



Airvac

Vacuum Technology Solutions

Vacuum 101

A free introductory guide
to vacuum sewer collection systems

Making a difference **today**, for a better **tomorrow**.

Thank you for taking the time to learn about Airvac and vacuum sewer collection systems.

What is a Vacuum Sewer Collection System?

A vacuum sewer collection system is a mechanized method of transporting wastewater. Differential air pressure creates flow rather than gravity or pressure. Essentially, a vacuum sewer collection system is a vacuum-assisted gravity sewer system.

Vacuum sewer collection systems require a vacuum station. Vacuum pumps maintain vacuum on the collection mains. To maintain this vacuum, a valve at each sewage input point seals the system. The valve opens automatically when a given quantity of sewage accumulates in a collection sump. This valve is entirely pneumatic in its control and operation. Differential pressure between local atmospheric pressure and the vacuum pressure provides the thrust needed for liquid transportation.

Vacuum sewer collection systems are applicable for:

- Residential connections.
- Commercial connections..
- Private developments.
- Areas where failing septic tanks are causing pollution.
- At least 25 connections. We also have systems serving more than 10,000 connections!
- Flat topography or moderate elevation change.
- Subsurface difficulties to overcome including high groundwater tables, sandy and unstable soils, rock, restricted construction conditions, acid sulfate soils (A.S.S), and sensitive eco-systems.

Why Use a Vacuum Sewer Collection System?

Cost-effective, Efficient, and Reliable

Airvac vacuum sewer collection systems are clean, efficient, easy to maintain, easy to install and typically less expensive than other collection systems. It is a proven technology with a long history of success and reliability. Airvac vacuum sewer collection systems use smaller diameter pipes installed in narrow, shallow trenches, reducing excavation, dewatering and surface restoration. The vertical and horizontal flexibility of the system allows for underground utility conflicts to be avoided, preventing cost overruns. Additional cost savings result when multiple lift stations are replaced by one vacuum station. Overall, the cost savings potential of using an Airvac system can be as great as 60% when compared to gravity or low-pressure systems.



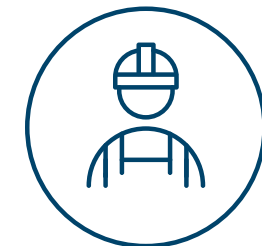
Environmentally Friendly

Our completely closed vacuum collection system prohibits the infiltration and inflow of groundwater from the valve pit to the vacuum station, protecting our environment from exfiltrating wastewater. It is one of the most environmentally friendly solutions available.



Safer for Operators

With an Airvac vacuum sewer collection system, operators are not exposed to raw sewage or work in confined areas, minimizing their risk of exposure to viruses, bacteria, parasites, or harmful gases such as methane and hydrogen sulfide. With our newest technologies, they also experience noise and heat reduction at the vacuum pump stations. This provides them with a more safe and comfortable work environment.



Less Disruptive to Communities

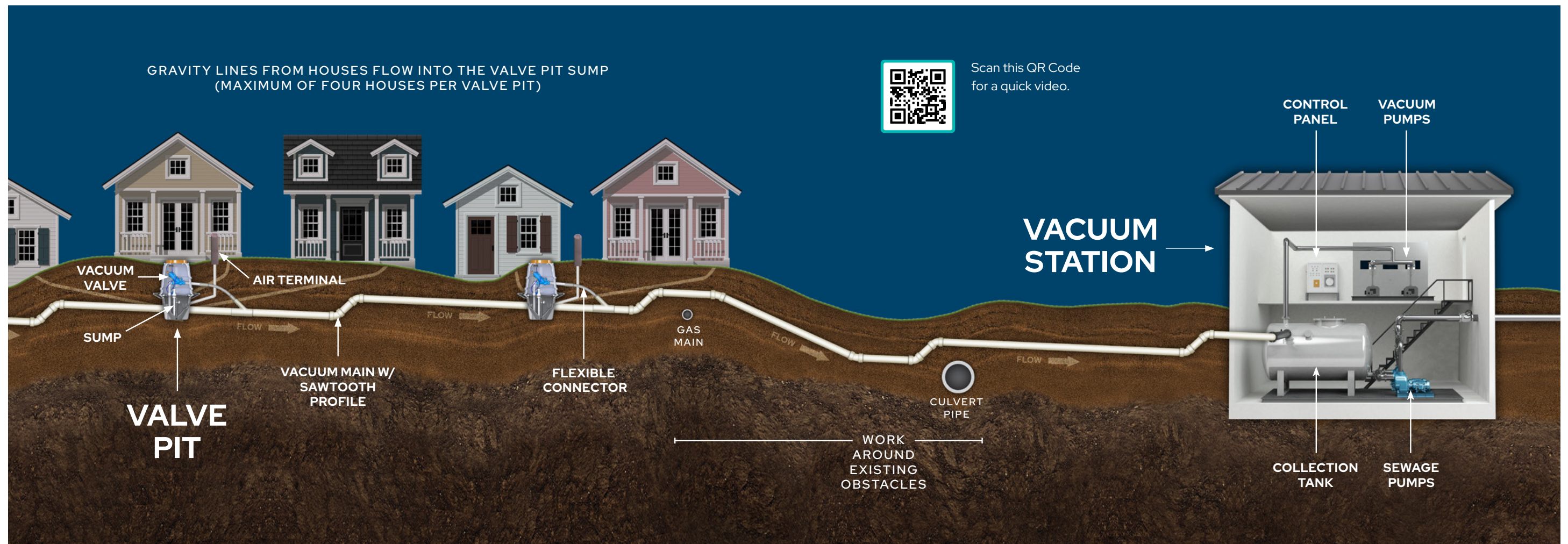
The fast and simple excavation required for an Airvac vacuum sewer collection system creates shallower trenches, uses smaller diameter pipes, and smaller excavation equipment. Roads can remain fully or partially opened, creating far less disruption to your community than traditional gravity sewers. You will experience significantly reduced restoration, construction, and energy costs as well.



Severe Weather Ready

Because vacuum valves are pneumatically operated, the only source of power required for an Airvac vacuum sewer collection system is at the main vacuum station. Every Airvac vacuum station has a permanent back-up generator or a hook up for a portable generator, so power outages are never an issue.





Scan this QR Code
for a quick video.

How It Works

Our completely closed vacuum sewer collection system prevents infiltration and inflow of groundwater from the valve pit to the vacuum station, protecting waterways from exfiltrating wastewater.



A traditional gravity line carries wastewater from a customer's home to an Airvac valve pit package.



The Airvac vacuum valve opens when 10 gallons of sewage collects in the sump and then differential pressure propels the contents into the vacuum main.



Wastewater travels at 15 to 18 fps in a vacuum main, which is laid in a sawtooth fashion to ensure adequate vacuum levels at the end of each line.



At the vacuum station, Vacuum pumps cycle on and off as needed to maintain a constant level of vacuum on the entire collection system.



Wastewater enters the collection tank and fills to a predetermined level.

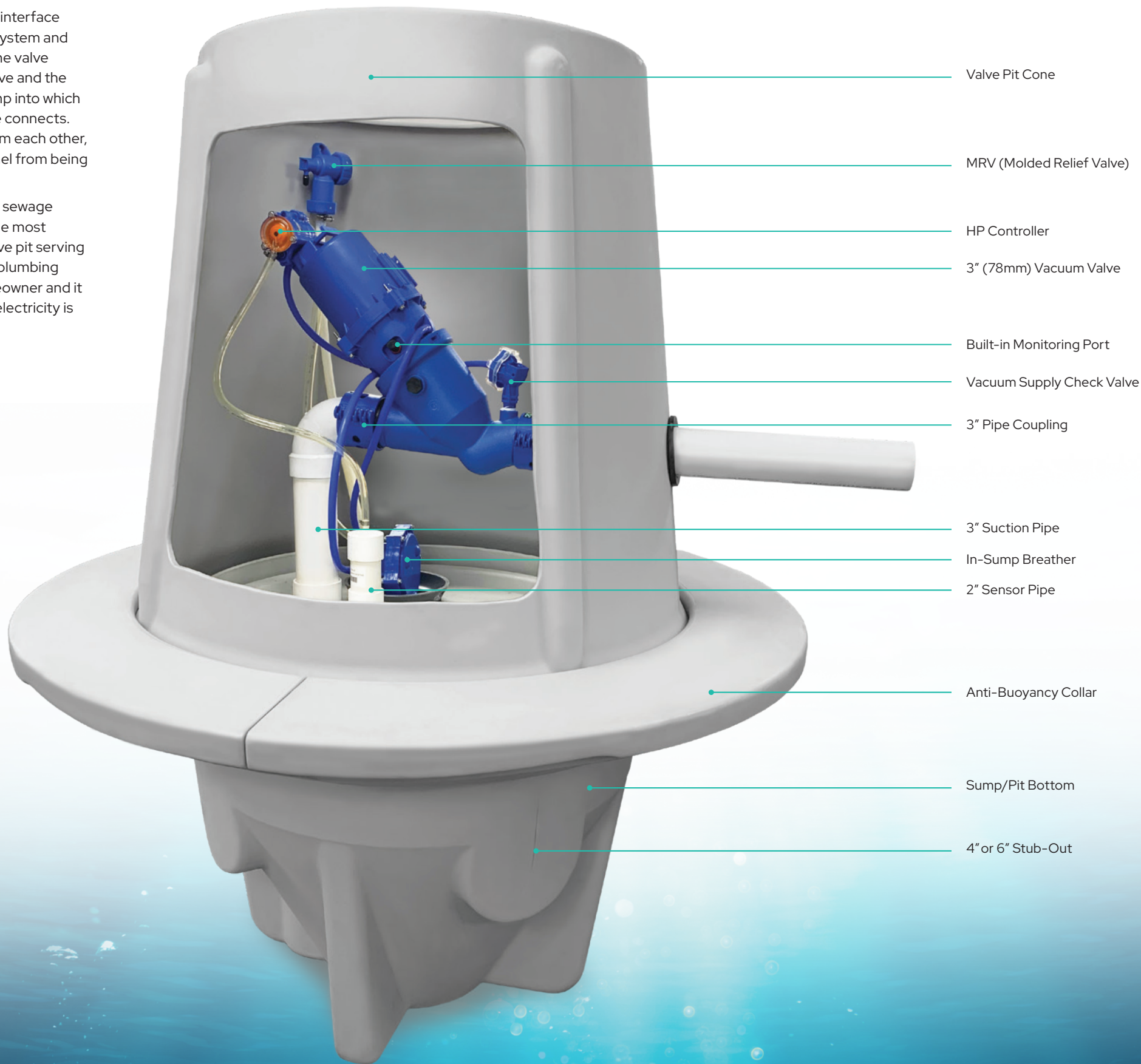


Sewage pumps then transfer the sewage to the treatment plant via a force main.

Valve Pit Components — the Valve Pit

The Airvac valve pit provides the interface between the vacuum collection system and the house. The top chamber of the valve pit houses the Airvac vacuum valve and the bottom chamber is a sewage sump into which the gravity lateral from the house connects. The two chambers are sealed from each other, preventing maintenance personnel from being exposed to raw sewage.

Each valve pit can accommodate sewage for up to four homes, although the most common configuration is one valve pit serving two adjacent houses. No special plumbing fixtures are required by the homeowner and it is pneumatically operated so no electricity is required at the valve pit.



Valve Pit Cone:

The valve pit cone securely houses key components, including:

- 3" (78 mm) Vacuum Valve
- HP Controller
- In-sump Diaphragm Sump Breather

The cone has a 36-inch (914 mm) diameter at the base and tapers towards the top to fit a standard frame and cover.

Sump/Pit Bottom:

The sump bottom, manufactured as a single piece using rotationally molded polyethylene (PE), is designed for strength and stability. It features:

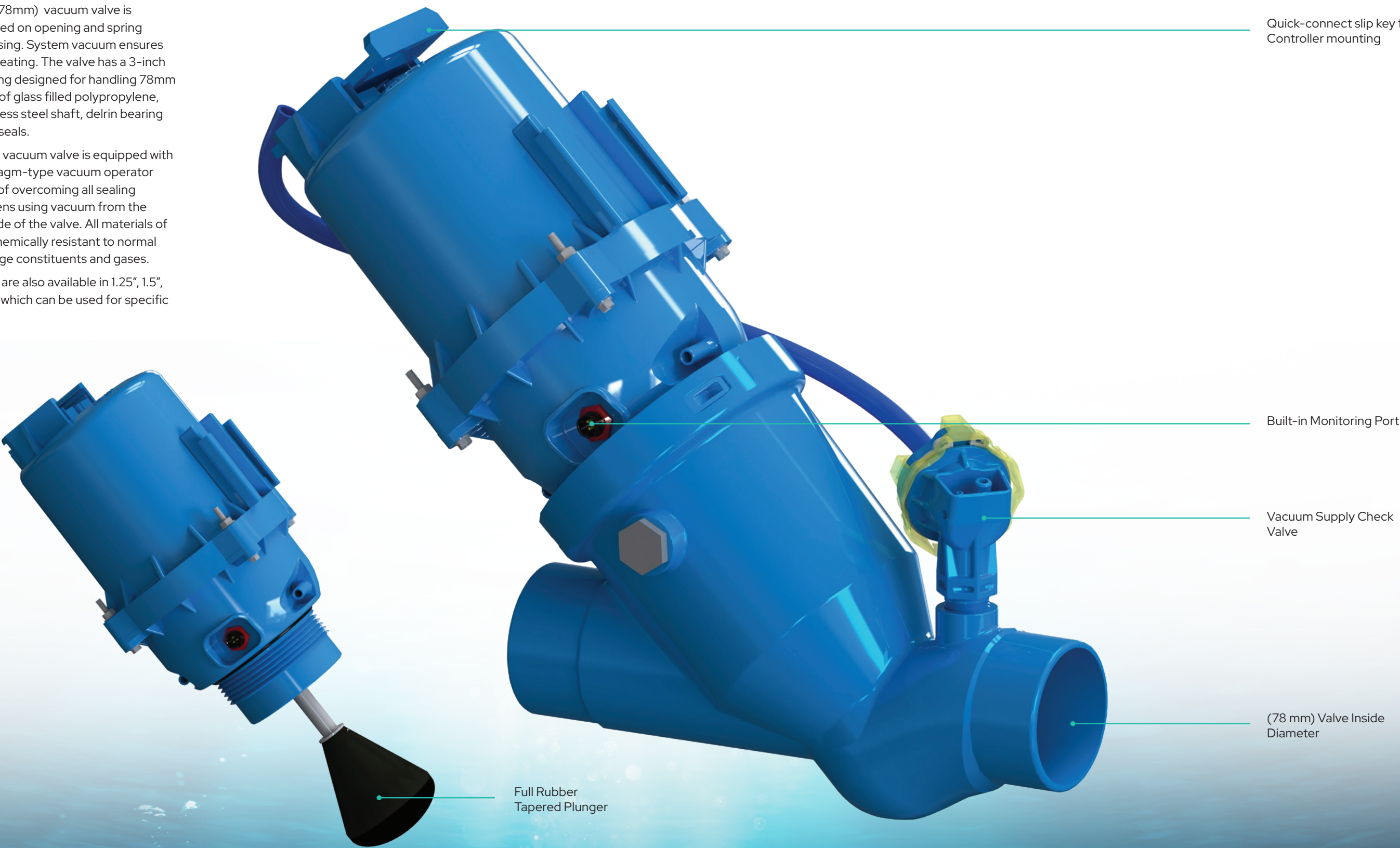
- **Tapered Design:** Seamlessly connects with the valve pit cone.
- **Stabilizing Embosses:** Support the cone and accommodate various pipe connections.
- **Elastomer Connections:** Allow easy entry for gravity line pipes, with holes field-cut to suit different pipe locations. No areas are excluded for gravity line connections.

Valve Pit Components — the 3” (78mm) Vacuum Valve

The Airvac 3” (78mm) vacuum valve is vacuum operated on opening and spring assisted on closing. System vacuum ensures positive valve seating. The valve has a 3-inch full-port opening designed for handling 78mm solids, is made of glass filled polypropylene, and has a stainless steel shaft, delrin bearing and elastomer seals.

The 3” (78mm) vacuum valve is equipped with a rolling diaphragm-type vacuum operator and is capable of overcoming all sealing forces, and opens using vacuum from the downstream side of the valve. All materials of the valve are chemically resistant to normal domestic sewage constituents and gases.

Vacuum valves are also available in 1.25”, 1.5”, and 2” models, which can be used for specific applications.



Valve Pit Components - Other



HP Controller

(High Performance Controller)

The Airvac valve pit was designed so that a very repeatable, specific amount of liquid is withdrawn each cycle. This in turn helps control the Air-to-Liquid (A/L) ratio, ensuring proper system operation. The HP Controller is the key component that provides this function.

The HP Controller relies on three forces for its operation: pressure, vacuum, and atmosphere. As the sewage level rises in the valve pit sump, it compresses air in the sensor tube. This pressure initiates the opening of the valve by overcoming spring tension in the controller and activates a three-way valve. Once opened, the three-way valve allows the controller to take vacuum from the downstream side of the valve and apply it to the actuator chamber, to fully open the valve.

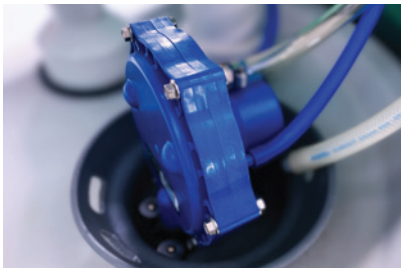


Sump Breather

The Sump Breather operates through the use of a diaphragm that reacts to the breather pipe pressure. The sensor pipe pressure ranges from 0" (sump empty) to 6" (level where valve normally cycles).

When the sewage level becomes abnormally high, the sensor pressure continues to rise. When 22" of pressure is present, the diaphragm will seal off the ports of the sump breather, protecting the controller from water and moisture damage. An internal switch will activate to provide a high sewage sump level signal for monitoring. As a result, high sewage sump floats are not required.

When the system operation problem is corrected, the valve will cycle, and the sewage sump will be emptied. The sensor pipe pressure will drop to 0" allowing the valve and controller to return to normal operation.



Vacuum Supply Check Valve

The Vacuum Supply Check Valve is engineered for reliable performance in cold weather conditions, offering enhanced drainage to reduce the risk of freezing and prevent system operation failures. Its robust construction is designed to withstand high vacuum forces without compromising integrity, avoiding the common issue of umbrella displacement under extreme suction.

This durable valve not only improves system resilience but also supports production efficiency with a simple, intuitive assembly process. For end users, maintenance is straightforward and hassle-free.



Molded Relief Valve

The Molded Relief Valve (MRV) is a robust, integrated solution designed to improve flow performance and streamline installation. By combining the functions of both the sump breather relief valve, the MRV eliminates the need for multiple elbow fittings typically required for air intake and venting.

This consolidated design not only reduces material costs but also simplifies system architecture. It incorporates a debris-reducing screen and utilizes existing production components, including the floating cup as an internal check valve and the umbrella check valve as the air inlet, making it a smart and efficient advancement in vacuum system technology.



Air Terminal

The air terminal provides the system with a source of atmospheric air, which is necessary for liquid transport. Airvac's 6" air terminal consists of a molded housing that is placed on 6" piping connected directly to a valve pit sump. The air terminal was designed to look like other utility boxes/structures typically seen in rights-of-way. The air terminal is supplied by Airvac and is installed by the contractor during the construction phase as part of the valve pit installation.

A solar light monitor can be mounted on an air terminal and connects to the internal breather and the vacuum valve. The monitor can signal a high sewage sump level via the breather or a valve failure via the vacuum valve. The light is easily visible from a long distance, avoiding the need for operators to physically check every vacuum valve in the system.



Vacuum Stations



PacVac Vacuum Stations

Airvac PacVac vacuum stations are ideally suited for small to medium-sized projects serving less than 550 connections and/or peak flows less than 350 gpm. Generally, the mechanical and electrical components are located on skids which includes the vacuum pumps, sewage pumps, collection tank and control panel. The skids are housed in a prefabricated building that can be supplied by Airvac.

For customers who need an inexpensive, small vacuum station for an initial phase of a larger system, Airvac can also house the vacuum station in a shipping container and make it available on a short-term lease basis.



Custom Vacuum Station

An engineered custom vacuum station is ideally suited for larger systems with more than 550 connections and peak flows greater than 350 gpm, but can be used with smaller systems as well.

With an engineered custom vacuum station, Airvac provides all internal components on a skid(s) which are housed in a building custom designed by an engineering firm. The Airvac skid(s) is typically housed in a two-story structure, with the vacuum pumps and control panel on the top floor, and the collection tank and sewage pumps on the lower floor.



Control Panels

Every control panel is custom designed by our engineers at Airvac. Our experience in vacuum technology has allowed us to create a control panel that is tailored to the specifics of vacuum sewer collection technology.

The interactive eCabinet provides a “real time” assessment of the vacuum sewer system. Prior to the interactive eCabinet, data was derived from system operators traveling to the job site, collecting data, analyzing, and developing a report. With the invention of the interactive eCabinet, key performance indicators are analyzed, computed, and displayed, in real time at the control panel.



The Collection Tank and Sewage Pumps

Every project is unique based on customer needs.

Collection tanks will vary in size and number of available connections, based on individual project specifications.

The make and model of the sewage pumps are also selected based on individual project specifications.



Vacuum Pumps

Vacuum pumps create negative pressure on the collection tank, which is then transferred to the entire piping network via the vacuum mains. The make and model of the vacuum pumps are selected by Airvac based on individual project specifications.



Airvac’s Wireless Monitoring with our patented S.M.A.R.T. Technology

(Strategic Monitoring for Advanced Remote Transfer)



Proactively Operate And Maintain Your System.

Airvac’s wireless monitoring system, with our patented S.M.A.R.T. technology, can track trends and identify any abnormal conditions as soon as they occur. The data received from LoRa modules can be used to adjust the system, making certain that it continues to run at peak performance levels. If an issue occurs along the vacuum main or at a valve pit, the monitoring system will pinpoint the exact location and identify any necessary adjustments that need to be made. Airvac’s system will monitor vacuum levels, valve status, high sump level, system trends, cycles, cycle time, and any instances of infiltration.

Our system not only monitors itself, but it also automatically makes real-time adjustments to optimize system hydraulics. This proactive approach of controlling a vacuum system’s behavior results in optimum system performance, prevents problems from occurring, and reduces operation and maintenance costs.

Benefits

- Predictive and proactive: Potential problems are not only identified, adjustments are automatically made to correct them.
- More efficient system: System imbalances can easily be overcome, resulting in a more cost-effective system.
- Airvac is connected 24/7: Airvac specialists can monitor the system in real-time, providing assistance to the operator.
- Built-in purge cycle: A “purge” cycle can be programmed into the logic controller that will automatically clear the vacuum mains at programmed times to prepare for potential high flow events.
- Automatic system updates: Airvac can remotely push programming updates to keep S.M.A.R.T. current.

S.M.A.R.T. Technology

Airvac’s patented S.M.A.R.T. technology works in conjunction with the monitoring system. It proactively makes real-time adjustments, prevents problems from occurring, and it reduces operation & maintenance costs.

Using artificial intelligence (AI), S.M.A.R.T. communicates with the various vacuum station controls and will override pump control as necessary. S.M.A.R.T. software uses several modes to identify system imbalances and to provide recovery options. This may include monitoring various system vacuum levels, monitoring pump operating parameters, monitoring incoming flows, actuating remote vacuum valves, and adjusting vacuum levels at the station.

Dedicated Ports

Dedicated ports are integrated into the vacuum valve and sump breather, which makes connecting monitoring cables quick and easy.

No Magnets or Floats Required

Our vacuum valve monitoring does not require a magnet with newer model vacuum valves, minimizing the risk of failure due to misalignment, switch malfunction, or debris build-up. Sump levels are monitored through our new diaphragm breather instead of using a float. This minimizes the chance of failure due to the float getting stuck or hung up on internal wiring. (floats are still available for older systems)

Two-Way Communication

Two-way communication offers operators the ability to remotely cycle specific S.M.A.R.T. vacuum valves.

Monitoring Features Side-by-Side Comparison

	Airvac	Industry Standard
System Connections		
LoRa Modules	✓	✓
Cloud Data Storage	✓	✓
SCADA Connectivity	✓	✓
Main Gateways	✓	✓
Remote Gateways	✓	✓
Magnet Activated Sensors	✓	✓
Sump Float	✓	✓
Vacuum Station Control Panels	✓	✓
Types of Reporting		
Vacuum Levels	✓	✓
Valve Status	✓	✓
Sump Level High	✓	✓
System Trends	✓	✓
Cycles, Cycle Time	✓	✓
Infiltration	✓	✓
Latest Technology		
Dedicated Ports	✓	
Modulation	✓	
S.M.A.R.T. Technology	✓	
Two-Way Communication	✓	✓
Interactive e-Cabinets	✓	
No Magnets or Floats Required	✓	

Vacuum Mains

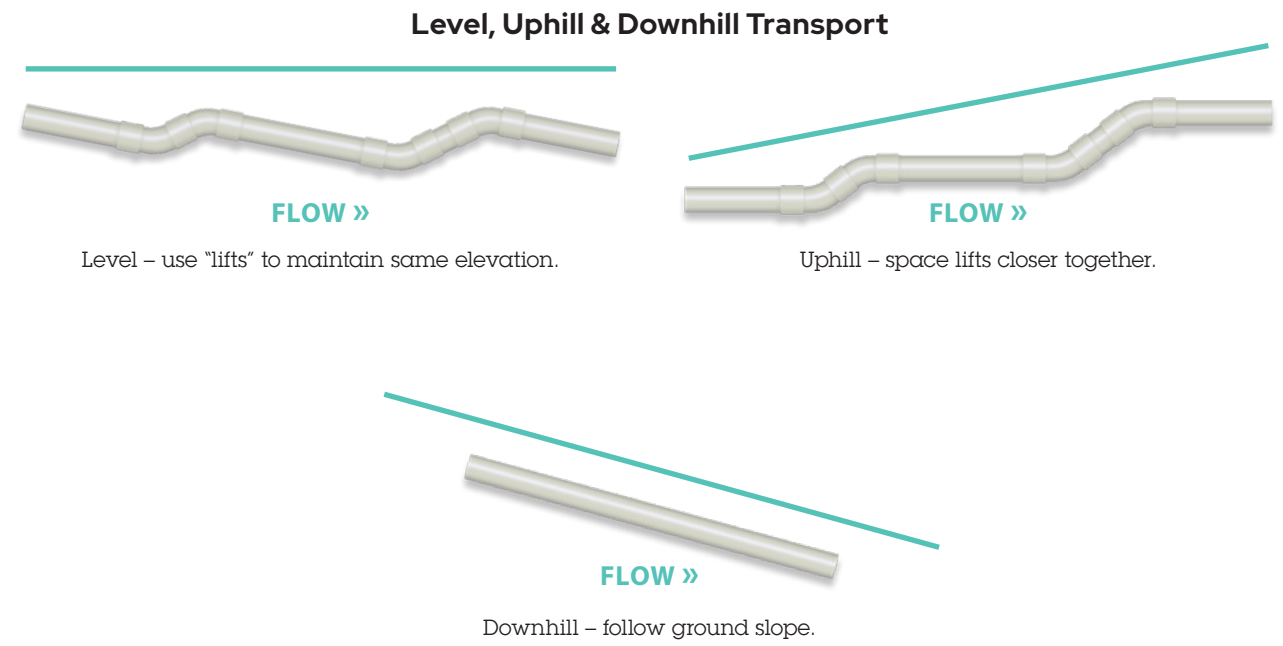
Traditional gravity sewer system installations can be very disruptive to a community, often shutting down roads completely for long periods of time.

Vacuum mains use small diameter pipes installed in shallow, narrow trenches (usually 3 to 6 ft below the surface). Because of these factors, the mains are typically installed adjacent to the pavement. This results in significantly reduced construction costs, road restoration and time savings.

Airvac’s fast and simple excavation requires not only smaller trenches, but smaller excavation equipment as well. Roads can remain fully or partially open, creating far less disruption to the people in your community.

The sawtooth profile of the vacuum main is the industry standard for vacuum sewer systems. It was originally patented by Airvac in 1979.

It ensures adequate vacuum levels are maintained at every point along the line.



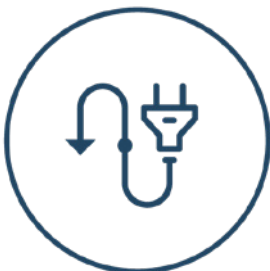
Vacuum Pump Modulation

Modulation is a patent pending program logic that improves the manner in which your vacuum system functions. Previous designs required vacuum pumps to turn on at 16” Hg and off at 20” Hg regardless of the situation within the vacuum system.

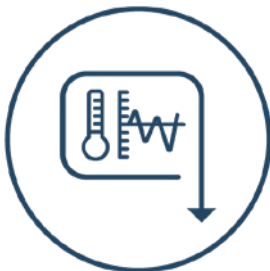
The modulation sequence controls the speed of the vacuum pumps to maintain a tighter vacuum range and speeds up and slows down depending on the demand of the vacuum system.

It is unusual for the pumps to ever operate at full speed.

Since the pumps are not turning on and off as frequently, it also significantly reduces the overall power consumption and creates less heat and noise.



Decrease Power Usage up to 35%



Less Heat & Noise



Improved Efficiency



O & M Savings



Airvac offers multiple services to keep your system running at optimal performance.

O&M Services

On-Site Airvac Trained Technicians operate your system 24/7, 365 days a year.

Annual Service Agreements

Customized service levels based on your needs for service by a Factory Certified Airvac Technician. Options include hours of coverage, response time, and any applicable parts discounts.

Block Hour Services

Choose the amount of hours pre-paid to utilize at your discretion at your site.

System Site Surveys

One day in-depth analysis of your system: evaluation of performance of the vacuum system (vacuum station & valve pits) and documented recommendations of operational improvement measures.

Regional Training Classes

Held at your site with focus on operator training and review of current parts and technology.

PM Services

Offered as Annual, Bi-Annual or Quarterly. Complete documented evaluation, adjustment, and recommendations for operation, repair or replacement of components. (Parts excluded)

Quarterly Service Package Specials.

(Contact Airvac Service Department for details)

Operator School

Offered monthly in Rochester, IN (free of charge)

Natural Disaster Prep Program

Minimize potential issues or downtime due to major weather events. Our documented preventative maintenance procedures were specifically created for preparing your system and your staff for these critical times.

Airvac Customer Portal

Contains troubleshooting videos, product data sheets, and other useful tools. The customer portal is available for all device platforms and is located at: <https://portal.airvac.com> (free of charge)



Interested in Learning More?

Whether you are a water and wastewater industry operator, a civil engineer, a public works manager, or decision maker, you owe it to yourself, your team, and your community to weigh all of the options for your next sewer system project.

Come to the Airvac Facility

For a real hands-on experience, we welcome site visits to our main facility in Rochester, Indiana. During your site visit, you will see, firsthand, all of the Airvac technologies in action, see our fabrication and production facilities, ask questions and get answers directly from the Airvac team.

We also have a Customer Solutions Center located in Tampa, Florida. Call 1-800-AIRVAC9.

Can't Make it to Rochester?

With more than 400 Airvac vacuum systems in the Americas, and nearly 1,000 systems installed worldwide, there is more than likely an Airvac installation within your proximity. Most of our clients are open to installation tours and can be scheduled through an Airvac representative.

Call 1-800-AIRVAC9.

Schedule an In-person Seminar or Online Webinar

Set up an in-person seminar or online webinar for you and your team to learn about the advantages of today's vacuum sewer collection technology.

Airvac vacuum systems are used in various indoor and outdoor applications. Our seminars/webinars cover in-depth information about Airvac's vacuum systems and gives you the opportunity to ask questions in an open forum. Call 1-800-AIRVAC9.

Course completion certificates are awarded to attendees that can be used toward PDH Credits in most states.

1-800-AIRVAC9

or visit airvac.com
info@airvac.com

We provide FREE cost estimates & system layouts.



Vacuum Technology Solutions

Making a difference **today**, for a better **tomorrow**.

Sustainable & Efficient

Our vacuum technology reduces water consumption, minimizes infrastructure costs, and supports environmentally responsible solutions across all industries.

Flexible & Scalable

Designed to adapt to diverse environments, our systems integrate seamlessly into new and existing projects, whether for municipal sewer networks, large-scale sanitation facilities, or railway infrastructure.

Hygienic & Reliable

Our sealed vacuum systems prevent leaks, odors, and contamination while offering easy maintenance and long-term reliability, ensuring uninterrupted performance in any application.

Innovative & Proven

With decades of expertise and patented industry-firsts, we continuously advance vacuum technology to deliver smarter, more reliable, and cost-effective solutions worldwide.

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or visit airvac.com
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We provide FREE cost estimates & system layouts.



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