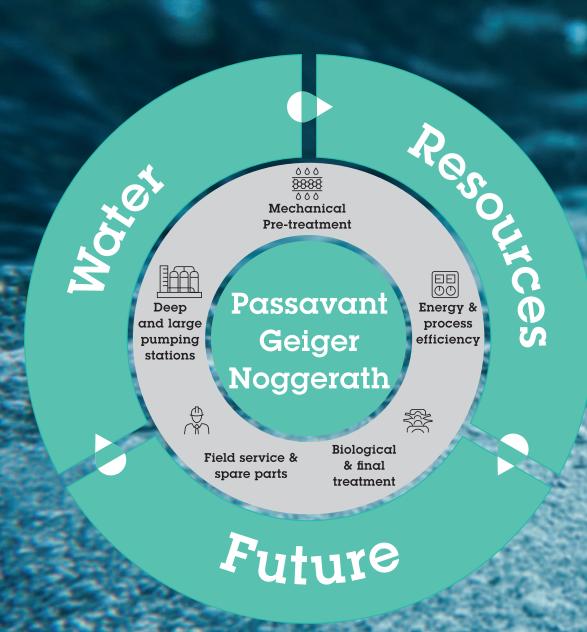


Water Processing Solutions

### Water Treatment

Our brands for reliable wastewater technology and clean water: Passavant®, Geiger® and Noggerath®.





### Our global organization:

### Global product lines

	Locations	Key brands	Markets
Water Processing Solutions	Aarbergen (Germany)	Passavant Geiger	= Water and wastewater utilities
		Noggerath	
	Karlsruhe (Germany)	Passavant Geiger	<ul><li>Power plants</li><li>Water intakes</li><li>Desalination</li></ul>
		Johnson Screens	
Vacuum Technology Systems	Hanau (Germany)	Roediger	<ul><li>Municipalities</li><li>Transportation</li></ul>
		Airvac	
Filtration and Thickening Systems	Lugo (Italy)	Diemme Filtration	<ul><li>Mining</li><li>Other industries</li></ul>
Water Well Screens	New Brighton (USA)	Johnson Screens	<ul><li>Water resources</li><li>Agriculture</li></ul>
Industrial and Architectural Screens	New Brighton (USA)	Johnson Screens	<ul><li>Food and beverage</li><li>Pulp and paper</li><li>Mining</li><li>Architectural</li></ul>
Oil and Gas Screens	New Brighton (USA)	Johnson Screens	= Petrochemicals
Mining Screens	Brisbane (Australia)	Johnson Screens	

### Competence overview

Passavant® Geiger® Noggerath®

Intelligent solutions for the challenges of the future: Never before has the world turned as fast as today. Urban areas are growing. Populations continue to develop. The climate is changing. And everything we do today has an impact on tomorrow. This makes it all more important to use resources in the most intelligent manner. In water and wastewater technology, this is of course about water and energy, but also about time and money.

Concentrated competence and committed employees, extensive experience and an individual, solution-oriented approach – this is the foundation on which the success story of Passavant-Geiger has been written. Whether for renovation or new construction, whether for wastewater treatment or industrial water intakes, whether for individual components or system solutions, whether for municipal operators or for industrial companies: We provide individual project-specific solutions and guarantee that all local, budgetary and environmental requirements are fulfilled optimally and efficiently. Due to our countless reference installations worldwide and due to a broad portfolio of in-house manufactured and innovative machines, we are able to meet your individual wishes and specific requirements like hardly any other company in the field.

Our solutions of the traditional brands Passavant®, Geiger® and Noggerath® cover the entire mechanical effluent treatment and clarification process – with low maintenance costs and, highest life-time. With our customized and flexible machines we upgrade hydraulically and serve for a better environment:

- 1 Pumping Stations Shut-off devices Coarse screens
- 2 Mechanical Pre-treatment
  Coarse screening
  Fine screening/sieving
  Screenings handling
  Sand and sewer grit treatment
  Septage receiving stations
- 3 Energy & process efficiency
  (in primary clarification, biological treatment
  and advanced wastewater treatment)
  Primary clarification due to
  the CarbonExtract® process
  Aeration
  Aqualogic®
  Adaptive Inlet System for secondary clarifiers
- 4 Services
  Field service & spare parts
- 5 Case studies/references



### Pumping Stations

### Shut-off devices & coarse screens

Proven technology, many years of experience and customized solutions.

A major challenge on the way to final cleaning: Wastewater and stormwater have to be pumped again and again – depending on the topography. The pumping stations we accomplish are located at depths of up to 100 meters. As the market leader for mechanical equipment on large and deep pumping stations for wastewater and stormwater, Passavant-Geiger supplies high-quality shut-off devices/ penstocks, stop logs and coarse screening systems of exceptional reliability and quality – as well as their associated controls.

Whether shutting off, controlling, pretreating or treating effluent and rainwater: All components of Passavant-Geiger for large and deep pumping stations meet the highest quality requirements and, thanks to their design according to DIN 19569-4, guarantee safety on a large scale – and reliability down to the smallest detail. Each of our customized solutions is based on the perfect balance between the latest technology and more than 125 years of experience starting with design and dimensioning, through production, assembly and commissioning. to customer services.

This uncompromising quality standard already begins with the production: Both Passavant® screens and shut-off devices are manufactured at our factory in Aarbergen (Hesse, Germany), assembled as far as technically reasonable prior to delivery and subjected to continuous factory acceptance tests - thus providing additional operational guarantee for our customers.



Passavant® Sluice Gates (7000 x 7000 mm)



A further advantage: Due to the enormously wide range of products, we can individually respond to all specific customer requirements or local conditions. For example, we offer automatic, Cable-Operated Bar Screens for deep intake channels or pump stations where large quantities of debris and sand are expected. Designed for the removal of very bulky floatings and sedimented mineral materials such as gravel and stones, the robust construction of our longterm proven Passavant® and Geiger® Cable-Operated Bar Screens is characterized by highest operational reliability and can easily be integrated into existing plants. Our intelligent PLC control system allows even extremely bulky screenings to be removed from any height by repeating the cleaning cycle as often as required.

Our portfolio for pumping stations is completed by upstream and downstream Passavant® shut-off devices – your dependable choice to control the volume flow to the individual units or to shut off the channels for maintenance work.

With a range of eight different screening systems in addition to shut-off devices up to  $7 \times 7$  m, Passavant-Geiger already supports hundreds of local authorities and industrial operators at home and abroad.



Passavant®
Cable-Operated
Bar Screens
COB-XXL with
Passavant®
Penstocks
(2000 x 2000 mm)



Passavant® Cable-Operated Bar Screens COB-C Passavant® Penstocks (1200 x 3500 mm)

### Mechanical Pre-treatment

### Coarse screening

Reliable, solid, established.

Reliable protection of all subsequent cleaning stages by safe retention of coarse materials: For good reason, the rakes and screening machines of Passavant-Geiger have an excellent reputation among customers and users worldwide. The Cable-Operated Bar Screens, Climber Screens and Multi-Rake Bar Screens have proven themselves under tough conditions, ensure optimum results as coarse and medium fine screens.

The first stage of mechanical pre-treatment not only serves the purpose of protection – it also has to cope with the most diverse requirements and inflow situations, which sometimes may fluctuate depending on the season. The customized coarse screening systems of our traditional quality brands Passavant®, Geiger® and Noggerath® are renowned for their durability and convince in practice by a high degree of flexibility. The individual design of the bar rack profiles ensures maximum separation efficiency and

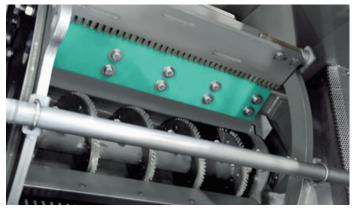
even coarse or bulky screenings in the inflow area of wastewater treatment plants can be reliably removed. On the other hand our coarse screens can also be used as fine screening machines due to the possibility to select the gap width individually to optimize hydraulics.



Passavant-Geiger provides tailor-made solutions for a wide range of installation conditions with most reliable service in more than 100 countries around the globe.



Passavant® Multi-Rake Bar Screen KUR



Noggerath® Rotating Bar Screen RBS



Passavant® Climber Screen KRC



Passavant® Step Screen PSS



Noggerath® Spiral Sieve NSI-V for the vertical removal of screenings



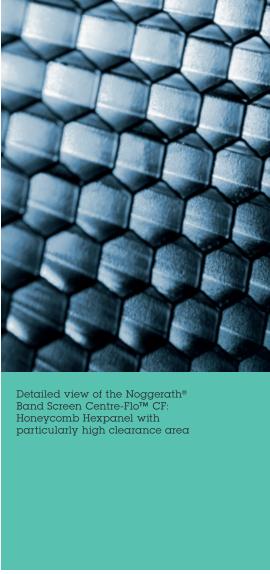
Noggerath® Band Screen Centre-Flo™ CF



Noggerath® Rotary Drum Sieve/Screen RSI-DD



Noggerath® Rotary Drum Sieve RSH-E





Noggerath® Overflow Screen OVF for stormwater overflow basins



Filtering hair, fibers, hygiene products or paper safely and reliably and recycling them if necessary – after the coarse screening, the finer particles must be filtered from the effluent. For this purpose Passavant® and Noggerath® fine screens/sieves are longterm proven solid, reliable and cost-attractive technology.



Noggerath® Spiral Sieve NSI

In order to ensure a safe and efficient sieving process, we offer a broad portfolio of fine screens and sieves adapted to your individual requirements. Thanks to their small mesh opening and sieve widths, they are excellently suited to remove fine particles and thus to prepare and protect downstream processing phases. In addition, many of the extracted residual materials from industrial applications can often be usefully reintroduced into the material cycle.

Like all machines of Passavant-Geiger, our fine screens and sieves offer their operating companies three essential and tangible advantages: They can be easily integrated into existing plants. They contribute significantly to more stable operational processes. But most of all, their extremely low-maintenance and low-wear running leads to a pleasingly longer service life and high availability.

Already succeefully commissioned on 4 continents – the Noggerath® Band Screen Centre-Flo™ CF machines with our Honeycomb Hexpanel provide screening capture rates around 90% and more. This makes it ideal to retrofit existing screens to provide a higher hydraulic throughout or improved solids removal.

# Screenings handling, sand and sewer grit treatment, septage receiving stations

Reduced disposal costs due to washing, compaction and conveyance.



Noggerath® Shaftless Spiral Conveyor SC

Material accumulated in the coarse and fine screening process is often hygienically critical waste that must be disposed of at often substantial costs. High water content and organic share as well as the odour formation in screenings require the use of special washing systems beforehand. Conveyance, compaction of screenings and washing. The water content and organic share in the sand of a sewage treatment plant is reduced with sand separators and sand washers. Both together play a major role in cost efficiency – and actively contribute to environmental protection.



Noggerath® Screenings Wash Press NWP/ Noggerath® Screenings Press NSP

#### Screenings handing

For many municipal and industrial users, the highly efficient, effective and therefore economical solutions by our brand Noggerath® provide sustainable solids disposal. The soluble organic substances are washed out of the screenings by using special and technically advanced washing systems. This is followed by mechanical dehydration to reduce the water content and weight. In addition to positive environmental aspects, the disposal costs are thus reduced significantly.

Weight reduction up to 80%

Dry substance content up to 47%

### Sand and sewer grit treatment

Enormous economic relief for operators of sewer networks, wastewater treatment plants and industrial facilities: the sand separators and sand washers type Noggerath®. This is because everywhere the increase in disposal costs is forcing utilities to separate recyclable materials from residual substances. Our solutions for the treatment of grit trap and sewerage material allow to transform the septic waste of today into a hygienically safe resource of tomorrow. And all this is provided with a compact and robust design as well as with a highly individual customization, which is necessary almost everywhere because of the diversity of fluids, catchment areas and recycling methods.

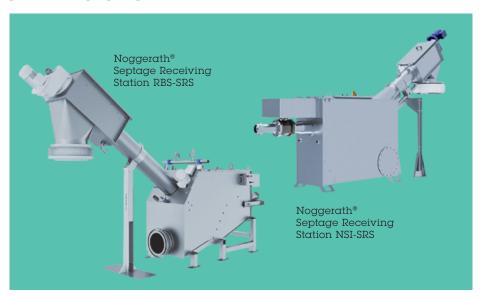
The world's largest program of sand washing systems with more than 500 machines on the market. Thanks to our wide range of design and process engineering variants, we can optimally adapt the sand separation process to the respective site conditions.



### Septage receiving stations

Compact dimensions, particularly robust in operation, long lifespan and low maintenance requirements: Noggerath® Septage Receiving Stations are the optimal choice for the discharge of faecal sludge from cesspools, septic tanks or sinkholes, but can also be used to receive industrial wastewater or be used for sludge screening. For the acceptance of sewer grit we offer individual storage and screening machines.

Flexible in use. Highly efficient Noggerath® Septage Receiving Stations and Sewer Grit Receiving Stations (Bunkers) prove their reliability in practice day by day.

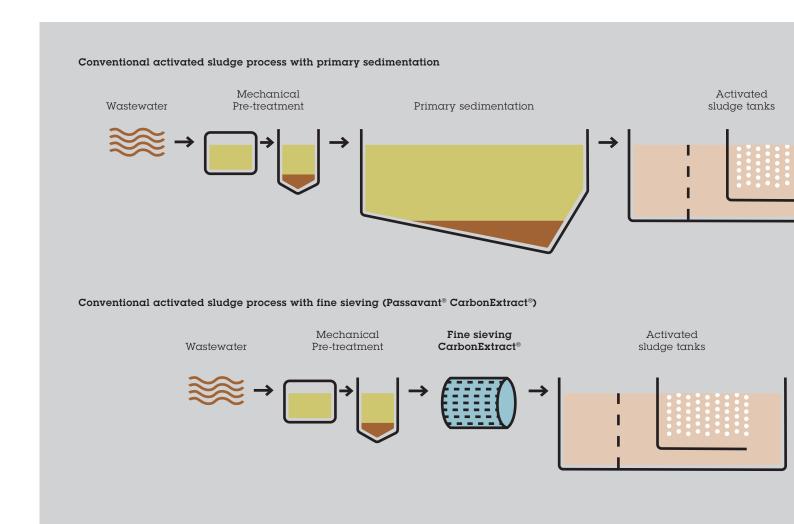


### **Energy & process efficiency**

# Primary clarification due to the CarbonExtract® process

Innovative, space-saving, clean.

Primary sedimentation involves the compact and reliable separation of floating, suspended and sedimentary materials in order to extract clear water. The Passavant® CarbonExtract® process from Passavant-Geiger takes an innovative approach to this: our MicroGiant sieve drums with exchangeable screen panels ensure an elimination rate that is equal to or even higher than that of a primary clarifier. The space required for a certain flow of wastewater is significantly reduced in comparison to a primary clarifier. This is the ideal solution when activated sludge plants are being upgraded with a sludge digestor or when the hydraulic load of a wastewater treatment plant increases resp. when a plant has reached its capacity limit.







Detailed view

Noggerath® Rotary Drum Sieve RSH-M/RSH-MG MicroGiant operates as a Micro Screen An innovative concept that offers many advantages for the utility: The use of screening drums such as the Noggerath® Drum Sieve RSH-MG (MicroGiant). Due to their exchangeable screen panels, the mesh size can be changed for flexibly adjustable elimination rates and different hydraulic capacities. This facilitates maintenance and enables a quick reaction to changed inflow conditions or changes in the subsequent processes.

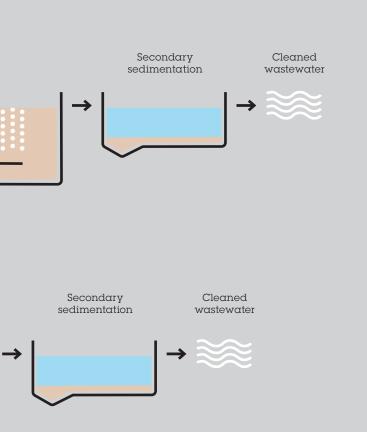
Moreover, the Passavant® Carbon-Extract® process provides further system-related advantages while only sedimenting and floating substances can be separated in primary clarifiers, pre-screening/ sieving enables a more reliable capture of all floating particles and impurities. Due to the flexible mesh size, the size of these particles and screenings can be redefined at any time. Furtheron particles smaller than the actual mesh size can be separated by the continuously re-formed filter layer. This method provides a highly reliable separation that has been virtually impossible to achieve so far by others and is essential for a more advaced treatment process.

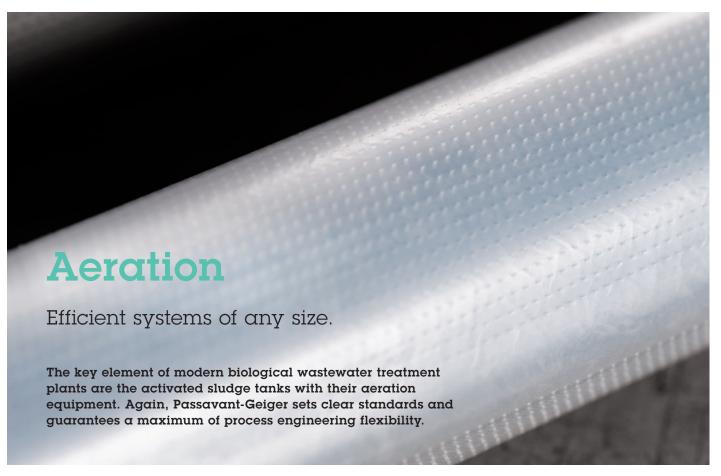
In terms of membrane bioreactors we provide a reliable pre-treatment to enable a more stable plant operation.

Due to the integrated thickening of the screenings or optional dewatering, the utilization of the generated screenings (primary sludge) becomes also very flexible.

Additionally, with the Aqualogic® CarbonControl solution we offer an intelligent control technology that allows to react to short-term fluctuations of the biological plant load during daily operation.

More reliable and effective than conventional methods: The Passavant® CarbonExtract® process has proven itself in day-to-day use in various, sometimes critical areas of application. For example, two Noggerath® Drum Sieves RSH-MG have been in operation since 2014 at the Ujams sewage treatment plant near Windhoek, Namibia, and protect the subsequent membrane bioreactors.





Passavant® Fine Bubble Aeration Bioflex®

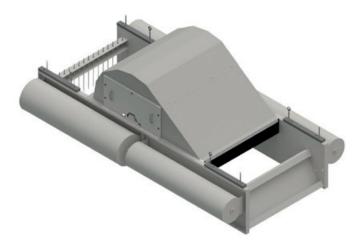


Passavant® Fine Bubble Aeration Roeflex®

The biological treatment is carried out with the help of microorganisms that absorb dissolved substances and convert them. Aeration systems play an important role here, as they create an oxygen-rich environment and ensure that sludge and water are mixed. Passavant-Geiger offers a wide range of efficient aeration systems for this area. Our technologies are characterized by high and constant oxygen input, robust and resilient construction and flexible adaptability to specific requirements.

The Passavant® Mammutrotor® Lago was developed especially for the aeration of smaller sewage plants and wastewater ponds. As it can be installed in circulation basins, in sequence batch reactors or for the aeration of sewage ponds and features minimal maintenance requirements, it is used frequently in municipal wastewater treatment. In addition the proven Mammutrotors®, provide a clear advantage over other aeration technologies for calcareous, solids-laden or warm wastewater as well as in industrial applications.

Worldwide synonym of economical and reliable surface aeration. The Passavant® Mammutrotor® – successfully in use with more than 8,500 installations.





Passavant® Surface Brush Aerator Mammutrotor® Lago for oxidation ponds



Passavant® Surface Brush Aerator Mammutrotor® – well proven and most reliable

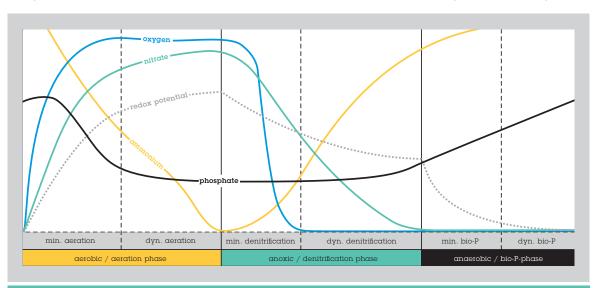
### Aqualogic® control system

Intelligence that pays off.

The different, partly opposing individual processes within wastewater treatment plants demand for the highest standards in terms of technology and optimized operation. Only with the help of a holistic approach can the highest cleaning performance, stable degradation processes and minimum energy consumption be achieved at the same time, while discharge values are being improved.

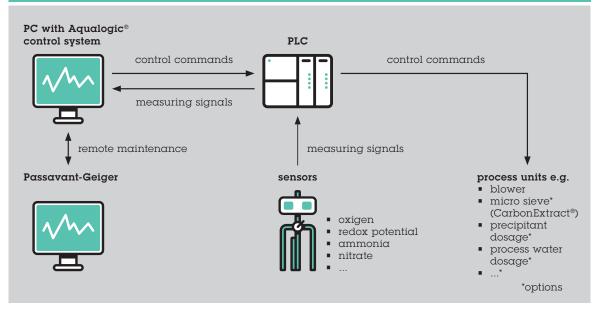
Hands-on and easy to use: the Aqualogic® control systems are able to create the ideal blend of contradictory requirements of different biological cleaning phases. The Aqualogic® controllers are customized transparently and optimally to your specific plant requirements, so that the system is tailor-made for your wastewater treatment plant. In addition to the oxygen control in the activation process, a multitude

of additional modules are available (i.e. process water dosing, precipitant dosing, recirculation control, sludge age control). Aqualogic® already shows its flexibility during the setup: It can be installed on any stand-alone or already existing computer. Thanks to OPC (Open Platform Communication) it can be operated with all commercially available probes, units and programmable logic controllers.



Timeline of different measurement parameters during intermittent operation of a plant – opposing parameters within the typical process phases of an activated sludge basin.

Several hundreds of wastewater treatment plants have already been equipped with Aqualogic® and benefit from more stable and better effluent values, from savings on energy and operating resources and from an always optimized process control.



Structure of Aqualogic® control system



Especially in densely populated areas, the operators of wastewater treatment plants face special challenges: Increasing throughput volumes require solutions with high capacities. However, the expansion of a plant is very expensive, requires a lot of space and often has to meet strict environmental regulations. So instead of an expansion of the concrete structure the better idea simply is to optimize the existing final clarifier. With the Passavant® Adaptive Inlet System hydrograv® adapt, Passavant-Geiger offers an innovative but state-of-the-art concept that makes water clarification more efficient.

#### Higher capacity and better than filtration

The patented system ensures that the water flows in as calmly and deeply as possible. That means that sludge overflow and flock discharge through secondary clarifiers can be consistently avoided – leading to a notable increase in the capacity of the system. This improves the flow rate significantly – without adding additional clarifier tanks to an existing plant. In practice an intelligent digital control system continuously adjusts the system to external conditions and water flow rate. In this way the effluent always enters with optimal speed at the correct depth. Turbulence is thus minimized, the water stays clearer

and the internal loading by entrainment is significantly reduced. As a result, more wastewater can flow through the system and the secondary clarifier becomes much more efficient. A further advantage: the flock discharge is significantly reduced, so that the phosphorus concentration of the suspended particles falls below a value of 0.3 mg/l average and frequently the downstreaming water even reaches reuse quality. An additional filtration is therefore often no longer necessary, which saves further investments as well as high efforts in maintenance. The adapt system is in fact virtually maintenance free.





### Elimination of secondary clarifiers bottlenecks

To this day, continuous flock discharge at average loading as well as massive spill-out of sludge at higher loading are fundamental problems for many wastewater treatment plants. As a result, the environment is unnecessarily polluted, the discharge limits are repeatedly exceeded and an additional sand filtration is necessary.

The innovative **Passavant® hydrograv® adapt System** solves this by using a movable inlet opening and variable outlet slots adapt the flock filter to the current conditions:



At a low sludge blanket level the inlet shifts itself to a low position.



At a high sludge blanket the inlet shifts itself just to a high position.

In addition to the elevation of the inlet opening, the height of the inlet slot is also individually controlled by narrowing and widening as determined by the current load.

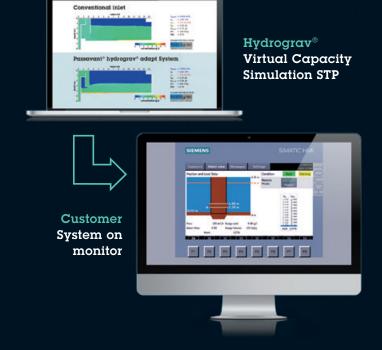
The advantages are obvious:

- less turbulences
- on additional filtration necessary
- higher loading capacity
- increasing efficiency at decreasing costs
- tailor-made solutions for the hydraulic design and control systems through hundreds of individual CFD simulations

### Our process expertise is your advantage

As developers of the **Passavant® hydrograv® adapt System**, we at Passavant-Geiger and hydrograv® are not only leading experts in our fields. We also know how to optimize our technology individually to achieve the best results.

This is why we analyze your wastewater treatment plant before installation and run a virtual test based on acquired data, which realistically forecasts all possible results. The number and size of the secondary clarifiers are just as important as the type of aeration tanks, the geographical location and its climatic conditions, the current load and, of course, the scope you want to achieve.



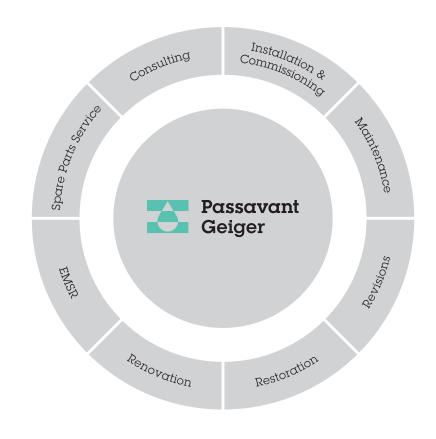
### 4 Service

# Field service & spare parts

Everything for a smooth operation and fast supplies.

Breakdowns, production interruptions or machine failures are annoying and costly. For this reason, a professional and trained service team keeps downtimes to a minimum. Required spare parts or service calls can be requested around the clock. Our customer service provides you with competent support. 24 hours a day, 365 days a year.

Your satisfaction with our company and our products is our ultimate goal. Through consistently high quality in production and services as well as by the expertise of our engineers and technicians we provide a significant advantage to utilities and to industrial customers. This enables a long-lasting plant functionality and thus benefit from efficiency, low operating and investment costs and of course safety in all process stages. No matter whether new installation, commissioning, maintenance, spare parts service, repair and refurbishment: professional advice and effective remedy of causes are paramount - even for plants and components of other manufacturers. In addition, we do provide a wide range of special machinery and spare parts, developed and manufactured at our locations in Germany (ISO 45001/9001 certified) and subject to strict controls before delivery.





For 125 years we have been available to our customers and with our brands Passavant®, Geiger® and Noggerath®. With our service team having more than 4,000 work assignments a year we ensure satisfied customers.

#### Our services:

- Assembly / commissioning / repairs of machines and plants
- Spare and wear parts supply from our own production
- Maintenance work / preventive maintenance (individual maintenance contracts also for process control systems and plants)
- Retro-fitting of machines (also from other manufacturers)
- Tests according to DGUV3 and, if necessary, retro-fitting of safety devices
- Modernization and maintenance of process control systems (PAMSA on Siemens WinCC SCADA)

- Modernization and upgrade from Siemens S5 to Siemens S7 or others
- Modernization, upgrade and expansion of automation and plant networks using fiber optic, WLAN, LAN, radio technology etc
- Remote maintenance / access to machines and plants via secure VPN connection
- Feeding computer system FILLControl for chamber filter presses



### Always at your disposal!

CUSTOMER-SERVICE
HOTLINE 24/7:
+49 6120 28 2222
service@passavant-geiger.com



Refurbishment of Scrapers



Overhaul and repair of screens



Overhaul of Roller Gates

### Case studies/references

### Competence overview

Intelligent solutions for the challenges of the future.

Planned, tested, commissioned: For more than 125 years,
Passavant-Geiger has set international standards for modern
and future-oriented seawater intakes and wastewater technology.
Our corporate philosophy is based on innovation and investment
security. With countless references and case studies from Germany
and abroad, we can prove this claim at any time and again.

#### Sewage treatment plant

#### Seonam, South Korea

 Installation of Aqualogic® control system for biological treatment of 1,200,000 PE / ~ 240,000 m³/d

#### Sewage pumping station

#### Doha, Qatar

- 2 x Passavant®
   Cable Operated Bar Screens
   COB-C 1,500 x 4,500 x 50
- 2 x Passavant®
   Cable Operated Bar Screens
   COB-C 1,500 x 4,600 x 50

#### Sewage treatment plant

#### Trikala, Greece

4 x Passavant® Surface
 Brush Aerator Mammutrotors®
 1,000 - 7.5 for biological
 treatment of ~80,000 PE /
 ~11,000 m³/d

#### Sewage treatment plant

#### Corby, United Kingdom

• 6 x Passavant® Surface Brush Aerator Mammutrotors® 1,000 – 9.0 for biological treatment of ~111,000 PE / ~18,500 m³/d

#### Sewage treatment plant

#### Dresden, Germany

 6 x Passavant® hydrograv® adapt Systems

#### Sewage treatment plant

#### Gotha, Germany

- 1 x Passavant® Grit Scraper
- 2 x Passavant® Claw Screens as Coarse Screens
- 2 x Passavant® Claw Screens as Fine Screens
- 16 x Passavant®
   Mammutrotors® 1,000 9.0
   with Guide Baffles
- 2 x Passavant® Sludge Thickener
- 8 x Passavant® Circular Tank Scrapers
- Aqualogic® control system

#### Deep sewer project

#### Dubai, UAE

 1 x Passavant® Cable Operated Bar Screen COB-XXL

#### Sewage treatment plant

#### Dubnica, Slovakia

 Installation of Aqualogic® control system for biological treatment of 60,000 PE / ~12,000 m³/d

#### Sewage treatment plant

#### Geneva, Switzerland

4 x Geiger® Fine Screens KUR

#### Sewage treatment plant

#### Deira Island, UAE

- 3 x Noggerath® Rotary Drum Screens RSI-DD 16
- 2 x Noggerath® Circular Grit Chamber GCC 40
- 2 x Noggerath<sup>®</sup> Grit Classifiers GS 80
- 2 x Noggerath® Screw Conveyors SC 250

#### Sewage treatment plant

#### Sharjah International Airport, UAE

 2 x Noggerath® Compact Combi Units TOP 3 30 (Peak Flow 100 m³/h)

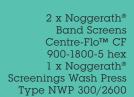
#### Sewage treatment plant

#### Son La, Vietnam

- 1 x Passavant® Multi-Rake
   Bar Screen KUR-S
- 1 x Noggerath® Screenings Wash Press NWP 200
- 1 x Noggerath® Grit Washer GWC 750
- 1 x Noggerath® Spiral Conveyor SC 160

### Noggerath® Band Screen Centre-Flo™ CF as Fine Screen for high solids removal

#### Warthausen, Germany





#### Passavant® Deep Pumping Station

South Jeddah, KSA





#### Passavant® Multi-Rake Bar Screens KUR

Marseille, France



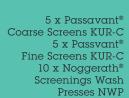
3 x Passavant® Multi-Rake Bar Screens KUR-C

### Noggerath® Sewer Grit Receiving/Treatment Cambrils, Spain

l x Noggerath®
Bunker Sewer Grit Receiver
l x Noggerath®
Rotary Drum Screen RSH-I
l x Noggerath®
Shaffless Spiral
Conveyor SC
l x Noggerath®
Pump BWP
l x Noggerath®
Grit Washer GWC



#### Passavant® Multi-Rake Bar Screens KUR Hamburg, Germany





#### Passavant® Cable Operated Bar Screens

Casa Colorada Profunda, Mexico





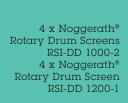
#### Passavant® Climber Screens KRC

Breda, Netherlands



#### Noggerath® Rotary Drum Screens RSI-DD

Ataköy-Istanbul, Turkey







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