by Jesse Yoder, Ph.D.

A Versatile Solution for Most Liquid Flow Applications

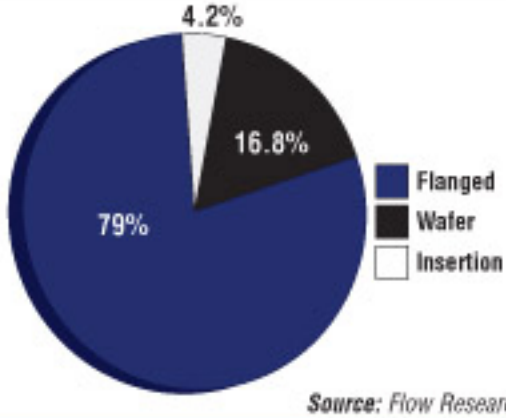
Principle of Operation: Magnetic flowmeters operate based on Faraday's Law of Electromagnetic Induction. According to this principle, a voltage is generated in a conductive medium when it passes through a magnetic field. This voltage is directly proportional to the density of the magnetic field, the length of the conductor and the velocity of the conductive medium. In Faraday's Law, these three values are multiplied together, along with a constant, to yield the magnitude of the voltage.

Magnetic flowmeters use wire coils mounted onto or outside of a pipe. A voltage is then applied to these coils, generating a magnetic field inside the pipe section. As the conductive liquid passes through the pipe, a voltage is generated and detected by electrodes, which are mounted on either side of the pipe. The flowmeter uses this value to compute the flowrate. Magnetic flowmeters are used to measure the flow of conductive liquids and slurries, including paper pulp, slurries, and black liquor. Their main limitation is that they cannot measure hydrocarbons (which are nonconductive), and hence are not widely used in the petroleum industry. While they cannot be used to measure the flow of gas or steam, they excel in measuring liquids.

Technology & Market Trends: Magnetic flowmeters are displacing traditional technology flowmeters, such as differential-pressure (DP), positive-displacement, and turbine flowmeters, in some applications. Magnetic flowmeters have significant advantages over traditional technology flowmeters. Unlike DP meters, especially orifice-plate meters, magnetic meters do not have a primary element that can wear and significantly degrade measurement accuracy. Placing a constriction in the flowstream also introduces pressure loss, which can cost money. Unlike positive-displacement and turbine flowmeters, magnetic flowmeters have no moving parts. This reduces unreliability and wear.

Magnetic flowmeters offer lower cost of ownership when compared with many traditional technology flowmeters. The flowtube of a magnetic flowmeter is highly durable and subject to little change. Today's linings, including PTFE, EFTE, PFA, and hard rubber are highly durable and designed to handle slurries as well as water containing chemicals. With no primary element to replace and no moving parts to introduce wear, magnetic flowmeters represent a very stable and reliable long-term method of measurement with minimal maintenance costs. For these reasons and others, magnetic flowmeters are displacing traditional technology flowmeters for some applications.

Shipments of Magnetic Flowmeters by Mounting Type in Europe in 2008 (Percent of Dollars)



Source: *Flow Research Inc.*

Important product areas for magnetic flowmeters are two-wire magmeters and wireless/battery-operated meters. Two-wire magmeters offer end-users reduced power requirements and lower installation costs. As a result, they are becoming more popular with end-users. Wireless/battery-operated magmeters are well suited to remote locations and also offer reduced installation costs.

The introduction of pulsed DC magnetic flowmeters is an important reason for the growing popularity of magnetic flowmeters. Pulsed DC meters do not require zero calibration, and they are better able to handle noise than AC meters. A number of suppliers have also introduced high-strength DC meters to better handle noise issues. High-strength DC meters are better able to handle dirty liquids and slurries than many of the standard DC meters. Standard and high-strength DC meters have become the dominant technology for magnetic flowmeters.

News & Notes: In June 2006, Spirax Sarco (*www.spirax.com/us*) acquired Advanced Flow Technologies (AFTCO). AFTCO was a manufacturer of AC magnetic flowmeters. In November 2008, Yokogawa (*www.yokogawa.com/us*) announced the release of its new ADMAG AXR 2-wire magnetic flowmeter. This meter uses dual-frequency DC excitation. In August 2008, KOBOLD (*www.koboldusa.com*) introduced its new MIK magnetic flowmeters. The MIK is available in PVC, PVDF, Polypropylene, and stainless steel. It is designed as an economical alternative to more high-priced meters.

In addition, suppliers have brought out a wide variety of liners to handle sanitary and caustic liquids. While PFA, PTFE, and Hard Rubber are popular liners, there are many other types of liners available. These liners increase the durability and reliability of magnetic flowmeters and make it possible to use them with almost any type of liquid. Special liners exist for sanitary applications. No other flowmeter that measures liquids has such versatility when it comes to the material in the flowmeter that makes contact with the liquid. FC

Jesse Yoder*, Ph.D., is president of Flow Research, Inc. in Wakefield, Mass., a company he founded in 1998. For more on Flow Research's coverage of magnetic flowmeters, visit* ***www.flowmags.com****.*