Neptune Benson
an EVOQUA brand

DEFENDER®
REGENERATIVE MEDIA FILTER

ABOUT US

Neptune-Benson, an Evoqua brand, has been synonymous with water filtration and disinfection serving the recreational, municipal, and industrial water markets since 1956. Featuring award-winning brands such as the Defender® regenerative media filter, ETS-UV™ disinfection systems, and Vortisand® and Legacy sand filters. Neptune-Benson also offers VAF™ filtration systems, the AEGIS anti-entrapment shield, Dominion™ butterfly valves, ProStrainer® and Guardian strainers, greendrive VFD systems, as well as all Lawson Aquatics® accessory products.

REGENERATIVE MEDIA FILTERS AND THE EVOLUTION OF WATER FILTRATION

Fresh, clean water is a common necessity in every corner of the world. We use it for drinking, bathing, food preparation, manufacturing, recreation and much, much more. With the need for clean water comes the need for water filtration. Water filtration has long been done using sand filtration. It is an easy and relatively inexpensive method for filtering water and has been used for thousands of years.

POOL FILTRATION:

Approximately 60 years ago, swimming pool filters were composed of alternating layers of sand and gravel. In order to provide a significant filter area, these filters were extremely large. The filters would be backwashed every one to two weeks, disposing a significant volume of water to the municipal waste line. While these filters of yesteryear were effective, they became impractical as innovation led to more compact and effiecient designs.

HIGH RATE SAND FILTERS:

Today, the sand and gravel filters have been replaced with high-rate sand filters. The modernized version uses a single layer of fine sand and requires about 15% of the space required by the original sand and gravel filters. Although the high-rate sand filters are more compact and cost effective, they waste around 40% more water because of the need to be backwashed more often. In addition, the previous sand and gravel filters were more efficient at trapping smaller particles because the pressure in the high-rate sand filter forces smaller particles through the sand and back into the pool.

DIATOMITE EARTH FILTERS:

Later, Diatomite Earth filters (D.E.) were introduced and offered significantly improved performance relative to traditional sand filtration. The D.E. filters replaced the sand media with diatomaceous earth and it was applied to internal filter elements at the beginning of every cycle and removed with the backwash water at the end of the cycle. The D.E. filters posed operational drawbacks associated with handling and disposal of the media, pushing for a safer and more environmentally friendly product.

REGENERATIVE MEDIA FILTERS:

Regenerative Media Filters (RMF's) are a more efficient alternative to sand or D.E. filtration. RMF's such as the Neptune-Benson's Defender® filter use up to 90% less water, take up a quarter of the space, and use less energy than traditional sand filters. Regenerative media filters are also more effective at removing contaminants. The Defender filter is able to remove particles as small as 1 micron from water while traditional sand filters generally only remove particles in the 20 micron range.

Neptune-Benson developed the Defender Regenerative Media Filter to provide a safe, non-hazardous filter which uses perlite media for the clearest, cleanest and safest water. Our automated system offers worry free operation and significant water savings. We invite you to explore all of the benefits of the Defender filter.

SIMPLY BETTER WATER FILTRATION

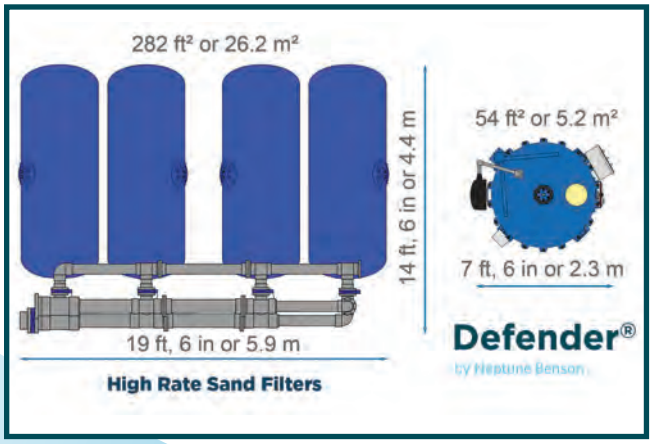
UP TO 90% WATER & WASTE SAVINGS

The Defender Regenerative Media Filter significantly reduces the amount of backwash water associated with sand filter operation. Instead of backwashing, it is programmed to automatically "bump" to regenerate the fine-grade perlite media for a fresh start. Eventually the filter will become saturated with trapped dirt and will require a quick and easy media discharge and replacement. Depending on bather load, the life cycle of the media averages around every four weeks.

75% SPACE & CONSTRUCTION SAVINGS

The Defender system takes up 1/4 to 1/6 of the space required by an equivalently sized sand system. This saves both space and construction costs. See the multiple benefits below.

- No backwash holding tank
- Smaller waste line to sewer
- Local backwash to waste flow rate restrictions
- Operating weight may be as little as 10% of a similar sand filter
- Smaller footprint = smaller access doors



50% ENERGY SAVINGS

Energy savings are derived in several ways. First, Defender filters operate at lower head pressure throughout the filter cycle reducing power demand. Second, the elimination of backwash waste associated with sand filtration provides significant wastewater treatment savings. Consider the cost of chemically treating 1.4 million gallons and the BTU's required to heat this volume from 50ºF (10ºC) to 80ºF (27ºC).

BACKWASH WATER CONSUMPTION

Sand vs. Defender	Filter Area (sq ft/M²)	Filter Rate (gpm/sq ft)/ (M³/HR/M³)	Backwash Volume gal/M³	Annual Volume gal/M3
Sand Filter (4) 4884SHFFG-6	126.8 sq ft 11.78 M²	11.8 gpm 28.86 M³	9510 gal 36.0 M³ 3x / week*	1,483,560 gal 5615.9 M³
Defender (1) SP-49-48-1548	1211 sq ft 112.5 M²	1.2 gpm 2.9 M³	1230 gal 4.7 M³ 1x / 4 weeks	14,760 gal 55.9 M³

Annual Water & Waste Savings:
1,468,800 gallons or approximately $10,282.00**
*Conservative backwash rate @ 15 gpm ft² for 5 minutes
**US average water/sewer costs $7.00 per 1000 gal

30% LESS FUEL & CHEMICALS

The Defender filter reduces the tremendous amount of backwash water associated with sand filter operation. This dramatic reduction of backwash waste directly translates to savings in chemicals and fuels for reheating associated make-up water. Less backwash = less chemicals and heat needed to treat the backwash.

The chart above illustrates the backwash water consumption of a typical indoor waterpark attraction with a 1500 GPM (341 m³/ hr) recirculation rate. The annual water savings in excess of 1.469 million gallons (5560 m³) is complemented by associated costs related to sewer expenses, chemicals, heating, power and labor.

CLEANER WATER, LOWER OPERATING COSTS

REMOVES PARTICLES DOWN TO 1 MICRON

The Defender Regenerative Media Filter achieves the highest quality of water by removing particles down to 1 micron. This is 20 to 30 times finer than sand. Benefits include:

- Extension to the life of the filter
- Unsurpassed water quality
- Improved UV disinfection performance
- Up to 30% chemical consumption savings
- Controls turbidity to levels better than those required for drinking water.

ROI SAVINGS ANALYSIS

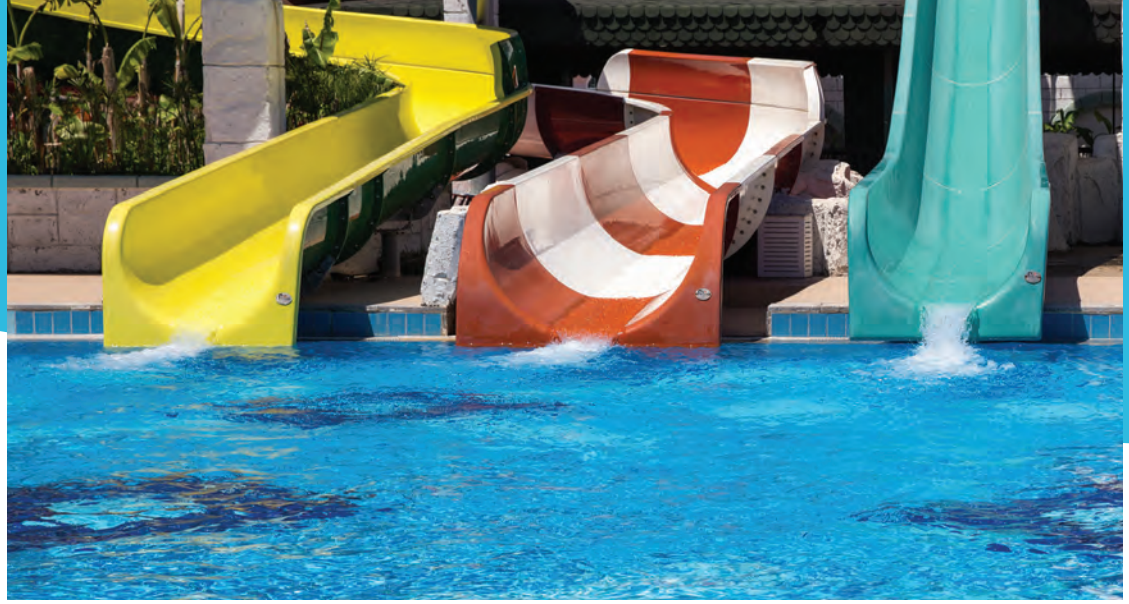
The combination of water, fuel, and chemical savings with the Defender filter can translate into significant savings over time. With Neptune Benson's 50+ year track record of delivering exceptional value, you will enjoy the peace of mind that can only come from partnering with an industry leader. Some facilities have realized a return on investment in less than one year.

See chart below for a breakdown of potential savings.

SAMPLE SAVINGS ANALYSIS

Potable Water & Discharge Impact	**Sand**	**Defender**
Backwash Volume	1,483,560 gal 5615.9 M^3	88,938* gal 336.7* M^3
Potable Water (Make-up) Fees (USD)	$5192.00	$311.00
Discharge Fees	$5192.00	$311.00
Energy & Fuel Impact		
Pump Power Consumption (kW)	216,569	170,170
Pump Power Cost (USD)	$13,307.55	$10,455.94
Heating Requirements (Therms)	4,449	489
Heating Costs (USD)	$4,004.00	$240.00
Water Treatment Chemical Impact		
Chemical Costs (USD)	$4,451.00	$267.00

*Includes 5% of the sand filter backwash volume to account for makeup water



DESIGNED WITH PERFORMANCE IN MIND

TANK CONSTRUCTION

All vessels are engineered and manufactured with Flex-sol 3000™ interior lining and include a 10 year fully rated warranty. The lining protects all wetted surfaces against corrosion to maximize the life expectancy of the vessel.

VACUUM TRANSFER

At the push of a button, a self-contained, integrated pump quickly introduces dry media into the Defender filter. This feature eliminates the mess and additional equipment required by wet, slurry designs.

INTERNAL HYDRAULICS

Our under-drain manifold is engineered to achieve ideal distribution of influent flow. The generous open area serves to minimize turbulence and ensure superior "Flex Tube" coverage.

LIFTING DAVIT

At some point it may be necessary to access the interior of the vessel. Our unique tank-mounted davit permits easy access without remote lifting devices. The davit reduces the overall height requirement and saves valuable floor space.

FILTER ELEMENTS

Our "Flex Tubes" are constructed of T304L stainless steel frames (optional T316L) with permanent polyester woven coverings. Not one has ever had to be replaced as result of wear. Other systems designed with rigid plastic frames, o-rings and socks require costly replacement frequent maintenance.

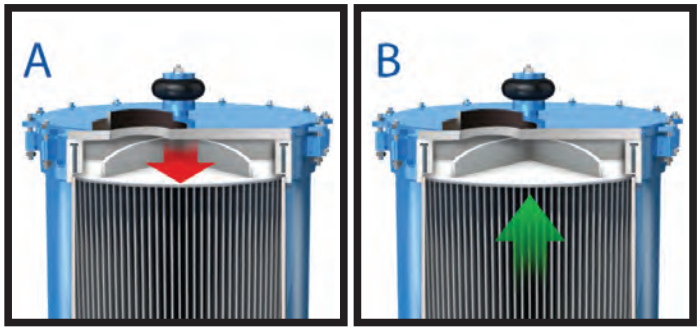
THE "BUMP"

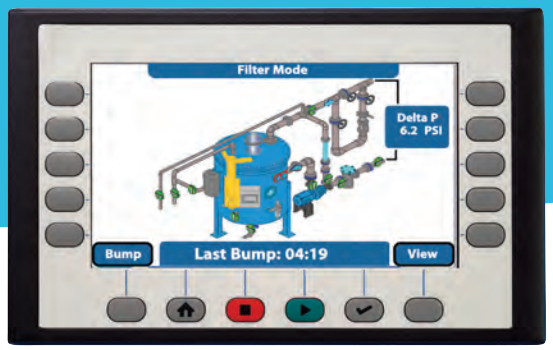
It's all about the "Bump" - The Defender filter is programmed to automatically "bump" on a daily basis to regenerate the media coating of the "Flex Tubes". This incredible benefit maximized system performance and reduces water consumption.

HOW IT WORKS

As the bump tire deflates **(A)**, the tube sheet lowers to loosen the media and trapped debris. The re-inflation of the bump tire **(B)** raises the tube sheet and forces water into the "Flex Tubes", gently expanding them to fully release all material. This bump cycle pulses ten times to ensure the entire cleaning process.

At the completion of the bump cycle, the Defender filter will automatically pre-coat the "Flex Tubes" and re-commence the filter cycle. The "Bump" is a vital function in order to achieve superior filtration and to make the most out of every filter cycle.





GETTING THE MOST OUT OF YOUR DEFENDER®

EASE OF USE

Operations of the Defender Regenerative Media Filter are controlled through the RMF System Controller, a 7" high resolution LCD control panel with simple push button operation and on screen menus to make operation quick and easy. It also provides animated graphics with step-by step instructions on operating proceedures.

DATA LOGGING AND EXPORTING

The RMF System Controller continually logs data provide detailed information on water pressure stats, bump schedule, purge and more. Data can be viewed remotely and is exportable to .CSV formats for creating reports and working with the data.

REMOTE MONITORING AND CONTROL

The RMF System Controller also provides remote monitoring, e-mail notifications of condition changes, and remote control of the system operations. It allos users to check performance remotely through a web browser or smart phone.

INCREASE EFFICIENCY

The data provided through the RMF System Controller can be used to analyze trends and modify operations to maximize efficiency. Analyze and identify peak usage, then automate or schedule bumping to ensure optimal operation. Data logs can also be used to help troubleshoot issues by identifying operating issues.

How do you improve the aquatic industry's best water filtration system? With an intuitive graphic control system with advanced data logging, automated capabilities, remote monitoring, and intersystem connectivity!

System Controller Features:

- 7" Hi-Res LCD w/ Tactile Feedback Membrane
  - Step by step animated graphics
- Advanced control of:
  - Bump & precoat cycle
  - Pneumatic valves & recirculation pump
  - Vacuum transfer system
  - Heater cool down delay
  - Data logging & maintenance reminders
- Remote monitoring/operation
- Modbus communication for PLC connectivity
- Nema 4x/IP66 approved
- greendrive VFD & ETS-UV connectivity
- Automated Drain & Purge

DEFENDER® CERTIFICATIONS & CREDITS

NSF: NATIONAL SANITATION FOUNDATION

An independent, accredited organization that tests, audits and certifies products and systems, as well as provides education and risk management.

Location Tested/Certified: USA
Certified for: NSF/ANSI 50: Pool, Spa and Recreational Water Products and NSF/ANSI 61: Drinking Water System Components.
nsf.org

UL: UNDERWRITERS LABORATORIES

UL is global independent safety science company offering expertise across seven key strategic businesses; Product Safety, Environment, Information and Insights, Life & Health, Verification Services, Enterprise Services, and Workplace Health & Safety. Their breadth, established objectivity, and proven history mean they are a symbol of trust and provide peace of mind to all.

Location Tested/Certified: USA
Defender Tested/Certified for: RMF Panel USA
ul.com/global/eng/pages/

SMART WATERMARK APPROVED

Australia's water conservation label, identifying & promoting products & services which help save water. An independent not-for-profit program supported by government & industry, and sister scheme to the WELS water efficiency rating program.

Location Tested/Certified: Australia
Defender Tested/Certified for: Validate Water Savings On An Application
www.smartwatermark.info/home/default.asp

CE APPROVED

The European Commission describes the CE mark as a "passport" that allows manufacturers to circulate industrial products freely within the internal market of the EU. The CE mark certifies that products have met EU health, safety and environmental requirements for workplace safety. All manufacturers in the EU and abroad must affix the CE mark.

Location Tested/Certified: USA
Defender Tested/Certified for: Meets Euro Health, Safety & Environmental requirements
ec.europa.eu/enterprise/policies/single-market-goods/cemarking/index_en.htm

PRODUCT VALIDATION

In addition to our certifications and credits, Neptune-Benson has a history of validating our technology. The value we provide is in the ongoing relationship – through the life of the filters and UV systems, we examine how the systems are being used and study the wear on the various components. Field Service Technician feedback is reviewed, and each product is continuously improved throughout the product life. Neptune Benson's commitment to research and development has been the backbone of the business for over 55 years.

DEFENDER® AND LEED CERTIFICATION

FOLLOW THE LEEDER

Neptune-Benson's commitment to LEED® principles pre-dates the creation of this formalized rating system. Improving the health and safety of aquatic environments has always been at the heart of what we do. The Defender filter has helped numerous projects achieve LEED certification by routinely providing the following category points:

ENERGY & ATMOSPHERE

- Meets Prerequisite 2
  - Minimum Energy Performance
- Earns Credit 1
  - Optimize Energy Performance

INNOVATION & DESIGN

- Earns Credit 1
  - Reduction in Water Usage

WHAT IS THE LEED SYSTEM?

Developed by the US Green Building Council (USGBC) in 2000, the LEED System-has become the National Standard certifying design, construction & operations of green buildings.Projects (not products) are evaluated in five (5) areas:

- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Materials & Resources
- Indoor Environmental Quality

* Extra credit may earned for Innovation & Design

DEFENDER® ASSERO

NOW EVEN SMALL POOLS CAN ENJOY BIG FILTER BENEFITS

The Defender® Assero Regenerative Media Filter is specifically designed for smaller applications with flow rates between 60-420 gpm. It's compact design saves space and will fit through a standard door frame. It is the perfect solution for achieving the same pristine water quality as our standard Defender.

NOW, FULLY AUTOMATED

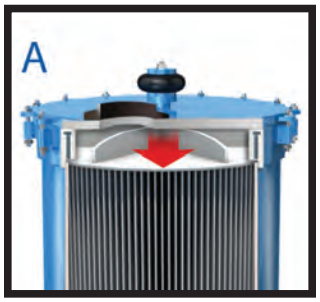
The Defender Assero system incorporates the new RMF System Controller, providing it with all the automated features found in full sized Defender filters. Features include an intuitive graphic control system with advanced data logging, automated drain & purge, remote monitoring, and intersystem connectivity!

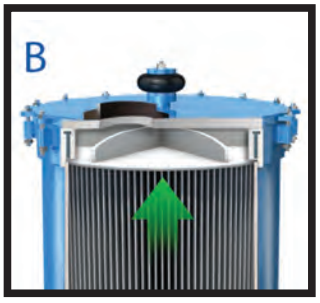
It also provides advanced control of:

- Bump & precoat cycle
- Pneumatic valves & recirculation pump
- Vacuum transfer system
- Heater cool down delay
- Data logging & maintenance reminders

IT'S ALL ABOUT THE "BUMP"

Like the full sized Defender filter, the Assero incorporates a simple, easy-to-use bumping mechanism to regenerate the media coating of the "Flex Tubes". The dynamic bumping action of our Defender filters sets the standard for precoat filtration effectiveness.





The Defender Assero filter delivers superior water quality at an affordable price.

SYSTEM SIZING OPTIONS

DEFENDER SIZES/CONFIGURATIONS

Model #	Filter Area		Recommended Flow Rate Range		Tank Volume	
	ft^2	m^2	.5 - 1.4 gpm/ft^2	1.22 - 3.42 $m^3/hr/m^2$	gal	m^3
SP-27-48-487	381	35.60	191 - 533	42.43 - 121.75	159	.602
SP-33-48-732	572	53.14	286 - 801	64.83 - 181.60	250	.946
SP-41-48-1038	812	75.44	406 - 1137	92.04 - 258.00	441	1.669
SP-49-48-1548	1211	112.50	606 - 1695	137.25 - 384.75	615	2.328
SP-55-48-2076	1625	150.97	813 - 2275	184.18 - 516.32	841	3.184

Note 1: Recommended flow rate range is suggested to optimize performance. This filter is NSF listed for up to 2.0 gpm/sq.ft (4.89 $m^3/hr/m^2$) flow rate. Consult Neptune-Benson for applications higher than the recommended flow rate range.

Note 2: Tank connection sizes based on velocity not to exceed 10.0 fps or 3.0 mps.

Note 3: The required perlite media volume is based on a 1/8" (3 mm) thick cake which is recommended for optimal performance.

DEFENDER ASSERO SIZES/CONFIGURATIONS

Model #	Filter Area		Recommended Flow Rate Range		Tank Volume	
	ft^2	m^2	.5 - 1.4 gpm/ft^2	1.2 - 3.9 $m^3/hr/m^2$	gal	m^3
SP-29-36-200	117	10.9	59 - 164	13.30 - 37.28	181	.7
SP-29-36-250	146	13.6	73 - 204	16.60 - 46.51	181	.7
SP-29-36-300	175	16.3	88 - 245	19.89 - 55.75	181	.7
SP-29-36-350	204	19.0	102 - 286	23.18 - 64.98	181	.7
SP-29-36-400	234	21.7	117 - 328	26.50 - 74.21	181	.7
SP-29-36-450	263	24.5	132 - 368	29.9 - 83.8	181	.7
SP-29-36-500	294	27.3	147 - 412	33.3 - 93.4	181	.7

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Note 3: The required perlite media volume is based on a 1/8" (3 mm) thick cake which is recommended for optimal performance.

Note 4: All Defender Assero models available in Automatic configuration

EVOQUA
WATER TECHNOLOGIES

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