Technical Publication

Seven Tips To Cut Wastewater Aeration Energy Costs With Thermal Mass Flow Meters

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Figure 1. FCI ST100 Thermal Flow Meter at WWT Plant

One of the biggest expenses in wastewater treatment operations is the cost of energy to run the blowers and compressors that produce air for the aeration basins. The figures most often cited are that 40 to 50 percent of a wastewater plant's total energy usage can be attributed to the aeration process.

By measuring the system's air flows with accurate, repeatable air flow meters, the aeration process can be better controlled to optimize the process and minimize plant energy cost. Three flow sensor technologies typically have been used in aeration air flow monitoring applications in wastewater treatment plants:

- Differential pressure (orifice plates)
- Vortex shedding technologies
- Thermal dispersion (mass flow)

Within wastewater treatment plant aeration systems, it is now generally accepted that thermal dispersion mass flow meters are the preferred, proven best solution and have the largest installed base for this application (Figure 1). For plant expansions, new plants and upgrades this trend is expected to continue. Here are seven tips that explain how thermal mass flow meters can reduce aeration plant energy costs and have become the flow meter of choice for aeration applications.

Tip 1: Replace Legacy Technology Flow Meters

Orifice plates and vortex shedding meters remain installed in many older aeration systems. Plant engineers can build a sound engineering case and strong ROI calculationsto gradually replace these legacy flow metering technologies during retrofit and plant upgrade projects. The justification for their replacement with thermal flow meters can easily be built around energy cost savings, improved aeration process performance and reduced maintenance costs of both the blowers themselves and the flow meters.

Tip 2: Get Better Measurement Accuracy

Thermal mass flow meters are generally accurate to ±1% of rdg, ±0.5% FS (or better depending on the specific meter), and with repeatability to ±0.5% of rdg.. This level of accuracy and repeatability adequately meets the needs of wastewater treatment aeration processes.

Tip 3: Achieve Wider Flow Range Flexibility

With the capability to measure from extremely low flows to very high flow rates (<1 SFPS to 1000 SFPS), thermal mass flow meters more than adequately support the requirements of wastewater aeration treatment plants. Their standard wide turndowns (100:1) provide the range needed to always measure accurately in variable or changing operating conditions such as those due to community demand fluctuations, seasonal changes in weather or in start-up versus full capacity operations.

Tip 4: Direct Mass Flow Measurement Is Less Expensive

Thermal flow meters measure mass flow directly (Figure 2). Unlike DP or Vortex shedding technologies, they do not require the additional installation of temperature or pressure sensors,

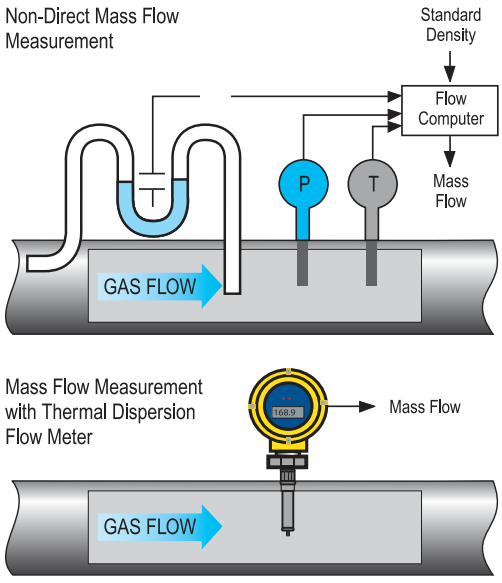

Figure 2. Thermal Mass Flow Versus Other Flow Technologies

which will still only infer mass flow. Applying thermal flow meters will not only avoid the expense of the additional sensors themselves, but will also avoid costs for extra piping, –extra piping installation and maintenance.

Tip 5: Low Cost, Single Tap Meter Simplifies Installation

Insertion-type thermal flow meters are easily installed through a single tap point in the pipe as opposed to full bore (i.e., spool-piece section) meter technologies. There is no need to interrupt the process, shut down the line or cut the pipe and re-weld. Most are installed with a simple ball valve to facilitate easy installation or removal. With its small diameter, center-point mounted insertion probe there is virtually no pressure drop with a thermal mass flow meter. That means the blowers in aeration systems outfitted with thermal flow meters can run at lower power levels resulting in reduced energy consumption and direct cost savings.

Tip 6: Easily Overcome Limited Straight Run

Wastewater treatment plant aeration systems often lack enough pipe straight-run to ensure proper flow meter performance. This best-practice engineering solution is to install a flow conditioner that will ensure a fully developed and repeatable flow profile with minimal pipe run. Insertion thermal mass flow meters can be supplied with, and specifically calibrated for use with, flow conditioners (Figure 3). Flow conditioners can reduce straight-run requirements from 20 to 30 diameters (d) down to as little as 7d. The highest quality flow conditioners eliminate both swirl and profile distortions and overcome flow profile changes that occur in transitional flow regions. However, some flow conditioner technologies add a lot of pressure drop that will increase blower usage to overcome and will negate some of the previously mentioned energy savings. Look closely at flow conditioner pressure drop ratings and choose one with minimal pressure drop to maximize energy cost savings and ROI.

Tip 7: Low Maintenance and Longest Service Life

With no moving parts, there is nothing to clog, foul, break, wear out, clean or repair with a thermal mass flow meter. Thermal flow meters can continue to operate un-touched and trouble-free for many years. With advances in techniques even calibration can be checked in-situ, without removing from the process, which can save cost and time by avoiding un-needed factory or calibration lab returns. In-situ calibration verifications can be done either partially (electronics only) with dry-check techniques or completely (sensors included) with a wet-check technique where the installed thermal flow meter is retracted into a ball valve in-situ and a precise, controlled amount of an inert gas like nitrogen is administered to the meter via a portable calibration verification kit.

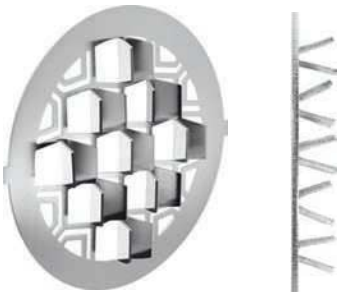

Figure 3. Vortab VIP Flow Conditioner Photo

Money and Time Saving Conclusions

Thermal mass flow meters offer a number of advantages in wastewater aeration treatment plant applications. They are accurate over a wide flow range, provide direct mass flow measurement, are easiest and lowest cost to install, cause virtually no pressure drop, are the lowest cost for line sizes 4 to 16 inches [100 to 400mm] and require very little maintenance, which ensures continuous, trouble-free operation over a long life.

All of that means optimum air flow measurement and control that will reduce the work load and run-time of blowers and compressor to deliver air to aeration ponds resulting in significant energy cost savings and lower maintenance. In addition, the lower cost installation and virtually no maintenance costs of thermal mass flow meters results in a low instrument life-cycle cost. With thermal meters supporting your aeration system, you'll save money up front with easy insertion-style meter installation, your air delivery costs will go down every day and you'll cut maintenance cost and time for years to come. ■