



## Two Processes, One Flow Metering Technology: The Benefits Of Standardization

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**W**astewater treatment facilities use multiple processes and a variety of equipment to produce water clean enough for reuse. Each process within the treatment train may serve a different function yet use the same or similar equipment. In such cases, standardizing equipment may be beneficial.

For instance, standardizing gas flow meters offers several advantages. Let's look at an activated sludge plant using anaerobic digestion for biosolids treatment as an example.

### Flow Measurement Requirements For Aeration Basins

Most of the biological removal of contaminants in activated sludge plants takes place in multiple aeration basins. Large blowers pump air to the basins, providing oxygen to keep the microorganisms alive while mixing the tank contents. Air is pumped through headers that branch out to each basin. Drop pipes then connect to individual diffuser systems.

Airflow measurement is critical to optimize treatment while saving energy costs. Depending on system size and complexity, airflow should be measured in each blower's air header, in the branch piping, and possibly in the drop pipes.

### Flow Measurement Requirements For Digester Control

Anaerobic digesters produce biogas, a potentially explosive mixture of approximately 55 to 65 percent methane and 30 to 40 percent carbon dioxide. Other components may include hydrogen sulfide, nitrogen, hydrogen, and other trace impurities. Biogas is often used to produce electricity for digestion and plant buildings, or combined heating and power (CHP). To prevent buildup of gas in the digester causing potentially explosive conditions, excess gas must be flared.

Piping configuration and flow measurement requirements are unique to each treatment plant. At a minimum, gas flow measurement will be needed:

- from the digesters to gas storage units (gas bags or storage tanks);
- from the storage units to generators, compressors, or cogeneration equipment; and
- from the gas storage units to the flare, to monitor greenhouse gas emissions.

### Standardizing Air Flow Meter Technologies

Anaerobic digestion and activated sludge aeration are separate processes within the plant. However, accurate gas flow measurement is a crucial component of both activities. Standardizing airflow meters offers several advantages.

#### ***Single Vendor Point Of Responsibility***

Dealing with one vendor means one point of contact and one phone call when there's a problem. One responsible vendor means issues get resolved quickly. You're less likely to endure finger-pointing and waiting to hear from multiple manufacturers' representatives. Also, time for processing purchase orders and invoices is reduced.

#### ***Reduces Training Requirements***

Using the same equipment throughout the plant expedites training for operators and technicians. Staff can focus on learning the intricacies of one type of equipment more thoroughly, while cutting training time in half. Training a staff of five technicians on installing, maintaining, and reading each type of flow meter might take a full day. Based on \$25/hour per technician, it might cost \$1,000 of lost productivity each time a new flow meter is introduced or reintroduced.



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### ***Simplifies Installation***

In addition to reducing the learning curve, with standardized flow meters installation will be essentially the same for each meter. The use of standardized equipment helps to avoid the problem of incompatibility with control systems and valves, cutting the installation time in half and minimizing the potential for human error and faulty installation.

### ***Simplifies Maintenance***

Standardization of airflow meters means maintenance technicians become more knowledgeable about the equipment. Calibration checks for flow meters at both processes are the same. It's not uncommon for a plant to store multiples of each type of flow meter used onsite in case a meter needs to be switched out at any time. Using the same flow metering technology, tools and spare meters can be shared, saving storage space.

### ***Improves Technician Responsiveness***

Each additional type of equipment increases the burden on technicians. Plant staff must develop different skills for troubleshooting, inspection, and repair. If using outside technicians, multiple vendors must be contacted. As this task often falls on the plant superintendent, this type of follow-up can cost up to \$80/hour. Standardizing equipment streamlines responsiveness and cost-efficiency.

### ***Lowers Operational Costs***

Reduced training requirements, simplified maintenance, and single vendor responsibility improves staff efficiency. Also, the ability to share spare meters and tools lowers supply costs.

## **Gas Flow Meters For Anaerobic Digestion And Aeration**

Beyond the cost advantages of standardizing flow meters, the biggest factor in choosing a meter is its ability to meet specifications suitable to both processes. The meters must be able to measure low flow velocities; they should have no moving parts to avoid clogging or fouling from dirty, wet biogas; they must be capable of handling temperature and flow changes; and they must have a rugged construction to withstand a tough environment.



Meters that have been used for gas measurement in wastewater plants include:

- Thermal mass flow meters
- Differential pressure meters (orifice plates)
- Vortex meters
- Ultrasonic flow meters
- Coriolis mass flow meters

Thermal mass flow meters have been used to measure aeration and biogas flows successfully for many years. They measure gas flow using temperature differential between two leads. Look for a meter that uses a constant power measuring technique that creates a slight heating effect to dry condensation off the sensor. This will allow accurate measurement of wet gases. These meters have no moving parts or holes to clog in a dirty gas environment. They handle temperature fluctuations and low flow velocities well and are ruggedly constructed.

Differential pressure meters have been used but are sensitive to dirty gases that can greatly reduce accuracy and create a high maintenance routine. Vortex meters are accurate, but wetting of the membrane may shorten the meters' life. They also may cause pressure losses that interfere with the process. Dirty gas may clog or foul a vortex meter.

Ultrasonic meters measure flow using the transit time of a sound through the gas. They have only recently come on the market, as wet gas negatively affected performance in the past.

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Coriolis mass flow meters measure the force from the acceleration of mass moving away from a center of rotation. While they are very reliable and low maintenance, low flow velocities degrade their accuracy.

Criteria:	Thermal Mass Flow Meters	Differential Pressure Meters	Vortex Meters	Ultrasonic Flow Meters	Coriolis Mass Flow
Wet Gas	■	■			■
Dirty Gas	■			■	■
Temperature Fluctuation	■	■	■	■	■
Anti-Clogging	■			■	■
Low Flow Velocity	■	■	■	■	
Rugged Construction	■	■	■	■	■

Thermal mass flow meters using the constant power method check all the boxes and have field-proven long-term performance. It is not uncommon to get over 15 years of service life from this type of flow meter.

### Conclusions

Standardizing equipment at wastewater treatment plants, including gas flow meters, improves efficiency and saves costs. Wastewater facilities have several meter technologies available, including thermal mass flow meters, which can address all critical criteria for both aeration and anaerobic digester gas flow monitoring with a single technology. ■