White Paper

Gardner Denver®

Comprehensive Solutions with Pre-Engineered Blower Packages

for Complex Wastewater Treatment Applications

Introduction

The water and wastewater treatment industries play a fundamental role in supporting the global population and are primarily concerned with the treatment of water that is a by-product of commercial, municipal or industrial activities. Treating wastewater requires a number of complex processes to be carried out, many of which require an effective positive displacement air blower to handle and transport materials and liquids. That's where we come in!

Gardner Denver understands the complex needs and challenges of wastewater treatment applications in both industrial and municipal settings. Our blowers and pre-engineered IQ-RB, IQ and IQ-HE blower packages aim to tackle the industry's major pain points, including: dynamic capacity demand, high maintenance cost and effort, substantial energy consumption and cost, and process downtime risk.
Our blowers and blower packages boast a range of exceptional features such as quiet operation, increased durability, and efficient operation due to Gardner Denver's unique rotor designs and advanced control options. With a focus on energy efficiency, flexibility, and scalability, our comprehensive solutions lead the way in the water and wastewater treatment industries.

Gardner Denver's Blower Technologies for Wastewater Treatment

Positive Displacement Blower Technology

Gardner Denver's high-performance blowers utilize tried-and-true positive displacement technologies. But what does this mean? The term "positive displacement" denotes a process in which the volume of air within the blower does not change but is instead trapped and then displaced from inlet to outlet during operation, which in turn propels materials through a pipe or hose. Positive displacement blowers are utilized in a myriad of industrial applications, from aeration to bulk transport.

But how do they actually work? It's quite clever, really! When air enters the positive displacement blower, its rotors revolve, which pulls the air further into the inlet port. As the rotors rotate, the air is forced into tight areas between the rotors and the casing. This air is then discharged into the outlet pipe or hose. Job done!

The design flexibility of positive displacement blowers allows them to be run in both blower and vacuum installations, as they can operate at a versatile range of pressures and vacuums. They are also renowned for their ability to maintain a consistent airflow even when discharge pressures vary. This is particularly useful for the wastewater and water treatment industries, as it ensures you can operate efficiently, even at varying levels of demand. Particularly useful for wastewater treatment applications that involve dust, particulates and sand, such as grit aeration, digestion, slurry liquid pumping and backwashing sand filtration, the robust design of positive displacement blowers makes them less sensitive to these materials than other types of blowers.

Stand-Alone Blowers and Their Applications

Gardner Denver's customizable options ensure that your blower package effectively meets your specific requirements. Positive displacement blowers are vital for a range of wastewater applications, including:

Primary Sedimentation:

Primary sedimentation is a crucial process in the wastewater treatment industry to remove floating organic material and suspended solids that enter a treatment plant from the sewage system. Water passes through the screening process, where all non-dissolved, non-organic materials are removed. Lobe positive displacement blowers are invaluable when it comes to the process of primary sedimentation. During this process, they remove grit and sand by introducing air pressure to unblock any blockages that are caused by the presence of static solids in the water. Blowers are also used to transfer sludge from primary sedimentation tanks to other storage vessels or treatment facilities.

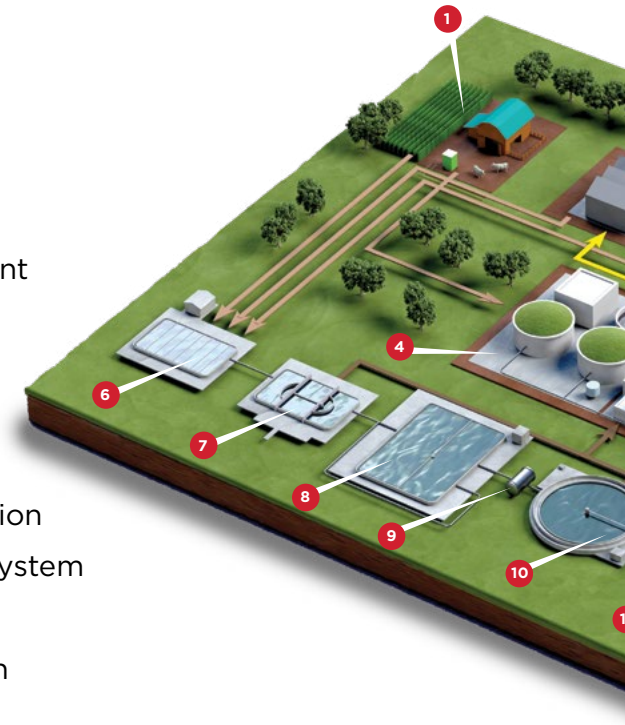
Aeration Process in Wastewater Treatment Plants:

The aeration or digestion tanks in wastewater treatment plants are activated with oxygen by using air. A thorough mixing of the sludge with oxygen enables a higher gas yield and, in the process, reduces its retention time in the tank. Warm air helps to achieve better results here. Warm air is achieved through the temperature rise that occurs when air is moving through the blower. This can yield improved results.

Blower technologies, typically rotary lobe blowers or rotary screw, are extensively used during this aeration process, particularly for membrane bioreactors (MBRs), sequencing batch reactors (SBRs), aerobic activated sludge systems, and nitrification and denitrification in a single basin. Two types of aeration occur in wastewater treatment plants: grit aeration and channel aeration. Positive displacement blowers can be used for both processes.

Wastewater Treatment Plant Layout

1. Agricultural waste
2. Industrial waste
3. Urban waste
4. Biogas plant
5. Natural gas grid
6. Screening pre-treatment
7. Primary sedimentation
8. Biological processes (aerobic process)
9. Chemical mixing
10. Secondary sedimentation
11. Sand filter backwash system
12. Dechlorination
13. Outlet pumping station
14. River

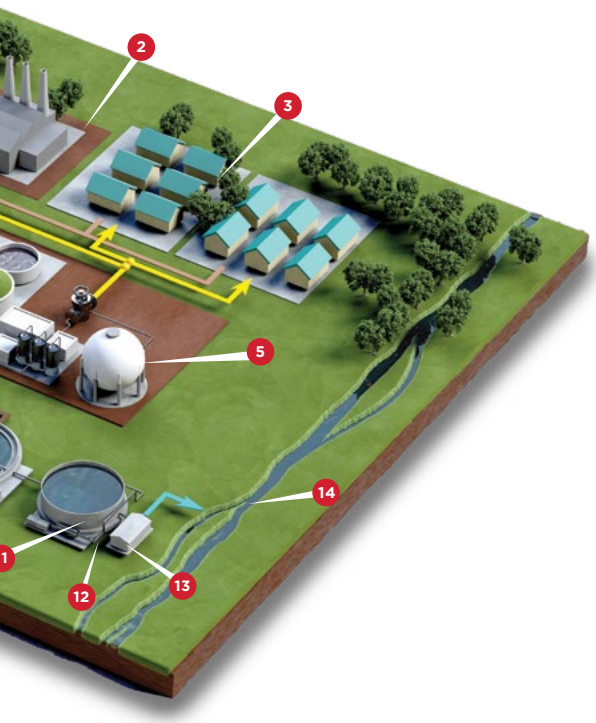


Digestion:

In wastewater treatment plants, digestion is the biological process that acts to break down organic matter in either the presence of (Aerobic digestion) or absence of (Anaerobic digestion) of oxygen. Digestion is essential to the wastewater treatment process and aids in the destruction of pathogens as well as a reduction of the total mass of solids present. Gardner Denver blowers can be utilized in both process applications:

Aerobic: This involves the presence of oxygen and is a process that consumes organic matter and converts it into water, CO_2, and other organic compounds. Aerobic digestion helps to reduce the volume of sewage sludge, making it easier to dewater or dry, thus making it suitable for other uses. The role of positive displacement blowers here is to introduce oxygen into the system, which is important for keeping solids suspended in the grit chambers and channels. This is essential for proper wastewater treatment.

Anaerobic: The process in which bacteria break down organic matter in the absence of oxygen. This includes materials such as animal manure, wastewater biosolids and food waste. A benefit of this process is that it can reduce sludge volume by up to 90%, decrease the presence of microplastics in the water and lower greenhouse gas emissions. Anaerobic operations have the additional benefit of producing biogas, which can be utilized in a number of environmentally-friendly applications. Positive displacement, typically rotary lobe blowers, are used to transport, compress, purify, separate and convey biogas.



Slurry Liquid Pumping:

The purpose of a slurry pump is to handle abrasive, tough, viscous liquids and particles in suspension, allowing them to be transferred from one tank to another. Blowers play a vital role in transporting slurry without damaging piping or the system.

Back Washing Sand Filtration:

During this filtration process, air expands the filter bed, breaking up compacted material. Clean backwash water is then pumped in, suspending the loose material. The suspended particles are then lifted and carried away. Here, positive displacement blowers are used to expand and agitate the filter media to break up compacted material. This process allows clean water to be pumped in, which removes any loose material.

Gardner Denver Blower packages Comparison

Choosing a blower for your wastewater treatment operations isn't a quick task, nor is it a one-size-fits-all situation. This is why Gardner Denver offers everything from bi-lobe, screw, tri-lobe, and twisted tri-lobe solutions to ensure we've got you covered! Our portfolio has something for every process and suits both small and large-scale wastewater treatment plants. For example, here's a look at some of our tailored blower packages:

IQ Package

Airflow: Up to 1,500 cfm
Pressure: Up to 15 psig
Vacuum: Up to 17 inHg

Features:
Intelligent package engineered with innovation and quality
Quiet design as low as 60
AirSmart Controller

IQ-RB Package

Airflow: Up to 5,500 cfm
Pressure: Up to 15 psig
Vacuum: Up to 15 inHg

Features:
Low pressure blower package
Integrated RBS 15-165 tri-lobe blowers
Low energy consuming electric motor
Fixed speed operation

GD IQ-HE

Airflow: Up to 5,625 cfm
Pressure: Up to 36 psig
Vacuum: N/A

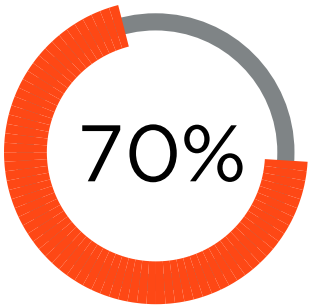
Features:
Offers extended high-pressure range
High efficiency package
Reduce energy costs
AirSmart G2 Controller

The Energy Challenge - Understanding the Energy Challenge in Wastewater Treatment Facilities

Globally, it has been estimated that wastewater treatment plants consume a significant amount of energy, accounting for approximately 1-3% of global energy output. The amount of energy used by a wastewater treatment plant varies and is dependent on a number of factors, such as the size and type of the plant, the quality of the treated water and technology used.

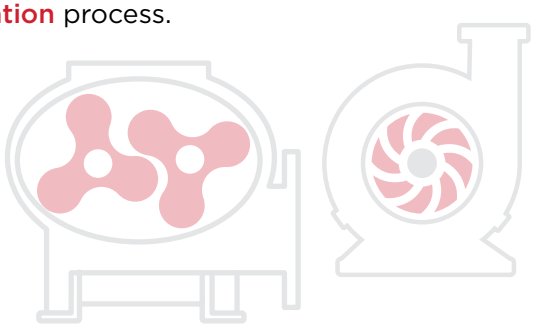
It is no secret that air blowers are one of the most energy-intensive components in your wastewater treatment plant. Blowers alone can often account for up to 60% of your total energy consumption. Selecting energy-efficient blowers is vital to reducing your plant's operating costs and consumption. Gardner Denver offers a range of blowers that can be tailored to optimize your system and reduce energy costs.

High Energy Savings with Decentralized Control

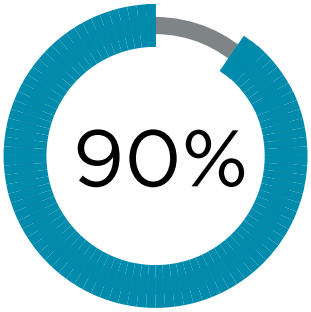


Up to **70%** of the total energy consumption of a WWT Plant can be attributed to the **aeration** process.

Huge Potential For Optimization with Decentralized Control



"Blower energy efficiency is paramount to lowered energy costs"



More than **90%** of the energy in the aeration process is consumed by **Blowers**.

Energy Waste Calculation based on

- 125.000 m^3 treated wastewater per day / ~33 MG per day
- 0.3 – 0.8 kWh per m^3 / ~1135 – 3030 kWh per MG
- $0.10 per kWh
- 20% annual savings potential

Solutions for Energy Optimization & Sustainability - We've got you Covered!

In an energy-conscious world, maintaining sustainable and efficient operations is increasingly important to the wastewater treatment industry. A predominant sustainability concern in the industry is that energy consumption is one of the largest expenses in wastewater treatment.

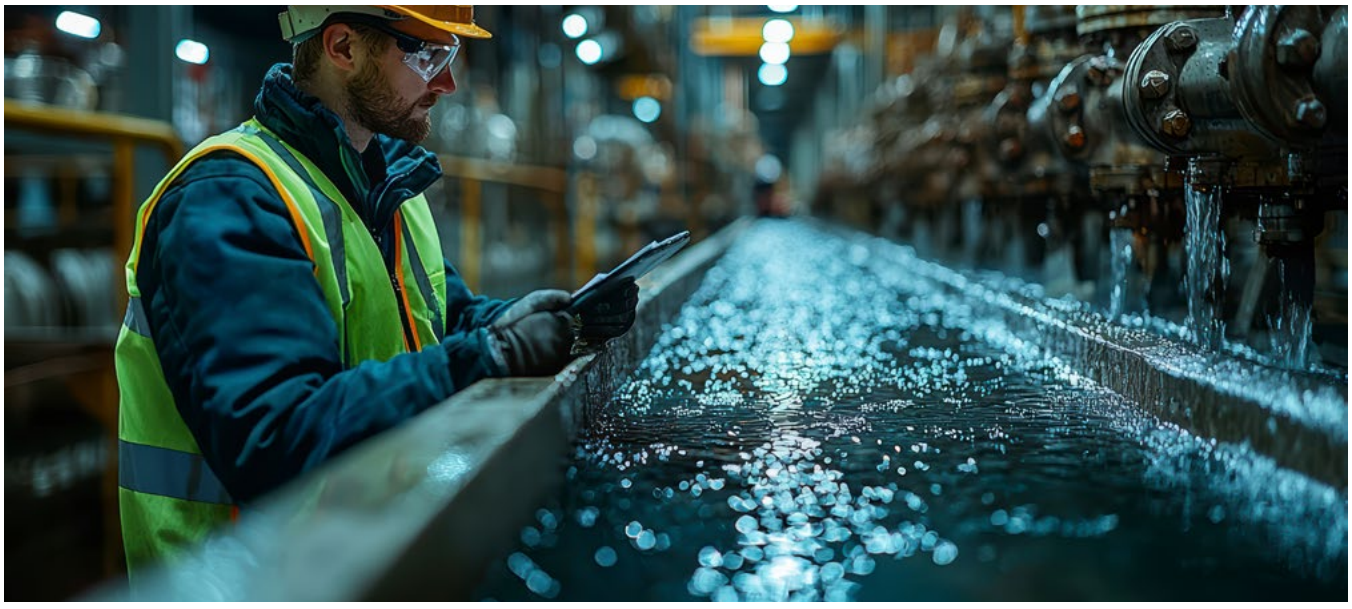
According to the U.S. Department of Energy, across the country, municipal wastewater treatment plants are estimated to consume more than 30 terawatt-hours per year of electricity. This equates to a staggering $2 billion in annual electrical costs. Most of this energy consumption comes from the aeration process alone, which can account for an estimated 50-60% of your plant's total consumption. Efficiency gains in your most energy-intensive process will help reduce consumption and build a more sustainable operation.

There are many ways in which Gardner Denver aims to optimize your energy efficiency. One example is our unique rotor designs, including the HeliFlow and the Cycloblower screw rotor profile, both of which deliver superior performance while also lowering your energy consumption.

Another solution we offer for energy optimization is through decentralized control of the aeration process. Did you know that up to 60% of your wastewater treatment plant's total energy consumption can be attributed to the aeration process and that blowers consume more than 90% of the energy during this application?

Improving your energy efficiency will drastically reduce your environmental footprint. But why is this benefit of energy efficiency so important? Well, treatment plants are costly to construct and require substantial land area for settling tanks and aeration basins. As demand increases, your treatment plant's footprint and capabilities will also need to increase. Gardner Denver can help you do this whilst still maintaining a small and low-impact footprint.

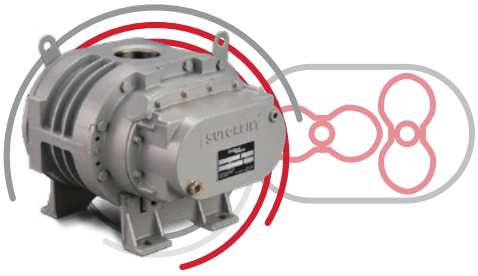
With all of these sustainability concerns in mind, Gardner Denver has designed their products with energy-efficient components and features specifically to help your sustainability bottom line!



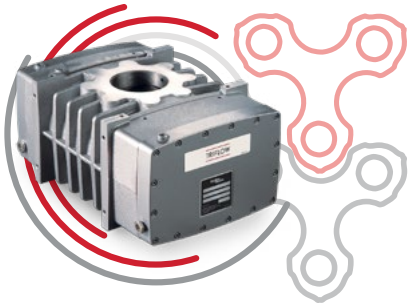
Adapting to Diverse Treatment Demands

In the wastewater industry, flexibility is key! Gardner Denver offers an unmatched range of blowers for a customizable and scalable approach that promotes ease of expansion. This is achieved through high-quality, high-performance modular designs that can be tailored to fix your application. Different blowers will be suitable for different treatment demands, with each rotor profile offering unique benefits:

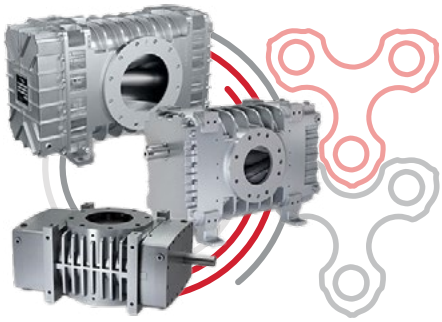
- All **rotary lobe** blowers offer optimal performance with continuous operation and are built to last in tough conditions, making them ideal for wastewater treatment processes.



- **Bi-lobes** are renowned as the most cost-effective, with heavy-duty construction and large, anti-friction bearings that promise unmatched longevity and durability. They also have dual-splash lubrication for reduced maintenance and dependability.



- **Tri-lobe** blower solutions are typically very quiet and operate efficiently. They also have a robust design to ensure reliability and dual splash lubrication for reduced maintenance intervals and superior durability. Flexible mounting options also enable easy drop-in replacement.



- **Twisted tri-lobe** blowers are even quieter and more efficient, particularly when compared to straight-lobe technology. This is because their design aims to reduce pulsation and lower noise for a quieter, more efficient operation with consistent and smooth airflow.

- **Screw** technology, in comparison, is widely considered the pinnacle of sound attenuation and efficiency. With their robust, screw blowers can operate flexibly, even in harsh weather conditions, and guarantee unmatched energy efficiency as their smooth operation delivers a continuous flow of air without wasting any energy. They are also more resistant to wear and tear, as they have no contacting parts, which helps to reduce maintenance costs.

Understanding your exact needs and treatment demands is invaluable to ensure optimal efficiency, productivity and performance. A couple of things you should consider when choosing your blower package are:

- **Flow & Pressure Specifications**
- **Your Aeration Requirements**
- **Efficiency & Energy Usage**
- **System Compatibility**
- **Noise Levels**
- **Maintenance & Serviceability**
- **Reliability & Durability**

Gardner Denver offers a diverse range of technologies to fit your treatment demands whilst also providing equipment that enables you to operate more sustainably and efficiently. Gardner Denver provides advanced controls for optimal operational performance, monitoring and protection.

How can these controllers benefit your wastewater treatment plant? Our controller systems offers enhanced connectivity, enabling you and your blowers to easily adapt to changing/ fluctuating treatment demands. Advanced monitoring with our controller solutions allows for you to make changes to system pressure and flow rates, preserving efficiency and reducing excess energy consumption. Precise and accurate flow is required to ensure wastewater facilities are working correctly, making a controller invaluable to ensure pressure and volume requirements. These smart controller systems also provide simple blower performance monitoring, instant alerts and emergency shutdowns, as well as enabling you to easily manage up to eight blower packages at once. You can choose how you want it to run — based on a set timer or process — and AirSmart will ensure the workload is shared across multiple packages, cutting down on maintenance time.

Conclusion

Gardner Denver's commitment to innovative wastewater treatment solutions is highlighted by our diverse range of blower technologies. Our energy-efficient, scalable and sustainable solutions offer unmatched performance and efficiency. Gardner Denver products are flexible and can meet a large range of requirements to meet the complex needs of wastewater applications.

Competitively, Gardner Denver offers a diverse range of technologies, leading the industry in research, development, and innovative product offerings. Backed by a trusted network of distribution and service professionals, Gardner Denver is your partner within the wastewater treatment industry.

Interested? Transform your wastewater challenges into success stories. Reach out to Gardner Denver's experts now!

www.gardnerdenver.com

Gardner Denver Industrial Products

Gardner Denver delivers the broadest range of compressors, blowers and vacuum products, in a wide array of technologies, to end-user and OEM customers worldwide in the industries we serve.

We provide reliable and energy-efficient equipment that is put to work in a multitude of manufacturing and process applications.

Products ranging from versatile low- to high-pressure compressors to customized blowers and vacuum pumps serve industries including general manufacturing, automotive, and waste water treatment, as well as food & beverage, plastics, and power generation.

Our global offering also includes a comprehensive suite of aftermarket services to complement our products. Gardner Denver was founded in 1859 and has thousands of employees and dedicated channel partners worldwide.

For further information please visit
www.gardnerdenver.com

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