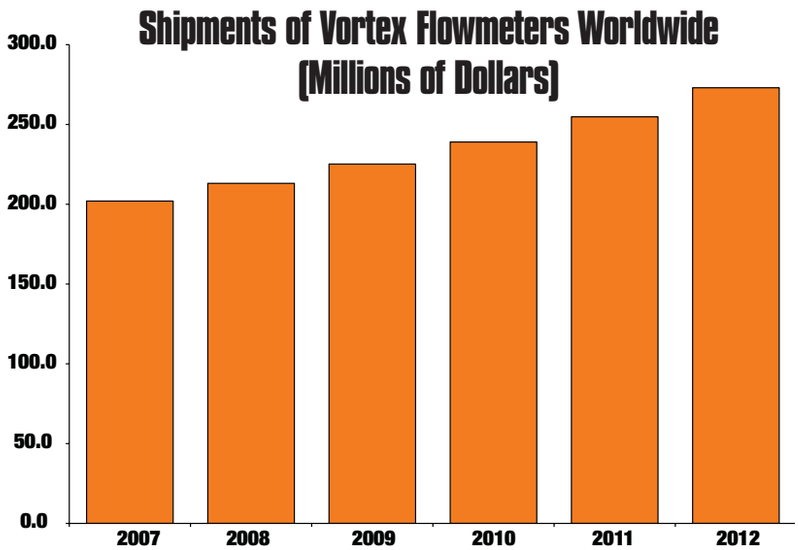
by Jesse Yoder, Ph.D.

What's So Great About Vortex Flowmeters?

Proven Technology Struggles to Differentiate In a Competitive Market

Today's flowmeter market is dominated by the heavyweights of measurement — magnetic, Coriolis, and ultrasonic. Together, these three flowmeter types accounted for close to half of all flowmeter revenues worldwide in 2008. And as the years go on, these new-technology devices continue to displace the old standards of flow measurement, i.e., differential-pressure (DP) and turbine flowmeters in many applications.

While vortex flowmeters are part of the newer generation of measurement devices, they have never been as popular or as widely used as magnetic, Coriolis, or ultrasonic flowmeters. This may be because vortex flowmeters lack that one compelling feature that makes them irresistible to end-users. Coriolis flowmeters have extremely high accuracy and can measure the flow of liquids and gases. Multi-path ultrasonic flowmeters have very high accuracy and can be used for custody transfer of natural gas and petroleum liquids. Magnetic flowmeters can measure liquid flows of any line size with high accuracy, and different types of liners enable them to handle almost any type of liquid. Vortex meters, while they are quite capable measurement devices, do not have an outstanding feature that differentiates them from other flowmeter types.



Source: *The World Market for Flowmeters, 2nd Edition, Flow Research Inc.*

Custody-Transfer: A Critical Application

Custody transfer is a critical flowmeter application. In custody-transfer applications, the custody or ownership of a fluid changes hands; it passes from one entity to another. If the fluid has high value, like petroleum liquids or natural gas, making an accurate and reliable measurement is extremely important.

For a type of flowmeter to be used for custody transfer, it must have an approval from a relevant industry organizations. In the United States, two of those bodies are the American Gas Association (AGA) (*www.aga.org*) and the American Petroleum Institute (API, *www.api.org*). Both ultrasonic and Coriolis flowmeters have received approvals in the form of standards for their use in custody transfer. These approvals have been significant growth factors for both types of flowmeters.

After many years with no approvals, vortex flowmeters finally received the approval of the American Petroleum Institute (API) for use in custody-transfer applications in January 2007. This approval was the work of API's Committee on Petroleum Measurement (COPM), which is comprised of representatives from the supplier and end-user communities. The API approval applies specifically to the use of vortex flowmeters for custody transfer of liquid, steam, and gas applications.

Product Enhancements Spur Growth

It remains to be seen whether API approval will give the vortex flowmeter market the same kind of boost that industry approvals have given to the ultrasonic and Coriolis flowmeter markets. In the meantime, suppliers have been working to address some limitations of vortex meters, and have been introducing product enhancements designed to make vortex flowmeters more accurate and reliable.

One issue that suppliers have addressed effectively has to do with vibration. In the past, vortex flowmeters have been susceptible to vibration error. If there is vibration in the line, a vortex meter can falsely generate a vortex signal or read an existing vortex incorrectly. Suppliers have successfully implemented software and electronics, including digital signal processing (DSP), which have enabled vortex meters to better handle vibration issues.

Reducer vortex flowmeters have also been introduced to enhance accuracy. Reducer vortex meters have a reduced diameter in the center of the pipe, where vortices are generated by the bluff body. This accelerates the flow of fluid through the pipe, which enhances the formation of vortices. The introduction of reducer vortex models has improved the ability of vortex flowmeters to accurately measure flow at low flowrates and has simplified the flowmeter installation process.

Multivariable Vortex Flowmeters Gain Popularity

Vortex flowmeters were introduced on the market in 1969 by Eastech. In 1972, Yokogawa (*www.yokogawa.com*) introduced its first vortex flowmeter. It was Yokogawa, based in Japan, that initially made vortex flowmeters popular in industrial markets. Another important change occurred in 1994 when Emerson Rosemount (*www.rosemount.com*) entered the vortex flowmeter market. Emerson Rosemount became one of the early US-based suppliers of vortex flowmeters. The company brought news and information about vortex flowmeters to a whole new group of customers.

Sierra Instruments (*www.sierrainstruments.com*) introduced a multivariable vortex flowmeter in 1997. This flowmeter included an RTD (resistance temperature detector) temperature sensor and a pressure transducer. By using the input from these sensors, the flowmeter was able to compute mass flow, as well as volumetric flow. Multivariable flowmeters measure more than one process variable and typically use this information to compute mass flow. This increases flowmeter accuracy in changing temperature and pressure conditions.

Since Sierra's introduction of its multivariable vortex flowmeter, a number of other companies have brought out their own multivariable vortex meters, including ABB (*www.abb.com*), Yokogawa, KROHNE (*www.krohne.com*), EMCO Flow Systems, (*www.emcoflow.com*), and Endress+Hauser (*www.us.endress.com*). While multivariable vortex flowmeters can be used for liquid applications, they are especially useful for measuring steam and gas flows, where temperature and pressure are highly important for accurate measurement.

More Suppliers Enter the Market

In the past five years, some new companies have entered the vortex flowmeter market. These include Yamatake (*www.yamatake.com*), Nice Instrumentation (*www.niceinstrumentation.com*), and Siemens (*www.siemens.com*) — the most recent entrant into the vortex space. In June 2008, Siemens announced a vortex flowmeter called the Sitrans FX300. This flowmeter is designed for the chemical, pharmaceutical, food & beverage, oil & gas and other process industry applications.

Several companies have also entered the market through acquisition in the past several years. Aalborg (*www.aalborg.com*) acquired Venture Measurement's vortex flowmeter product line (*www.venturemeas.com*), while Racine Federated (*www.racinefed.com*) purchased two vortex product lines as well — first acquiring J-TEC Associates' (*www.j-tecassociates.com*) industrial vortex flowmeter line and then Asahi America's (*www.asahi-america.com*) vortex flowmeters. Spirax Sarco (*www.spiraxsarco.com*) also bought its way into the vortex market when it purchased EMCO Flow Systems (*www.emcoflow.com*). The presence of these new suppliers and product lines is injecting new life into the vortex flowmeter market and helping to spread this technology to still more customers.

Vortex Meters Offer A Combination of Features

The strength of vortex flowmeters lies not so much in a single feature, such as high accuracy or the ability to do custody transfer, but in a combination of features — i.e., vortex meters can offer accurate and reliable flow measurement at a competitive price. While they are not as accurate as Coriolis flowmeters, many vortex meters offer accuracy readings of better than 1 percent, depending on the fluid being handled and the application. And while they are somewhat more intrusive than ultrasonic and magnetic flowmeters, vortex meters are less intrusive than DP flowmeters using orifice plates.

Vortex flowmeters can also handle a range of process conditions better than almost any other type of flowmeter. They can reliably measure liquid, gas and steam flow. Vortex flowmeters do especially well in steam flow measurement. One reason is that they can handle the high temperatures and pressures associated with steam flow. Vortex flowmeters can also reliably measure liquid and gas flow for a wide variety of applications. They are available in line sizes of less than ½" up to 16 inches.

One disadvantage facing vortex meter suppliers is that steam is not as high priced a commodity as petroleum liquids or natural gas. As a result, end-users may not be motivated to pay high prices for high-performing vortex meters to measure steam flow. By comparison, the high prices of petroleum liquids and gases help justify the relatively high cost of Coriolis and ultrasonic meters used for custody transfer. Steam is becoming more important and more valuable, however, as companies seek to become more energy efficient.

Despite all their advantages, vortex flowmeters do not yet have that single compelling feature that would cause the market to grow at the same pace as ultrasonic, Coriolis, and magnetic flowmeters. This could change if they become widely accepted for custody-transfer applications. Also, if there is an upsurge in demand for higher performing vortex flowmeters, expect to see growth in this market to pick up. FC

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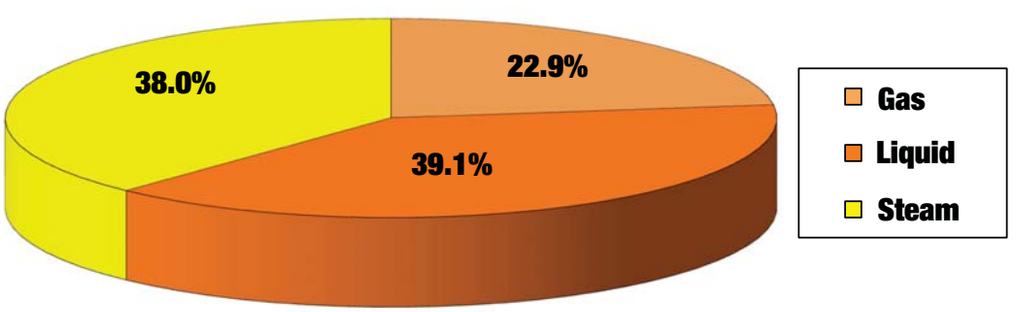
Shipments of Vortex Flowmeters Worldwide by Fluid Type in 2008 (Percent of Dollars)



Source: *The World Market for Vortex Flowmeters, 3rd Edition, Flow Research Inc.*

Flow Research is currently working on a new study called "The World Market for Vortex Flowmeters, 4th Edition," scheduled to be published in July 2009. For more information, visit Flow Research's vortex flowmeter Web portal at ***www.flowvortex.com****.*