by Jesse Yoder, Ph.D.

Something to Be Said for Tradition

Legacy Flow Measurement Systems Live On

Today's flowmeter market is driven by many factors. The growth in the energy markets, especially oil & gas production, is creating a greater need for accurate and reliable measurement. The increasingly high price of crude oil and natural gas is generating more opportunities for instrumentation suppliers, as oil and gas production companies ramp up their search for new supplies. The same companies are also attempting to gain more petroleum and natural gas from existing sources of supply.

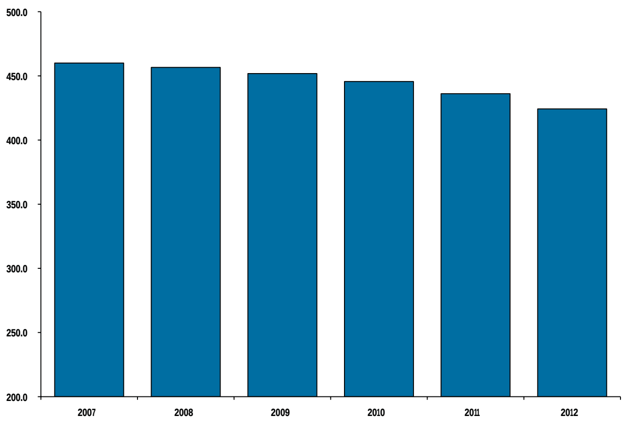
New-technology flowmeters, especially ultrasonic and Coriolis, have been grabbing most of the headlines when looking at growth in the flowmeter markets. This is because many end-users are selecting them due to an increased need for the high accuracy and high reliability that these meters offer. While both Coriolis and ultrasonic flowmeters may have a higher initial purchase price than some competitive meters, the reduced maintenance for these meters often means lower cost of ownership.

Despite the surge in interest in new-technology meters, many end-users are still selecting traditional technology flowmeters for certain applications. This includes positive-displacement, turbine, and variable-area meters. Positive-displacement and turbine meters are used for water utility, gas utility, oil, and industrial liquid applications. These two meter types are more complementary than competing, as positive-displacement meters are often used for low-flow measurement and for line sizes below four inches. Turbine meters perform well on medium- to high-speed flows, and on line sizes of four inches and up. However, turbine meters are also used on lower line sizes.

Positive-Displacement Flowmeters

Positive-displacement meters operate by repeatedly filling and emptying compartments of known volume, and then counting how many times this is done. Flowrate is calculated based on the number if times these compartments are filled and emptied. The main types of positive-displacement meters are oval gear, rotary, nutating disc, piston, diaphragm, and helical.

Positive-Displacement Flowmeter Market 2007-2012



While the positive-displacement flowmeter market will face some tough competition in the years to come, it will continue to generate significant interest for certain applications.

Positive-displacement meters are widely used to make low-cost mechanical measurements for utility purposes. This includes residential, commercial, and industrial applications. The primary competition for positive-displacement meters in these applications is different types of turbine meters, including single-jet, multi-jet, Woltman, and compound meters. While new-technology meters, including magnetic and Coriolis, are beginning to make their presence known in utility applications, many of these applications require industry approvals, and it is taking time for new-technology meters to acquire the necessary approvals.

Positive-displacement meters also face competition from turbine meters for gas applications. However, positive-displacement meters have an advantage in the smaller line sizes. Most positive-displacement meters for gas applications have line sizes between 1.5 inches and 10 inches. While turbine and ultrasonic meters are also used in line sizes between four and 10 inches, positive-displacement meters still have an advantage in line sizes below four inches. Low flowrates are not a barrier to positive-displacement meters. Diaphragm positive-displacement meters still dominate the utility gas flow measurement market.

Positive-displacement meters do face a serious challenge from new-technology meters in oil flow measurement. Their main competition comes from Coriolis meters. Because oil is a high-value product, end-users are willing to pay the higher prices for Coriolis meters to measure oil flow. Both positive-displacement and Coriolis meters are widely used to measure hydrocarbon flows both upstream and downstream of refineries at custody-transfer points along the process line.

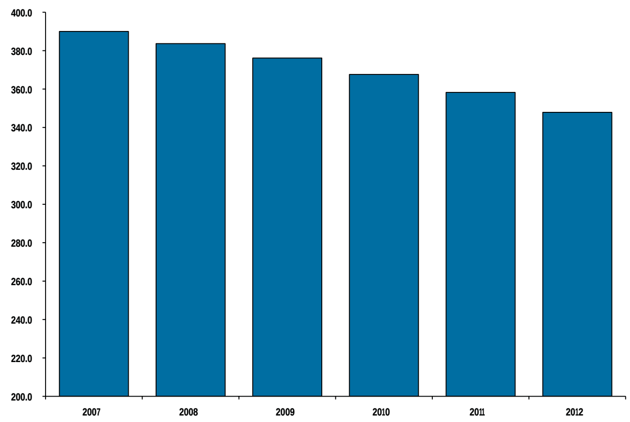
Another area where positive-displacement meters are being challenged is in the measurement of industrial liquids. Coriolis, magnetic and ultrasonic meters are making inroads in these applications. Some end-users are gravitating to Coriolis meters due to their high accuracy, while others are seeking meters with no moving parts.

Turbine Flowmeters

Turbine flowmeters have a spinning rotor with propeller-like blades that is mounted on bearings in a housing. As fluid passes over the rotor, it spins in proportion to flowrate. Flowrate is calculated based on the rotor speed. A variety of methods, including a mechanical shaft and an electronic sensor, are used to detect the speed of the rotor.

Turbine flowmeters differ according to the design of the spinning rotor. Different types of turbine meters include axial, single-jet, multi-jet, paddlewheel, Pelton wheel, propeller and Woltman. Single-jet and multi-jet meters are widely used for municipal water

Turbine Flowmeter Market 2007-2012



Like the positive-displacement flowmeter market, turbine meters figure to continue to serve a valuable role in the flow measurement space going forward.

measurement. Propeller meters are used mainly to handle dirty liquids. Woltman meters are water meters for large-volume applications. They get their name from Richard Woltman, who is credited with inventing the first turbine meter in 1790.

While turbine meters are losing ground to new-technology flowmeters in some market segments, they are still a practical choice for measuring medium- to high-speed flows. Even though turbine flowmeters were invented before 1800, they were not prevalent in industrial markets until after World War II. One of the early uses for turbine meters was for fuel measurement on military planes in World War II. Soon after this, turbine meters began being used in the petroleum industry to measure the flow of hydrocarbons.

The history of using turbine meters for gas flow measurement goes back to 1953. Rockwell introduced a turbine meter to the gas industry in 1963. Ten years later, turbine meters had become widely accepted for measuring flow by the gas industry. In 1981, the American Gas Association (AGA, *www.aga.org*) published its Report #7, "Measurement of Fuel Gas by Turbine Meters." Since that publication was issued, turbine meters have been widely accepted in the gas industry as a measurement device, especially for custody-transfer application scenarios.

The use of flowmeters for custody-transfer of natural gas is the fastest-growing niche within flow measurement, and it is an area where turbine meters are competing with ultrasonic and differential-pressure (DP) flowmeters with primary elements. Both turbine and DP meters have the advantage of installed base. However, ultrasonic meters are making headway in custody-transfer applications, especially for new pipelines and for new projects. End-users are selecting ultrasonic meters for their minimal pressure drop, their high accuracy, and their low cost of ownership. Even so, turbine flowmeters have a cost advantage over ultrasonic meters, and are still favored for some replacement application scenarios.

Despite the trend away from mechanical meters, turbine suppliers are countering with technology improvements designed to make their meters more competitive and reliable over time. By making the ball bearings out of more durable material, such as ceramic, turbine suppliers have been able to add to the life of the bearings. These and other technology improvements will help turbine meters hold onto their market share in the face of competition from new-technology flowmeters.

Variable-Area Flowmeters

Variable-area flowmeters, or rotameters, also face pressure from new-technology flowmeters. Variable-area meters consist of a tapered tube that contains a float. The force of gravity counters the upward force of the fluid. The volumetric flowrate is indicated by the point at which the float remains constant. This point can often be read on a scale on the meter tube. Variable-area meter tubes are made of glass, metal and plastic.

While most variable-area flowmeters are read manually, some have transmitters with an output that can be sent to a controller or recorder. While variable-area meters should not be selected for accuracy, they do well when a visual indication of flow is sufficient. They excel at measuring low flowrates and can also serve as flow/no-flow indicators. Variable-area meters do not require electric power and can safely be used in flammable application environments.

Low cost and simplicity are two of the main advantages of variable area meters. Plastic meters are typically lowest in cost, followed by glass meters. Metal-tube meters are typically the highest cost variable-area meters. Metal-tube meters are used for high-temperature and high-pressure applications. Some metal tube meters range in price between $1,000 and $2,000, although many are available for much less.

The Future of Flow Measurement

While there is no doubt that new-technology flowmeters are on the rise, traditional meter types still have a place in the flow measurement world. Turbine, positive-displacement, and DP flowmeters still have an advantage in installed base in many applications, and this will help them maintain their presence despite competition from new-technology meters. The extent to which suppliers continue to invest in traditional meters with product improvements will help determine how much these traditional meters can maintain their own. This is an evolving story worth watching. FC

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