	BW30-365FR	LF3	8822FR-365	TML20-370		Duraslick RO 8040	RE8040-FN	8040-X201-TSA
TFC - SW - <400 sq. ft.	SW30HR-380	SWC3	2822SS-360	TM820-370	SC8040F		RE8040-SR	8040-ACMS-SPA
TFC - SW - 400 sq. ft.	SW30HRLE-400	SWC3+	2822SS-360 Premium	TM820H-400			RE8040-SH	8040-ACMS-SPA
TFC - SW - 400+ sq. ft.	SW30XLE-400i	SWC5	2822HF-370	SU-720R				
TFC - FF - 390 sq. ft.	RO-390-FF	SanRO CPA3	8822RO-N1		SG8040C	Muni LE-RO-FF-365		8040-M2P3W7
NF	NF90-400	ESNA1-LF	TFC 8921S	SU-620		811NF300(PA)	NE-8040-90	8040-TS80-TSA
NF	NF270-400	HYDRACoRe			DL8040F	811NF100(PA)	NE-8040-40	

4" Membranes

Type	Filmtec	Hydranautics	Koch/Fluid Systems	Toray	Desal	GE Osmonics	Saehan	Trisep
TFC - 4040	BW30-4040	CPA2-4040	4820HR/320HR/4820XR	SU-710L	AG4040FF	414-HR(PA)/414-HF(PA)	RE4040-BN	4040-ACM2-TSF
TFC - LP - 4040	BW30LE-4040	ESPA1-4040	4821 ULP	SUL-G10	AK4040FF		RE4040-FL	4040-ACM4-TSF/ACMS-TV
TFC - TW - 4040	TW30-4040		4040HR	TM710	AG4040TF	415-HR(PA)	RE4040-TE	
TFC - XLP - 4040	XLE-4040	ESPA4-4040	4040 ULP			411-LE(PA)	RE4040-BLF	
TFC - SW - 4040	SW30-4040	SWC1-4040	1820SS/820SS/1820HF	TM-810L	SE4040FF	414-SW2(PA)	RE4040-SR	4040-ACMS-SSF
TFC - FF - 4040	RO-4040-FF	SanRO CPA3-4040			SG4040C			
TFC - HSRO - 4040	HSRO-4040-FF	SanRO ESPA2-4040						
NF	NF-4040				DL4040F/DK4040F			4040-XN45-TSF

Note: Membrane equivalents are based on similar size and functionality. Conversion may require consideration of flow rates changes, adapter modifications and feed water characteristics. Please contact technical support for more information.



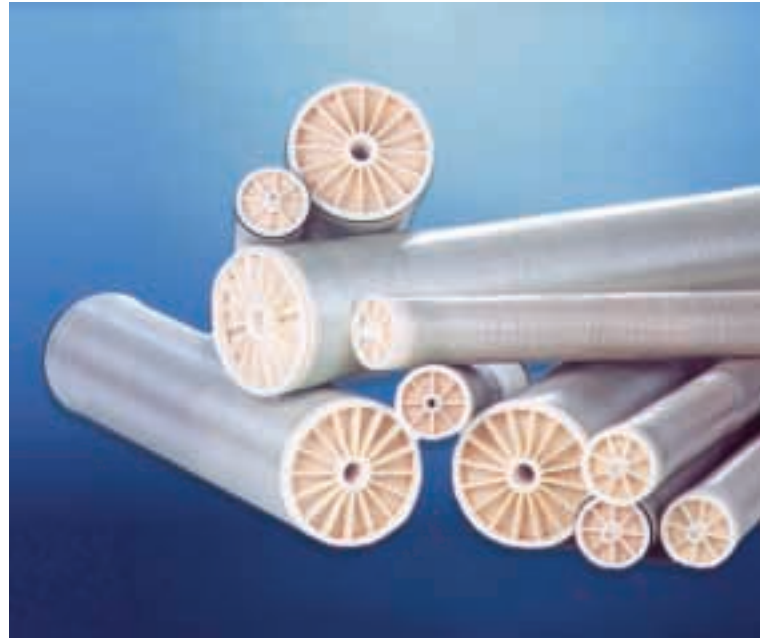
A Complete Care Program for Your Membrane System

Siemens Water Technologies is a leader in providing solutions for high-purity water applications. We offer a wide-range of membrane purification systems featuring proven technologies such as Reverse Osmosis (RO), Ultrafiltration (UF), Microfiltration (MF) and Nanofiltration (NF). We design, build, install, operate and service these systems. With responsibility for operating and servicing over 1,000 RO systems and 50,000+ membranes, Siemens has the expertise and technical-know how to ensure you get the most from your membrane system investment.

The Membrane CareSM Program from Siemens is a comprehensive program designed to provide customers with the products and support services necessary to maintain membrane systems for peak performance and long-term operation. The program includes the sale of replacement membranes, parts and cleaning chemicals, as well as support services such as on-site/off-site membrane cleaning, analytical testing, system optimization analysis and preventative maintenance contracts. This program provides the right combination of products and services to help save time, remain on budget and ensure your membrane system provides continuous, reliable water quality. Siemens offers complete support at every phase throughout the life of your system.

Membrane CareSM Program offers customers:

- Large inventory of stocked membranes from the leading manufacturers
- Same day shipment of stocked membranes
- RO accessories and cleaning chemicals
- Regional membrane distribution/cleaning centers
- On-site and off-site membrane cleaning services
- Membrane Center of Excellence - extensive analytical and laboratory testing
- Proprietary, Performance Evaluation Program - data analysis, normalization and technical system evaluation
- Service and preventative maintenance contracts
- Personnel training and start-up services
- Mobile RO systems for temporary or long-term water requirements
- 24-hour customer service telephone staff
- Trained, technical support telephone staff
- Over 85 sales and service branches throughout North America and Canada



Consumables and Replacement Parts

Siemens helps ensure that your membrane system continues to perform by providing access to our large inventory of replacement membranes, common wear-and-tear parts and membrane cleaning chemicals. We maintain inventory of these critical components at our regional distribution centers so we can respond to your needs quickly and efficiently, often shipping these items within 24 hours of order receipt.

Replacement Membranes and Spare Parts

Siemens supplies replacement membranes and has relationships with all of the major membrane manufacturers. For our customer's convenience, we inventory FILMTEC® and Hydranautics® membranes at our regional distribution facilities. This enables us to meet short lead times, and thereby minimizes system downtime.

In addition to membrane elements, we also stock many wear-and-tear, maintenance and spare inventory items. Retrofitting your RO system to use different membranes may require permeate tube adaptors, specific pressure vessel endcap adaptors or both. Siemens has extensive experience retrofitting different RO systems and carries

most adaptors and interconnectors to allow for smooth membrane change out with minimum risk and downtime. Pressure gauges, valves, pressure vessel components and many other RO system parts from most major manufacturers are available from Siemens at competitive prices.

Monitoring the influent and effluent water characteristics of the RO system enables you to guarantee the quality of the product water, minimize membrane fouling and reduce pretreatment costs. Siemens offers a wide variety of water quality meters, flow meters and test kits for nearly every application – with many sensors and accessories stocked for quick replacement.

Automatic silt density index monitors greatly reduce the work and wait of testing the plugging nature of RO feed water at a manageable cost. This microprocessor-controlled automatic unit continuously monitors the feed water sidestream to prevent stagnant line conditions and uses standard filters to minimize the cost of usage. Siemens can easily install an automatic silt density monitor to help prevent premature membrane fouling and training your operator takes only minutes.



Membrane elements before and after chemical cleaning.

Quality melt blown, string wound and pleated cartridge filters in many different lengths and micron ratings are stocked in our warehouses and are ready to ship on short notice. Siemens can help select the best suited and cost effective filters to protect your RO system and meet product water requirements.

Cleaning Chemicals

During normal operations, membranes can become fouled by scaling salts, inorganic oxides, colloidal material or biological matter. Fouling involves the entrapment of material in the feed/brine path or deposits on the surface of the membrane. These deposits can accumulate until there is a loss in productivity, an increase in feed pressure requirements, a loss of salt rejection or all three. Siemens also offers services and products to help determine the source of your fouling problem and to make recommendations on the selection and purchase of proper chemical treatment. We work with all the RO chemical manufacturers and will provide the best combination of RO anti-scalants, chemical feed systems and dosing rates to keep your RO system running smoothly. For municipal and beverage applications, Siemens uses NSF-certified treatment chemicals and processes.

We provide technical assistance with membrane cleaning, either on-site using the customer's clean-in-place (CIP) skid or by removing and returning the membranes to one of our membrane cleaning facilities.

RO Fouling Components

Metal Oxides

- Iron
- Manganese
- Aluminum

Scaling Salts

- Calcium Carbonate
- Calcium Sulfate
- Barium Sulfate
- Strontium Sulfate
- Calcium Fluoride
- Silica

Biological

- Organic Slimes
- Bacteria

Colloids (SDI)

- Silica
- Clay
- Silt
- Rust

Organic (TOC)

- Humic Acids and Other Natural Organics
- Coagulants - Floccing Agents
- Incompatible Pretreatment Chemicals



Membrane Support Services

Flexibility plays a significant role in support service programs from Siemens Water Technologies. We offer customer-tailored programs that provide the level and frequency of support needed to stay within your operating budget. Some of the on-site services we offer include operator training, start-up, membrane cleaning and preventative maintenance.

The Siemens Membrane Center of Excellence located in Rockford, Illinois, provides leading edge design, analytical and evaluation services to help maximize your membrane investment and minimize life-cycle costs.

Technician Qualifications

Siemens maintains a formal training and certification program for all field service technicians. The training consists of classroom, on-the-job training and comprehensive testing for each class of technician. Each employee must pass a comprehensive, closed-book exam at the end of the training course. Technicians are trained in system and membrane maintenance for industrial, beverage and municipal systems. They understand the unique differences and operating challenges associated with each of these applications.

Our training and certification program ensures that the technician arriving on-site is qualified and proficient in servicing the systems at our customer's site.

Service Contracts & Preventative Maintenance

The optimal operation and maintenance of your membrane system requires frequent monitoring, documentation and adjustments. A Siemens service contract allows customers to select which services they need, service frequency and billing configurations – all of which can be upgraded at any time. Typical maintenance agreements include warranty extensions, preventative maintenance, emergency repair, parts and expendables replacement.

After equipment selection has been made, Siemens can provide a team of process experts to assist with system installation and start-up. Our factory and field project team will assist in bringing the system on-line, monitoring the process through several production cycles and show operating personnel all the process adjustments necessary to ensure the system's product water is what you expect.



Autopsy Techniques:

- External and internal visual exam with pictures
- As received membrane performance testing – flux, pressure and percent reject
- Bubble testing – physical integrity of the membrane envelope
- Dye Testing – Membrane surface integrity
- Fujiwara test – Chlorine oxidation of polyamide layer
- Metals Analysis
- Digestion – ICP
- SEM EDX
- FTIR spectroscopy
- HPLC-FTI and/or UV spectroscopy
- GCMS spectroscopy
- X-ray fluorescence spectroscopy
- Loss on ignition – organic vs. Inorganic foulant
- Microscopy of membrane surface with pictures
- Coupon testing of membrane surface with or without chemical cleaning evaluation with pictures

Membrane Cleaning

There are two membrane cleaning options to consider – cleaning at your facility (on-site) or at our facility (off-site). You may choose to use your clean-in-place (CIP) skid using standard cleaning procedures. Depending on your needs, we can provide training or on-site labor personnel, along with the necessary cleaning chemicals. Or you may choose off-site cleaning.

Analytical and Laboratory Testing

Membrane systems are complex systems with components that are linked to each other. Siemens provides process analysis including feedwater and outlet water testing, permeate analysis and particle size analysis. Additionally, we provide a range of non-destructive and destructive testing, as well as complete autopsies on the elements themselves. Membrane analysis assists in identifying the fouling agent(s), proper cleaning techniques and pretreatment methods to prevent or minimize membrane fouling. Autopsies examine the membrane's integrity, performance characteristics and foulants, and help determine the proper cleaning chemicals and procedures to remove the foulants. Customers who choose to have a

membrane autopsy receive a full-color report which details findings and includes recommendations based on the autopsy.

Performance Evaluation Program

An important part of the Siemens service offering is to assist customers achieve maximum performance from their membrane system. Our proprietary, Performance Evaluation Program is a computer-based tool which evaluates current operating conditions. We determine the existing performance of the system from the pretreatment to the effluent, current operational protocols, cleaning techniques, and economic factors. This data is compared to the theoretical by component in our Performance Evaluation Program. This allows us to evaluate the current membranes, system operation parameters and replacement times, based on your economic factors, and make appropriate recommendations.



Off-site Membrane Cleaning

Siemens' off-site membrane cleaning programs vary to meet individual customer needs and budgets. Customers choose the program level based on specific requirements for feedwater analysis, fouling and cleaning chemical determination, pre- and post-element testing and report documentation.

The results of off-site cleaning are dramatically different from on-site cleaning. While conventional on-site cleanings can increase the life of a membrane, the flow rates eventually decline. Figure 1 is an example of the decline of an RO system and the non-recovery to new performance after on-site cleaning.

Off-site cleaning at one of our Membrane Care Centers provides better cleaning, extends membrane life and is

more cost effective than on-site cleanings. Our proprietary equipment and strict cleaning process – air dosage rates, temperature and flow rates – are tightly controlled to ensure optimum cleaning performance and restore RO membranes to or near the original manufacturer's performance specifications. This results in longer intervals between cleanings and/or replacement. The cleaning process does not affect the structural integrity of the membrane, and therefore does not void the manufacturer's warranty.

Figure 2 illustrates the dramatic gains that can be achieved with off-site membrane cleaning vs. on-site cleaning. Note that the off-site cleaning is typically less frequent and the performance loss is less.

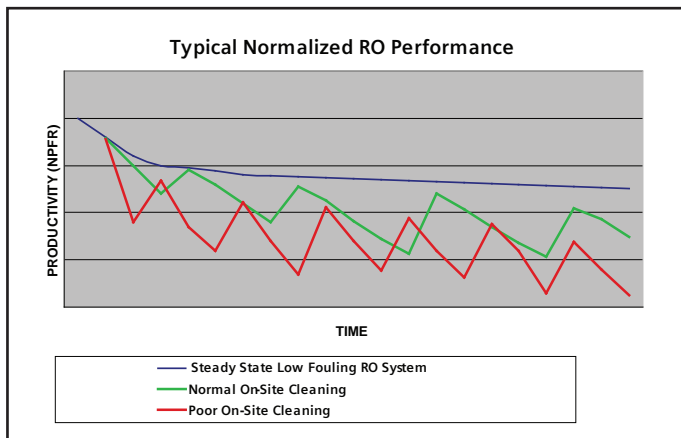


Figure 1

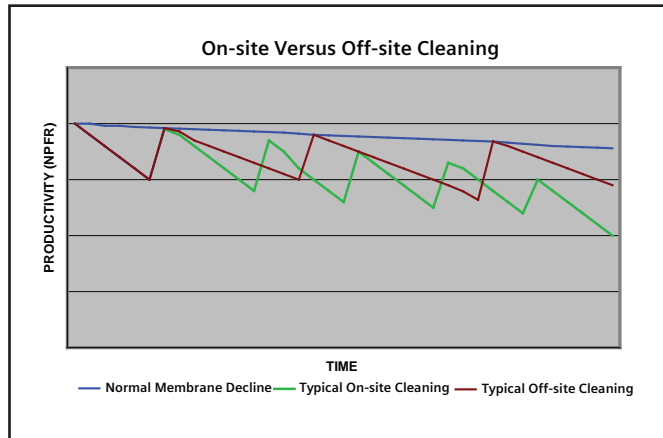
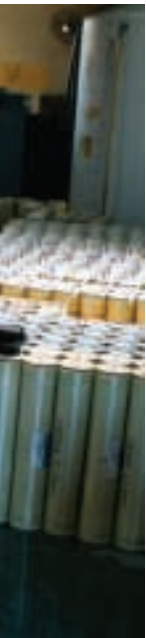


Figure 2



Benefits of Off-site Membrane Cleaning

- Increases membrane life
- Costs less than replacement membranes
- Improves membrane reject and flow, reducing post-RO polishing costs
- Reduces direct labor costs
- Reduces power consumption
- Removes discharge of cleaning chemicals, avoiding wastewater issues or plant upsets
- Reduces water consumption and related waste disposal volume caused by fouled membranes
- Eliminates record keeping and storage of cleaning chemicals.

Siemens offers three levels of off-site cleaning services for membranes. Many customers choose the Platinum Level Cleaning Program which provides 100% pre-testing and evaluation to determine fouling characteristics, and "best" cleaning procedure as determined from performance data. Post-testing membranes determines the effectiveness of the cleaning and a printed report interprets the pre- and post-data.

Off-site cleaning provides the advantages of reduced direct labor costs and system downtime. It also reduces the need for storage of hazardous cleaning chemicals on-site. And, since off-site cleaning provides a more effective cleaning of the membranes, customer's realize an

increased membrane performance, longer time between cleanings and increased membrane life. Customers of this service report reductions in operating and membrane life cycle costs.

Optimally, membrane cleaning should be performed as a matter of routine maintenance rather than by necessity. Our experience has shown that cleanup frequency varies from weekly to annually. As a general rule of thumb, we recommend that systems with good feedwater quality and pretreatment require a cleaning once every three to six months as a part of a good maintenance procedure.

Platinum Level Cleaning Program:

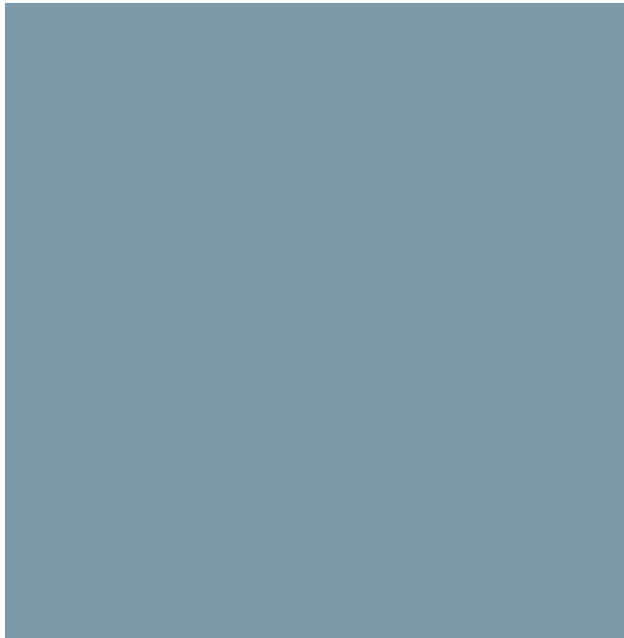
- Determination of the proper cleaning chemicals, dosage rates and sequences
- Evaluation of feedwater analysis and operation data prior to fouling
- In-house evaluation and analytical diagnostic testing, as required
- 100% of the elements pre- and post-tested
- Elements bagged, boxed, palletized and (on request) preserved
- Report issued with the membranes

Gold Level Cleaning Program:

- Determination of the proper cleaning chemicals, dosage rates and sequences
- Evaluation of feedwater analysis and operation data prior to fouling
- In-house evaluation and analytical diagnostic testing, as required
- Approximately 10% of the elements pre- and post-tested
- Elements bagged, boxed, palletized and (on request) preserved
- Report issued with the membranes

Silver Level Cleaning Program:

- Standard low pH followed by high pH cleaning procedures
- No pre- and post-testing
- Elements bagged, boxed, palletized and (on request) preserved
- Recommended for high volume quick turnaround applications



Additional Support Services

Customers who partner with Siemens have the confidence of working with leaders in the water treatment industry. Our businesses, which provide engineering and design, manufacturing, customer service and field operations, have unmatched experience in providing solutions to water and wastewater treatment challenges. With the best brands and people in the industry, Siemens has the experience and expertise to identify the right solution for you.

Advantages of partnering with Siemens Water Technologies include:

Local Service Branches

At Siemens, we combine expert technical and operations knowledge with the largest network of trained, field service technicians. Our field support includes trained service personnel with experience in maintaining and operating our own systems as well as equipment provided by other companies. Our technicians provide prompt, courteous service to help customers manage their water treatment system with minimum downtime and maximum use of direct labor and operating budgets.

These service technicians are ready to assist customers from over 85 offices in North America. Local service branches allow us to schedule service and repairs when you need them, not when the airfare is cheaper. In fact, we are positioned to reach over 85% of the North American population in less than a two hour drive.

Inventory Logistics and Support:

Our inventory logistic and technical support program helps multi-facility and multi-national companies reduce on-site inventory levels, minimize system downtime and improve water quality. Siemens evaluates each of the customer's water treatment systems to determine which replacement components and spare parts will be inventoried. We work with the customer to establish basic on-site inventory requirements and arrange for other necessary inventory to remain at one of our regional stocking and distribution facilities. Quick and easy access to standard consumables and critical spare parts allow customers to maintain their systems and productivity with minimum downtime and to reduce their system life cycle costs.



24/7 Customer Service and Technical Support

Peace of mind comes from knowing you can reach Siemens 24 hours a day, 7 days a week. Our customer service department is available to assist with information on parts, place orders, locate a local Siemens service branch or contact a sales representative. If you have technical questions, we have industry experts ready to assist at our toll-free, technical support hotline.

Emergency/Temporary Mobile Water Treatment Systems

Mobile water treatment systems provide supplemental water to handle short-term water shortages or meet peak demand. We provide temporary water while customers await new water systems to be delivered and installed; while an existing system is shutdown for scheduled maintenance or due to specific regulatory issues. Siemens mobile fleet features state-of-the-art, self-

contained systems in equipment and process configurations to match customer's site and raw water conditions. Systems contain instrumentation and equipment for a fully automatic and monitored operation, and are backed by an inventory of critical components. Installation is minimized with quick hose and simple utility connections, all of which are performed by our skilled installation and service technicians. And with seven regional dispatch and regeneration facilities, we can service and exchange these trailers with rapid response and a quick turnaround. When using our mobile systems, Siemens guarantees the water quality and quantity, while assuming responsibility for the storage, handling and disposal of hazardous chemicals, ensuring a safer work environment.

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