Flowmeters 101 – Magnetic and Coriolis Flowmeter

Flowmeters play a vital role in sanitary processing. They are used to measure incoming raw materials, incoming water supply, CIP solutions, ingredients in your formulation, final product production and even waste water leaving the plant. Considering their use in critical applications, ensuring that you are using the right type of meter with the correct level of accuracy for your application can be the difference in the quality of your product and save you thousands of dollars in lost revenue or profit.

In sanitary processing, one will typically find mechanical flowmeters (Positive Displacement, Turbine), electromagnetic and Coriolis flowmeters.

Magnetic Flowmeters

Magnetic flowmeters use Faraday's Law of Electromagnetic Induction to determine the flow of liquid through a pipe. This type of flowmeter works by generating a magnetic field and channeling that through the liquid in the pipe. Faraday's Law states that flow of a conductive liquid through the magnetic field will cause a voltage signal that can be sensed by electrodes on the tube walls. When the fluid moves faster, more voltage is generated. The voltage generated is proportional to the movement of the liquid. Transmitters process the voltage signal to determine liquid flow.

The signals produced by the voltage are linear with the flow. With this, the turndown ratio is very good without sacrificing accuracy.

Pros and Cons

Since these flowmeters measure conductivity, obviously the fluids measured need to be conductive – water, acids and bases. Low conductive liquids, such as deionized water or gases, can cause the flowmeter to turn off and/or measure zero flow. There is no obstruction in the path of the liquid, therefore no induced pressure drop across the meter. One other benefit of mag meters is that they can be used on gravity-fed liquids. With gravity-fed liquids, make sure the orientation of the flowmeter is vertical so that the flowmeter is completely filled with liquid. These flow meters are sensitive to air bubbles because the meter cannot distinguish entrapped air from the liquid. Air bubbles will cause the meter to read high.

Mag meters are typically chosen because they have no obstructions, are cost-effective and provide highly accurate volumetric flow. Additionally, they can handle flow in either direction and are effective at low and high volume rates.

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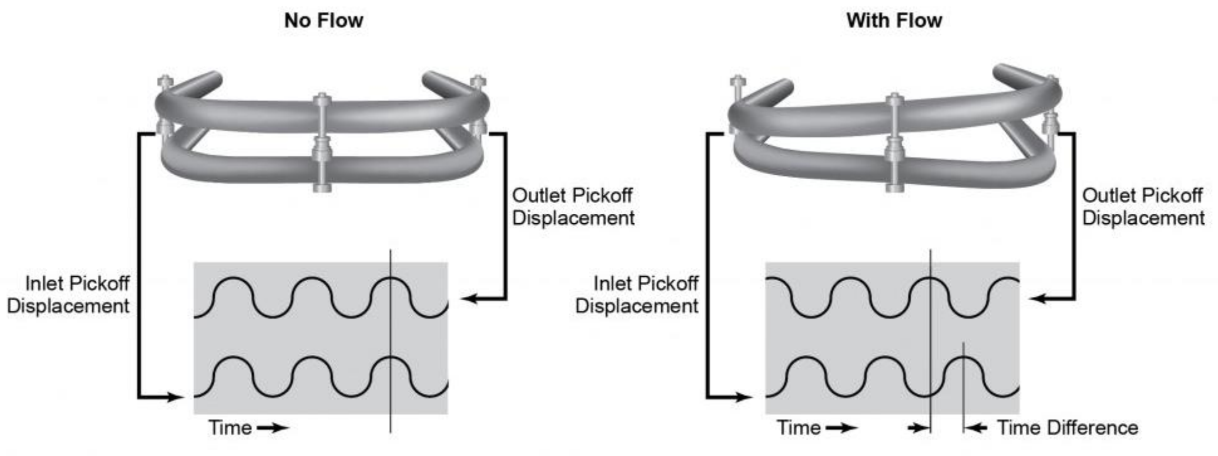
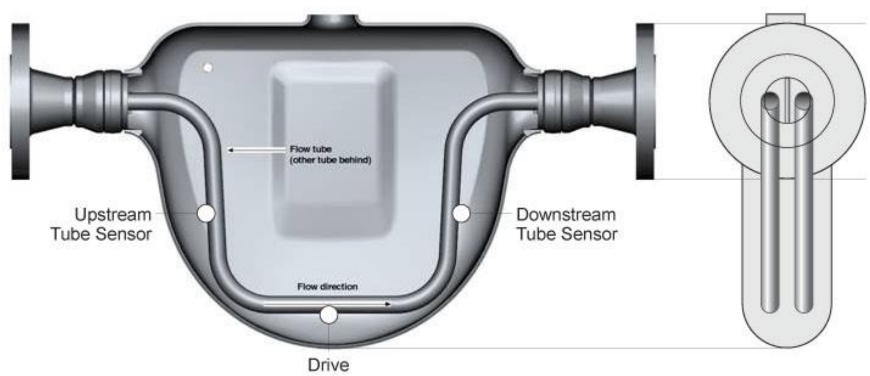
Coriolis Mass Flowmeters

A Coriolis mass flowmeter operation is based on the principles of motion mechanics. This flowmeter contains a vibrating tube in which a fluid flow changes in frequency and amplitude. As fluid moves through this tube, it is forced to accelerate toward the point of peak amplitude vibration. Conversely, a decelerating fluid moves away from the point of peak amplitude as it exits the tube. The result is a twisting reaction of the tube as flow moves through it. The amount of twist is proportional to the real mass flow of fluid passing through the tube.



This effect can be experienced when riding a merry-go-round – when moving toward the center, a person will “lean into” the rotation to maintain balance. Most flowmeters have a split coil design. During operation, a drive coil stimulates the tubes to oscillate in opposition (sine waves). A sensor measures the time delay between the two sine waves (Delta T) which is directly proportional to mass flow rate.



Pros and Cons

These flowmeters are used in a wide range of critical and challenging applications. They can handle low to high flow rates with very high accuracy. They are highly reliable and have minimal calibration requirements and low maintenance costs. In addition, fluid density has basically no impact on flow measurement which makes Coriolis meters ideal where the physical properties are unknown. They have a higher initial cost than other flowmeters. Pressure drop must also be considered, especially if running high viscosity fluids.