



Total Water Management for the Petroleum and Petrochemical Industries

Water Technologies

SIEMENS

Siemens Water Technologies firsts/introductions to the market

1895 – Link-Belt® Traveling Water Screen	1959 – Countercurrent Regeneration of Ion Exchange Resins	1986 – Continuous Microfiltration System
1912 – Zeolite Water Softening	1963 – Externally Regenerated Condensate Polishers	1987 – CDI® Continuous Deionization System
1920 – Zeo-Rex® Manganese Zeolite	1967 – Hydro-Clear® Pulsed Bed Sand Filter	1987 – Envirex® Fluidized Bed System
1928 – Tow-Bro® Sludge Collector	1968 – Orbal® Aeration Process	1992 – Auto-Shell™ Walnut Shell Filter
1937 – API Separator	1969 – Corrugated Plate Separator	1992 – Westates Carbon Opens GAC Reactivation Facility
1938 – Ion Exchange Water Softening	1972 – Quadricell® IAF/IGF Separators	1994 – Hydrocyclone
1944 – Spiractor™ High Rate Lime Softener	1972 – PACT® System	1999 – USFilter/Envirogen MTBE Treatment Partnership
1952 – Mixed Bed Ion Exchange Process	1978 – Hydrocell® IAF/IGF Separators	2003 – Cannibal® Solids Reduction System
1955 – AVGF® Gravity Filtering Apparatus	1981 – VARI-CANT® Jet Aeration	2003 – USFilter and Paques bv of the Netherlands sign license agreement
1957 – Dissolved Air Flotation Separator	1983 – OMNIFLO® SBR	2006 – Petro™ Membrane Bioreactor
1958 – Zimpro® Wet Oxidation Process	1985 – Gravisand® Traveling Bridge Filter	

Our Core Business is Water

We Provide Bottom Line Results

There are advantages to working with Siemens Water Technologies, a global company whose core business is the processing and treating of water and wastewater. Among these are:

Bottom Line: We can positively affect your cash flows by providing efficient, low maintenance water or wastewater treatment equipment and services for your specific operation.

Consistency: We can ensure that a dependable supply of water is available for your production processes, treated to the levels required.

Compliance: We can deal with and have solutions for any wastewater regulatory issue, including VOC and H₂S emissions. This includes complete wastewater

recycling/reuse for cooling tower make-up and boiler feedwater.

Service: Siemens has offices in over 190 countries around the world, ensuring local representation and quick response to your water treatment needs.

Experience: We have well over 80 continuous years of experience in the petroleum and petrochemical industries. We developed the first API oil/water separator, the first DAF separator, Zimpro® wet air oxidation system, and many other crucial processes.

Safety: All of our products are risk assessed for safety, an assurance not always offered by others.

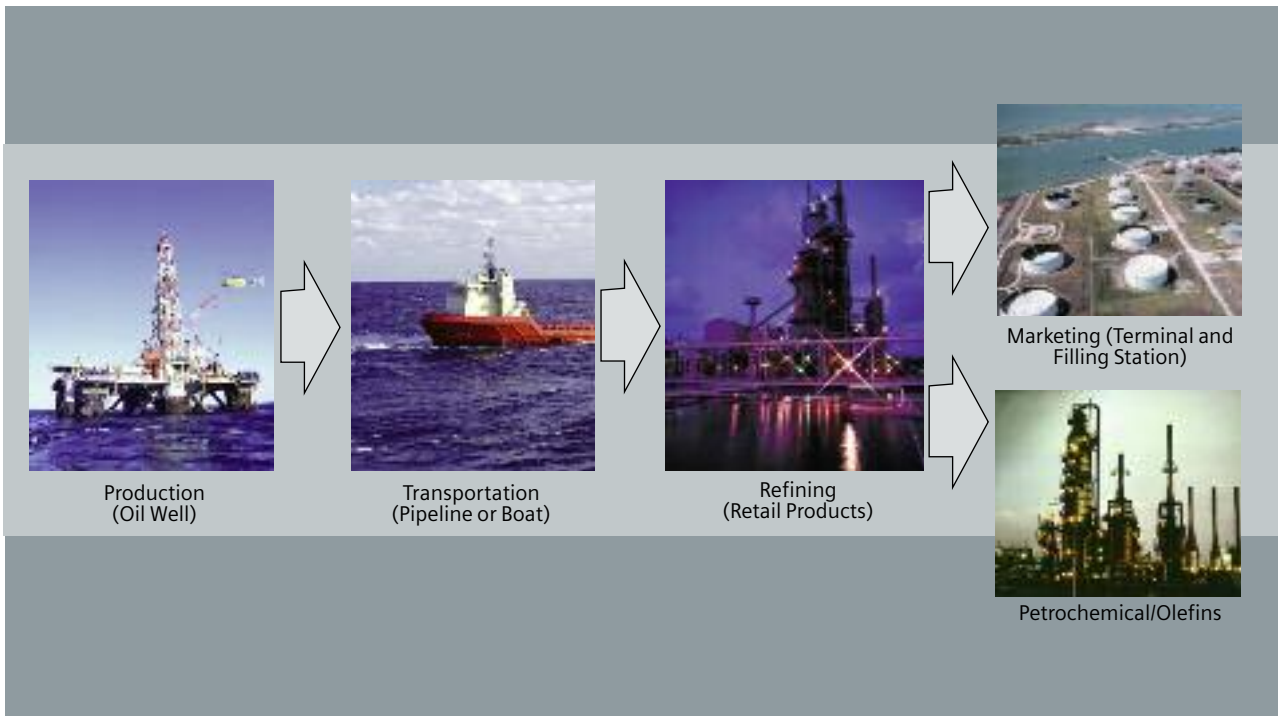
Single Responsibility: We have over 100 different products and processes that can be used to solve your process water or wastewater treatment needs. We can handle

the entire job, so that you can do yours.

Outsourcing: We are the leader in the outsourcing of water and wastewater treatment, with operations at over 50 facilities worldwide. Our experience and product depth allows us to provide you with financial and operational incentives to consider outsourcing.



Let Siemens Water Technologies solve your water management needs.



Siemens Water Technologies is Upstream and Downstream

Siemens Water Technologies provides total water management for all waters used by, generated by or emanating from the petroleum and petrochemical industries. Whether upstream or downstream, no matter what the application or its global location, we have the expertise needed to resolve your water issues.

We can implement a comprehensive, start-to-finish treatment program or apply a single unit process. Specifically, we can handle and guarantee the results from typical processes such as:

- Produced water from oil and gas wells
- Water for oil well injection
- Ballast water from oil tankers
- Wastewater from refineries and petrochemical plants
- Water draws and tank bottoms from bulk storage terminals

- Process water for cooling towers and boilers
- VOC and H₂S emissions from upstream and downstream operations
- Treatment of wastewater for reuse/recovery/ recycle

We do everything with water that needs to be done. Providing mobile water services. Recycling, recovering and reusing refinery sized inorganic and organic waste streams. Handling turnkey activated carbon services for refinery NESHAP programs. And removing MTBE from contaminated groundwater in or around petroleum industry operations.

In every segment of the petroleum and petrochemical industries, our customers include the world's largest companies, many operating under stringent regulatory compliance efforts, and many relying on our processes and equipment to meet these standards. Siemens Water Technologies

provides complete water and wastewater treatment solutions. Our total water management solutions offer accountability, system competence, integrated technologies, experienced technical support. . .and a single source relationship you can depend upon.



Our total water management resources are the most extensive in the world.

Our Oil and Gas Production Technologies

- Waterflood and Water Injection
- Traveling Water Screens
- Media Filters
- Clarifiers
- Nanofiltration Membrane Systems
- Thickeners
- Presses
- Centrifuges
- Chemical Feed Systems
- Electrochlorination Systems
- Produced Water Treatment
- Hydrocyclones
- API and CPI Separators
- Flotation Separators
- Media Filters
- Biological Treatment
- Softeners
- Thickeners
- Presses
- Centrifuges
- Chemical Feed Systems
- Electrochlorination Systems



We offer flexible configurations of liquid-liquid and solid-liquid hydrocyclone systems.

Oil and Gas Production

Proven Capabilities

The ability to produce clean water is vital to the industry – especially when you need to remove solids from water used for oil field injection or to clean oily produced water before re-injection or discharge to the environment. Siemens Water Technologies, through its total water management approach, can ensure your production requirements are met and your liability is minimized.

For sea water injection or produced water cleanup, on-shore or off-shore, we have the industry's largest range of treatment equipment. We can offer individual process components or the entire integrated treatment system for large volume water applications such as:

- Seawater for oil field waterflood
- Produced water treatment
- Ballast water treatment
- Storm water runoff

Among our key products are the liquid-liquid and solids-liquid hydrocyclone separators, which economically and effectively remove gross oil and solids from a wide

variety of waste streams. They can be custom designed to remove a wide variety of free oil droplet and solids particle sizes.

Our Chloropac® electro-chlorination system generates sodium hypochlorite solution from seawater on-site, on-demand to ensure freedom from fouling by marine organisms in waterflood and other applications. For inland locations, our OSEC® system can generate sodium hypochlorite solution from brine.

If you need to remove oil from large volumes of produced water in your oil field, our Induced Gas Flotation (IGF) systems are among the most efficient methods available.

Our Hydrocell® gas induction system provides the equivalent water quality of an impeller-driven system, yet weighs less and is economical and easily maintained.

Our rugged Quadricell® system uses a motor-driven impeller mechanism to forcefully induce an air/gas mixture into the water, thereby separating the oil from the water.



Our DGF separator system, using the patented Brise™ recirculation pump, is an economical gas flotation system for produced water.



The CPI separator is a cost effective means to remove free oil from produced water.

Our liquid/liquid hydrocyclone is a highly advanced, yet non-complicated oil/ water separation device. It provides maximum separation efficiency for the smallest space impact of the available technologies.

Siemens Water Technologies has an extensive range of solid/liquid hydrocyclones. Sizes range from 1-inch hydrocyclones for removal of particles below 5 micron, to 24-inch hydrocyclones for more coarse separation. Materials range from urethanes through a range of alloys to ceramic materials.

Our DGF separator technology is specifically designed to provide efficient removal of the smallest oil particles in produced water applications. The process includes our proprietary Brise™ pump, which pre-dissolves air, or other gases, in the recirculation water, eliminating the need for costly pressurization tanks,

resulting in a low cost, footprint efficient system. The advanced hydraulic design of our flotation tank results in high hydraulic loading rates, further reducing the cost and footprint of the DGF separation technology, compared to other produced water flotation separation technologies.

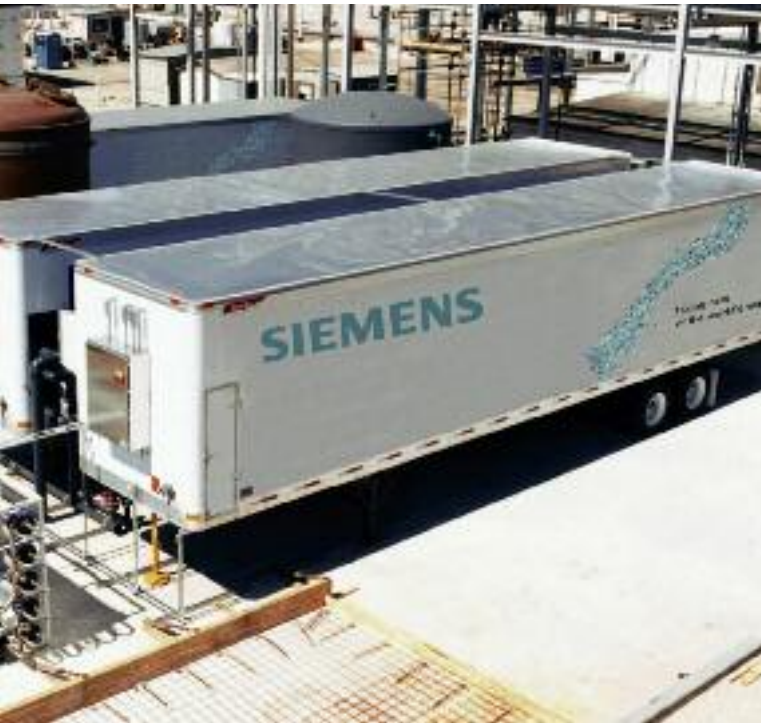
To filter oily water, our Auto-Shell™ filter uses black walnut shells with a high affinity for oil, low hardness and high resiliency. The use of a scrub pump and vessel, which can be common for multiple filters, eliminates the need for air scour blowers and improves the cleaning process.

When low hardness for steam injection is required, the solution is ion exchange softening. We have long been the leader in this technology. As such, we have the expertise to evaluate your feedwater and to recommend the ion exchange system to best meet your needs. All components, including

internal distribution and collection systems, solid state controls and system piping, are custom engineered and manufactured to stringent quality standards.



Walnut shell filters remove almost 100 percent of free oil from produced water.



Siemens Water Technologies offers mobile water treatment system to meet any water quality requirement.



We provide a wide variety of clarifiers to treat surface water for suspended solids, hardness and turbidity removal.

Process Water Treatment

The handling of process water is not at the top of everyone's list, since it is often a set-and-forget task when the plant is running. Yet, the treatment of process water has a substantial and serious impact on bottom line results in the short term as well as over the life of the equipment.

Improperly conditioned boiler feedwater, for example, leads to higher chemical, maintenance and energy costs in the short term. Over the long term, it can lead to premature equipment replacement because of corrosion, scaling and the subsequent loss of production.

The quality and reusability of your process water is just as important as the other raw materials that are employed in your production; and the cost and availability of raw water continues to become more of an everyday concern. These factors, along with increasingly tighter restrictions on wastewater discharge, mean that the entire process water handling system must be designed, maintained and run properly.

Our Process Water Technologies

- Screening/Grit Removal
 - Trash Rakes
 - Traveling Water Screens
- Suspended Solids Removal
 - Solids Contact Clarifiers
 - Adsorption Clarifiers
 - Circular Gravity Clarifiers
 - Rectangular Gravity Clarifiers
 - Gravity Filters
 - Pressure Filters
 - Membrane Filtration
- Solids Handling
 - Belt Filter Presses
 - Filter Presses
 - Gravity Thickeners
 - Centrifuges
 - Sludge Dryers
- Dissolved Solids Removal
 - Cold Process Softeners
 - Zeolite Softeners
 - Demineralizers
 - Continuous Electro-Deionization
 - Reverse Osmosis Systems
 - Condensate Polishers
- Dissolved Gas Removal
 - Deaerating Heaters
- Chemical Feed Systems
- Residuals Management
- Flow Meters



Our reverse osmosis systems remove more than 98 percent of the dissolved salts and all colloidal and suspended matter greater than 0.05 microns.



Siemens offers a wide variety of both pressure and gravity filters.

Our total water management program is an asset for you to draw upon. By uniting our expertise and your knowledge of your precise requirements, we spotlight the areas that can be changed to help you produce more product, less expensively, with fewer complications and restrictions.

Our expertise includes the facilities for virtually every kind of water analysis and treatability study, and the capabilities to perform a plant or specific process water audit.

Because we have so many available products and processes, we can discuss without bias a number of different directions based on these results:

- First, should you require it, we can own, manage and operate your entire process water treatment system, including maintenance, under terms favorable to you. As part of this program, we can ensure your process has the amount of water and the quality needed to meet your production goals.
- Second, we can design and equip a new water treatment train for your operation from the raw water intake system to the final use point, with intervening steps for suspended solids and dissolved solids removal.

As a corollary, we can provide individual unit processes such as our packed bed deionizers, which improve water quality significantly while using 50 percent less chemicals; or our patented CDI® Continuous Deionization system to purify water without chemicals; or our MEMCOR® CP continuous membrane filtration systems which are capable of replacing primary clarifiers or treating secondary effluents for recycle/reuse as cooling tower or boiler make-up.

- Third, our mobile water services can give you trouble-free water without capital expense in temporary or emergency situations; in instances when high quality water is needed for pilot facilities; or when system scale-up flexibility is required.

For mobile systems, a wide range of media filters, softeners, deionizers, ultra-filtration systems and reverse osmosis systems are available. We stringently control the quality of our resins, membranes, chemicals and regeneration processes to ensure reliable and high quality water.

Siemens Water Technologies is your one-stop shop, and we are the single source relationship you can depend upon.

Our Wastewater Technologies

- Primary Oil/Water Separation
 - API Separators
 - Corrugated Plate Separators
 - Hydrocyclones
- Secondary Oil/Water Separation
 - DAF/DGF Separators
 - IAF/IGF Separators
 - Walnut Shell Filters
- Biological Treatment
 - Cannibal® Solids Reduction System
 - Anaerobic Treatment Systems
 - Petro™ Membrane Bioreactor
 - Surface Aerators
 - Jet Aerators
 - Sequencing Batch Reactors
 - Vertical Loop Reactors
 - Orbal® Aeration System
 - Field-Erected Biological Treatment Plants
 - Fine Bubble Aeration
- Coarse Bubble Aeration
- Rotating Biological Contactor
- Trickling Filters
- PACT® System
- VertiCel® System
- Biological Clarification, Separation
 - Scraper Clarifiers
 - Tow-Bro® Clarifiers
 - Rim-Flo® Clarifiers
- Tertiary Treatment
 - Hydro-Clear® Sand Filters
 - Gravisand® Traveling Bridge Filters
 - Multiwash® Filters
 - Multi-Media Filters
 - Membrane Filtration Systems
 - Reverse Osmosis Systems
 - Activated Carbon Systems
- Solids Handling
 - Gravity Thickeners
 - Belt Filter Presses
 - J-Press® Filter Presses
 - Centramax™ Centrifuges
 - J-Mate® Sludge Dryers
 - Carbon Regeneration
- In-Process Treatment
 - Zimpro® Wet Oxidation System
 - Metals Precipitators
 - Coker Clarifiers
 - Desalter Oil/Water Separators
 - Selenium Removal Units
- Residuals Management
- VOC and H₂S Control
- Wastewater Reuse
- Chemical Feed Systems
- Groundwater Remediation
- Fully Permitted RCRA Hazardous Waste Facilities

Wastewater Treatment

Wastewater treatment in the petroleum refining and petrochemical industries is not a simple matter. Groundwater contamination. VOC control. Double containment. High strength and toxic waste streams. Effluent toxicity. Wastewater reuse. The list is endless, and the regulatory provisions are nearly as complex.

Our total water management approach, however, helps strip out the complexity. Our methodology means your application is reviewed from a number of different angles, and, with you, the critical parameters are determined. They may involve regulatory compliance. They may include space constraints, VOCs, operational complexity, capital costs, operating costs, double containment and operational flexibility, among others.

Our focused petroleum industry applications team, led by experienced senior engineers, coordinate the Siemens Water Technologies response, drawing upon over 80 continuous years of experience in treatment of petroleum industry wastewater with 1000's of installations worldwide. Our response may be for a single product, such as the activated carbon adsorbers for

groundwater remediation, or a Folded Flow® dissolved air flotation separator for separation/recovery of suspended oils. Or it may include several pieces of equipment ranging from primary oil/water separators to biological treatment to effluent filtration to wastewater recycle/reuse technologies.



Four, 16-foot (4.88 meter) wide by 160-foot (48.76 meter) long API oil/water separators were shop fabricated and finish painted before shipment.



The Orbal® aeration system has been proven for performance and flexibility of total nitrogen control in numerous petroleum applications.



The Zimpro® wet oxidation system is used primarily for spent caustic waste treatment, but can be used successfully in other applications.

Because Siemens Water Technologies offers the most extensive array of services and equipment, we can provide you the right solution for your specific application. For everything from petroleum refinery and petrochemical plant wastewater to ballast water treatment to water draws and tank bottoms, we can help.

We can provide standard or custom equipment to do the job at extremely competitive pricing. We can provide the laboratory, bench scale or pilot testing required to ensure full scale systems are properly designed. And we have every service required to keep your plant running efficiently and trouble-free.

The wastewater unit process or complete system we provide will be compatible with existing equipment or processes, integrated with controls within your existing framework, and accommodating your residuals management needs.

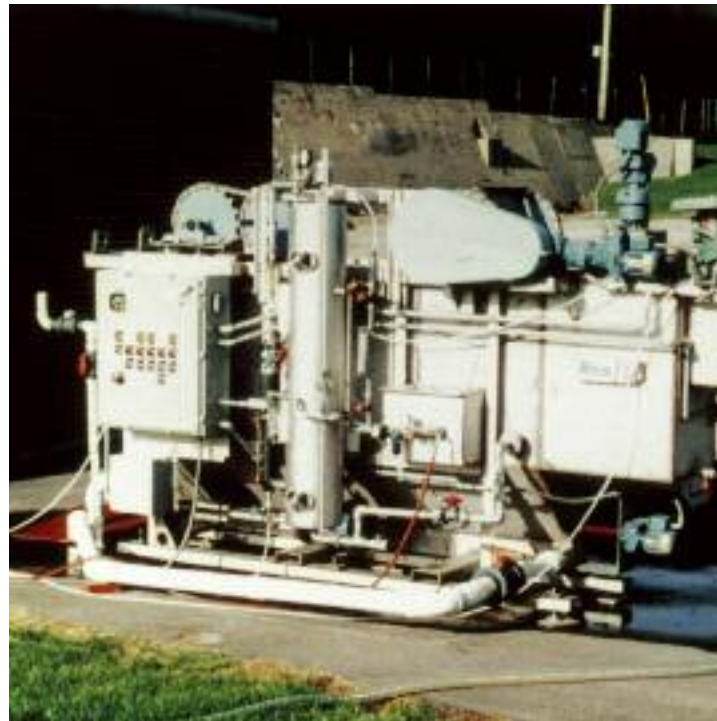
Moreover, our total water management approach gives you one contact for accountability. That way, you can turn your efforts to what you do best, while we take on the responsibility for what we do best – wastewater treatment and regulatory compliance.



Siemens Water Technologies offers single source responsibility for process design, equipment supply and field installation.



We offer activated carbon to meet all of your process, water and wastewater treatment needs.



Dissolved air/gas flotation is one of many types of pilot units offered by Siemens Water Technologies

Your Total Water and Wastewater Treatment Solution Provider

Our total water management approach means we can provide solutions for every water and water related issue in your hydrocarbon processing operation.

If you need pilot or laboratory studies, count on us. We have a number of worldwide laboratories that can perform comprehensive testing or can run any number of different bench scale tests. Over 50 different treatment processes can be tested by fully equipped mobile pilot units.

If you need chemical feed equipment, we can handle every need from bulk storage/feed to small chemical metering pumps. Our line includes pH adjustment, as well as coagulant, flocculant, nutrient and chlorine feed.

And for the ancillary equipment, from sophisticated multi-panel electrical controls to screw pumps to passive intake screens, Siemens Water Technologies has the equipment you need.

Of course, one of our core capabilities is to combine all the equipment and services we offer into the design, supply and guarantee of complete water and wastewater treatment systems. This provides single source responsibility and the lowest costs possible for our petroleum clients around the world.



Completely shop fabricated equipment skids can significantly reduce field installation cost and schedules.



The LO/PRO® scrubber is a high efficiency "wet chemical" scrubber, all in a small footprint.

Emergency vapor scrubber systems prevent potentially dangerous gas release.

Siemens Water Technologies also operates one of the nation's largest activated carbon products and services organizations. Our complete line of liquid and vapor phase adsorbers, designed for the efficient use of activated carbon, are ready to be shipped from our multiple facilities worldwide. And through our qualified technical staff, we can assist you in all areas. We can design the carbon system; supply the proper adsorbers and activated carbon; provide the carbon changeout services; package and transport the spent carbon; recycle the spent carbon at our RCRA Part B licensed reactivation facilities; and provide a certificate of reactivation to complete the turnkey service.

If you need H₂S or mercaptan removal, we offer a complete range of solutions that have been developed to provide maximum value. Our equipment meets treatment objectives while significantly reducing chemical costs and enhancing reliability. Patented technologies such as the LO/PRO® fume scrubber, incorporate design elements that cut chemical consumption in half and significantly reduce footprint. The LO/PRO® scrubber is a high efficiency, "wet chemical" scrubber, with a design incorporating a

unique arrangement of baffles to provide a multi-stage, "unitary construction" packed tower scrubber. The baffling maximizes air throughput while minimizing the footprint and height of the vessel.

Our Emergency Vapor Scrubber Systems (EVSS) are used in applications where chlorine gas is used to disinfect facility water or wastewater. The systems are available in modular or bulk formats, and their patented design ensures that potentially dangerous gas release are neutralized prior to discharge into the environment.

We can recommend the best product or process for your facility because Siemens Water Technologies is experienced with and offers nearly every possible process water and wastewater treatment product available – and our single bias is to serve you well. We are a globally oriented company with financial strength, immense product resources and the collective expertise of thousands of skilled engineers. The combination is your assurance that we're committed to you and your requirements today and in the years ahead.

AVGF, Auto-Shell, Brise, Cannibal, CDI, Centramax, Chloropac, Envirex, Folded Flow, Gravisand, Hydro-Clear, Hydrocell, J-Mate, J-Press, LO/PRO, MEMCOR, Multiwash, OMNIFLO, Orbal, OSEC, PACT, Petro, Quadricell, Rim-Flo, Spiractor, Tow-Bro, VARI-CANT, VertiCel, Zeo-Rex, and Zimpro are trademarks of Siemens its subsidiaries or affiliates.

Link-Belt is a trademark of Link-Belt Construction Equipment Company LP.

The information provided in this brochure contains merely general descriptions or characteristics of performance which in actual case of use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

1.724.772.0044
petroleum.water@siemens.com

HP-GN-BR-0209
Subject to change without prior notice.

© 2009 Siemens Water Technologies Corp.