

Achieving accurate wastewater flow measurement

Gaining an enhanced overview of wastewater flows using ABB's WaterMaster



Improving wastewater measurement and reducing the risk of excess discharges through accurate flowmetering

Measurement made easy

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Introduction

Measurement of wastewater flows is needed to help maintain compliance with increasingly stringent legislation aimed at minimizing the impact of human activities on the environment. Whether for measuring industrial or domestic waste flows, the use of flowmeters to help gather discharge data can play a vital role in helping to keep wastewater emissions within the prescribed limits.

In cases where an industrial site, business or other heavy water user discharges large quantities of wastewater to a public water treatment works, accurate flowmetering is especially desirable to ensure that the emitter is correctly billed for the amount of water discharged.

The application

In most cases, the point at which wastewater flows are measured is the pumping station, which relays wastewater from industrial sites and/or domestic sewer networks from treatment at one or more wastewater treatment plants. For the reasons stated before, as well as the need to make sure that water treatment works are not overloaded with excessive quantities of wastewater, it is necessary to measure the quantities of water being pumped as closely as possible.

One way of measuring these quantities is to estimate the flow by multiplying the volume of water that flows each time the pump is started by the number of pump starts over a set period of time. This gives an approximate total volume figure for a known period which can then be used to estimate the flow.

Another, more precise way, is to use a flowmeter to provide an exact and continuous measurement of the volume of water that flows through a wastewater distribution system.

The challenge

There are two main challenges that users face when selecting a flowmeter for measuring wastewater. The first challenge is the choice of the right flowmeter for the job. There are various options available, each offering their own distinct set of advantages and drawbacks depending on the characteristics of the application, including the ability to handle high velocity flows of particulates and suspended solids as well as the overall installation space available.

The ability to handle high velocity flows where solids may be present, rules out many conventional flowmetering technologies. Differential pressure meters such as orifice plates and flow nozzles, for example, could become clogged.

Mechanical meters are also unsuitable. With moving parts subject to wear and tear, these meters can quickly suffer reduced accuracy, leading to either under or over-registration of flows. Furthermore, the need for mechanical meters to be periodically tested, recalibrated and repaired means that they have to be removed, requiring users either to replace the meter with a temporary device or cease measurement until the meter is refitted back into the line.

Ultrasonic flowmeters also suffer various drawbacks which can make them unsuitable. Transit time meters in particular can struggle to handle flows with high levels of particulate matter, requiring a strainer to be fitted. Both transit time and Doppler meters can also be affected by velocity profile distortions, requiring from 10 to 40 upstream diameters, depending on the severity of the disturbance. The turndown of ultrasonic meters is also limited within an ideal range of 20:1 to 40:1. Ultrasonic meters can also be difficult to install and set up, especially where high accuracy is required.

As a further consideration, there may also be the need for data from the meter to be accessed from a central location, particularly on large, dispersed sites or where the meter is situated in a hard to reach location.



Adding flowmeters to pumping installations can help to provide a more precise measurement of waste water flows.

A solution

Electromagnetic flowmeters offer a good alternative for water distribution applications. Compared to other flowmeter types, electromagnetic flowmeters offer greatly enhanced accuracy and repeatability throughout their operational life, with uncertainty of $\pm 1\%$ reading or better. With no moving parts, they do not suffer from problems with wear and tear, minimizing maintenance and require no upstream strainers to filter sediment. A choice of flow primary linings affords further protection against coating and high sediment flows, with users able to choose from a variety of materials, including ceramic linings for particularly abrasive flows.

The ability of electromagnetic flowmeters to better handle distorted velocity profiles also reduces the amount of piping upstream and downstream of the meter.

Modern electromagnetic flowmeters are also capable of being buried, eliminating the need for the construction of costly installation chambers.

Available in sizes from 10 to 2400 mm ($\frac{3}{8}$ to 96 in), ABB's WaterMaster electromagnetic flowmeter is ideally suited to wastewater flow measurement applications.

A key feature is the WaterMaster's revolutionary octagonal sensor design. By improving the flow profile, the octagonal design minimizes the upstream and downstream pipe lengths required from the point of installation, greatly reducing the cost of fitting the meters into new or existing pipelines.



ABB's WaterMaster electromagnetic flowmeter enables operators to gain an enhanced overview of their wastewater flows.

The WaterMaster also features on-board verification capability. Called VeriMaster, it assures operators of the performance of the meter through constant self-checking. When coupled with ABB's VeriMaster software tool, it enables operators to produce a printed verification certificate for regulatory compliance.

The effects of signal noise are also minimized by the WaterMaster's use of advanced Digital Signal Processing (DSP) technology. This enables the WaterMaster's transmitter to separate the real signal from the noise, thereby providing high quality outputs especially in harsh environments involving vibration, hydraulic noise and temperature fluctuation.

All WaterMaster sensors have a rugged, robust construction to ensure a long, maintenance-free life even under the most difficult conditions experienced in water and waste water applications. The sensors are inherently submersible (IP68, NEMA 6P) as standard, ensuring suitability for installation in chambers and metering pits which are liable to flooding.

All sizes of the WaterMaster are buriable and are straightforward to install, with installation merely involving excavating to the underground pipe, installing the sensor and wiring the factory pre-potted cabling to the transmitter and then backfilling the hole.

Operation has been simplified by the use of ABB's universal Human Machine Interface (HMI), which has now been extended across its range of instrumentation products. Based on Windows™ technology, the HMI simplifies operation, maintenance and training, reducing cost of ownership and providing a consistent user experience. Data can also be accessed remotely via HART™, Profibus DP™ and Modbus™ communications.

Installation is further simplified by the WaterMaster's 'Fit and Flow' data storage feature. On initial installation, the selfconfiguration sequence automatically replicates into the transmitter all calibration factors, meter size and serial numbers as well as customer site-specific settings. This eliminates the opportunity for errors and leads to increased speed of start-up.

Measurement integrity is ensured by redundant storage of data in both the sensor and transmitter memory, which is continually updated during all operations. The on-board sensor memory eliminates the possible problems associated with pluggable data memory modules.

WaterMaster is proven to be robust and reliable, with unmatched diagnostic capabilities providing the right information to keep the process up and running. Alarms and warnings are classified in accordance with NAMUR NE107.

The meter is also verified to OIML R49 type 'P' requirements to ensure the highest accuracy and long term performance of the system by continuously self-checking the sensor and transmitter in the field.

All ABB flow meters are designed and manufactured in accordance with international quality procedures (ISO 9001) and are calibrated on nationally-traceable calibration rigs to provide the end-user with complete assurance of both quality and performance.

Acknowledgments

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ABB Limited**Measurement & Analytics**

Oldends Lane
Stonehouse
Gloucestershire GL10 3TA
UK
Tel: +44 (0)1453 826 661
Fax: +44 (0)1453 829 671
Email: instrumentation@gb.abb.com

ABB Inc.**Measurement & Analytics**

125 E. County Line Road
Warminster
PA 18974
USA
Tel: +1 215 674 6000
Fax: +1 215 674 7183

ABB Engineering (Shanghai) Ltd.**Measurement & Analytics**

No. 4528, Kangxin Highway
Pudong New District
Shanghai, 201319,
P.R. China
Phone: +86 (0)21 6105 6666
Fax: +86 (0)21 6105 6677
Email: china.instrumentation@cn.abb.com

abb.com/measurement

