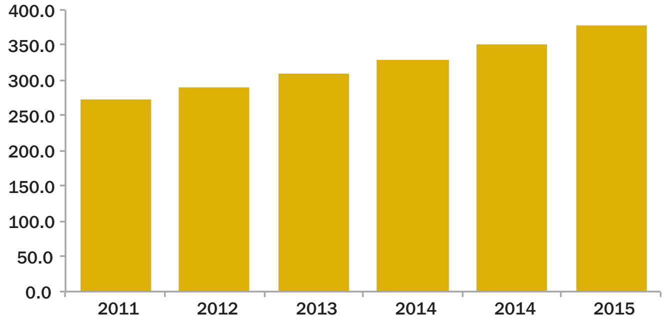
By Jesse Yoder, Ph.D.
Flow Research Inc., *FlowResearch.com*

An Advantageous Flow Measurement Solution with Upside Potential

The history of vortex flowmeters goes back to 1969 when they were introduced by Eastech. But Yokogawa (www.yokogawa.com) is the company that made vortex meters popular in process control markets. Yokogawa brought out their first vortex flowmeter in 1972. Since that time many changes have occurred in the vortex flowmeter market, yet Yokogawa remains among the leading suppliers of vortex flowmeters worldwide.

Shipments of Vortex Flowmeters Worldwide (Millions of Dollars)



Source: The World Market for Flowmeters, 4th Edition; published by Flow Research, 2013

Vortex flowmeters employ a principle called the von Karman effect, named for engineer and fluid dynamicist Theodore von Karman. According to this principle, flow will alternately generate vortices when passing by a bluff body. In a vortex meter, the bluff body is a piece of material with a broad, flat front that is mounted at right angles to the flowstream. Flow velocity is proportional to the frequency of the vortices. Flowrate is calculated by multiplying the area of the pipe times the velocity of the flow.

One problem with vortex meters has been the effects of vibration on the measurement. Suppliers have developed software to deal with this issue and mitigate these effects. Another important innovation has been the development of reducer vortex flowmeters. Instead of having the fluid flow straight through the meter with an internal diameter the same as the pipe, in a reducer vortex the line size of the meter is less than the line size of the pipe. So, for example, a vortex meter with a meter body with a diameter of 2" is fitted into a 3" pipe. This has several beneficial effects. It enhances the vortex meter's ability to measure low flows, and it also increases the strength of the vortices, thereby providing a stronger vortex signal.

Probably the greatest strength of the vortex meter is its versatility. Vortex flowmeters can readily measure steam, gas, and liquid flows with relative ease. Only differential-pressure flowmeters can approximate the versatility of vortex flowmeters, but they have other disadvantages not shared by vortex flowmeters. For example, orifice-plate flowmeters cause significant pressure drop. The advantages and disadvantages of DP flowmeters vary with the type of primary element used. Vortex flowmeters cause minimal pressure drop because the bluff body is relatively small in relation to the internal diameter of the pipe.

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Despite their advantages, vortex flowmeters have lagged behind Coriolis and ultrasonic flowmeters in terms of growth rate and market size. One reason is that vortex flowmeters have not been a custody transfer meter in the past, and much of the research and growth in both Coriolis and ultrasonic flowmeter markets stems from their use for custody transfer applications; however, this may be changing. In 2007, the American Petroleum Institute (API, *www.api.org*) approved a draft standard for the use of vortex flowmeters for custody transfer. This draft standard was reaffirmed in 2010. While this represents a potential breakthrough for vortex flowmeters, both suppliers and end-users have been slow to respond. The standard has, however, had some impact on the use of vortex flowmeters for custody transfer of steam.

It is not clear whether vortex flowmeters can achieve the required accuracy levels for use in custody transfer of natural gas or petroleum liquids. This presents a challenge to vortex suppliers, to develop more accurate and reliable vortex meters. Vortex flowmeters also have a line size limitation, and currently cannot measure flows in line sizes above 16". This eliminates them from competing with ultrasonic, turbine, and DP flowmeters for measuring the flow of natural gas in large natural gas pipelines. In this way they are like Coriolis flowmeters, which have a similar limitation. On the other hand, many of the line sizes of petroleum liquids and refined fuels on the distribution side are much smaller and could, at least in theory, be handled by a vortex flowmeter. FC

*For more information on Flow Research's work in the area of vortex flow measurement, visit **FlowVortex.com**.*