When Will the Vortex Flowmeter Market Pick Up Steam?

By Jesse Yoder, Flow Research, Inc.

Vortex flowmeters have been around since 1969 when Eastech introduced them. But Yokogawa 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 still remains the leading supplier of vortex flowmeters worldwide.

Vortex flowmeters make use of a physical principle that involves the formation of swirls downstream from an obstruction in a flowstream. Leonardo da Vinci wrote about this phenomenon a notebook around 1500. In 1911, Theodore von Karman analyzed the row of alternating vortices that forms after a flat object is inserted into a flowing stream. This row of vortices is today called von Karman's vortex street.

The operating principle of vortex flowmeters involves the phenomenon that von Karman studied. A flat object called a bluff body is placed into the flowstream. This works somewhat like a primary element, since it causes a change in the flow that forms the basis for flow measurement. The presence of the bluff body causes alternating swirls or vortices to form. Flow velocity is proportional to vortex frequency. A vortex flowmeter uses one of several means to count the number of vortices, including thermal, ultrasonic, and pressure sensors. Volumetric flowrate is determined by multiplying flow velocity times the area of the pipe.

Comparison to Other New-Technology Flowmeters

It is interesting to compare the development of vortex flowmeters with the development of other new-technology flowmeters. Coriolis meters were not introduced until 1977, yet they have grown dramatically since that time. In terms of revenues, Coriolis meters bring in more than three times the revenues as vortex meters. Coriolis meters are the most accurate flowmeter, and they are widely used for custody transfer purposes. Their main limitation that they are expensive and unwieldy in sizes four inches and above.

Ultrasonic flowmeters were first introduced by Tokyo Keiki in Japan in 1963. Since that time, they have become widely used in process control environments. The past five years have seen dramatic growth in the use of ultrasonic flowmeters for custody transfer of natural gas. Now major advances are also being made in the use of ultrasonic meters for liquid applications, including hydrocarbons. While the revenues from ultrasonic flowmeters still do not equally the revenues from Coriolis meters, they significantly outpace revenues from vortex flowmeters. And ultrasonic flowmeters are the fastest growing flowmeter.

Vortex flowmeters have not enjoyed a parallel growth pattern. Probably the most significant event for the vortex flowmeter market was when Rosemount entered the market in 1994. Rosemount brought its instrumentation expertise and distribution channels to vortex flowmeters. Rosemount became very competitive to Yokogawa in vortex, especially in North America. The two companies continue to vie for the leadership role in North America, though Yokogawa still has a worldwide advantage.

Why Vortex Meters Haven't Taken Off

Why haven't vortex flowmeters enjoyed a similar growth path as the Coriolis and ultrasonic flowmeters? There are a number of reasons for this. Vortex flowmeter technology is fundamentally different from that of Coriolis and ultrasonic flowmeters, and the supplier situation is also quite different. The following are some reasons why vortex flowmeters have experienced slow growth.

Vortex flowmeters do not have a single, compelling feature that makes them a "must-have" flowmeter for certain applications. For Coriolis flowmeters, this feature is accuracy. For ultrasonic and magnetic flowmeters, this feature is their nonintrusive method of measurement. Magnetic flowmeters are also well suited to sanitary applications, and multipath ultrasonic flowmeters are capable of achieving high degrees of accuracy. Vortex meters, by contrast, cannot achieve the same accuracy levels as Coriolis and multipath ultrasonic meters. They are also more intrusive than either magnetic or ultrasonic meters, since they have to place an obstruction in the flowstream to create the vortices that are counted.

The closest thing that vortex meters have to a single, compelling feature is their ability to tolerate high temperature measurements. This makes them well suited for steam applications, a type of measurement that magnetic flowmeters cannot make, and Coriolis and ultrasonic meters only make with great difficulty. Steam flow measurement is certainly an area of potential growth for vortex flowmeters. However, steam only accounts for about ten percent of the flow measurement market.

Another reason that vortex flowmeters have shown slow growth is that they are not typically used for custody transfer applications. Much of the growth in the Coriolis and ultrasonic flowmeter markets has been due to their use for custody transfer applications. Typically a flowmeter is used for custody transfer applications when its use has been approved by some standards organization. But the suppliers of vortex flowmeters have generally not worked with standards organizations to gain approvals of vortex meters, especially in the area of gas flow measurement. Unless the vortex flowmeter suppliers are willing to commit their resources to getting vortex meters approved by standards organizations, it is unlikely that these organizations will issue reports approving their use.

The inability of vortex flowmeters to achieve high degrees of accuracy is another reason their growth is limited. While Coriolis and multipath ultrasonic flowmeters can achieve accuracies in the ±0.1% range, vortex flowmeters typically offer accuracies in the ±0.5%

to 1.0% range. This is not accurate enough for many custody transfer applications, and it helps explain why vortex meters are not widely used for custody transfer.

The supplier situation also works against vortex flowmeters. For all the major suppliers of vortex meters, vortex is secondary in importance to one or more other products. Yokogawa, Rosemount, and Endress+Hauser are all much stronger in magnetic flowmeters than in vortex meters. Vortex flowmeters are not the bread and butter of any of the major vortex suppliers. Coriolis meters have Micro Motion, and ultrasonic flowmeters have Emerson Daniel, Instromet, GE Panametrics, and Controlotron. Magnetic flowmeters have Endress+Hauser and Krohne. These companies have invested substantially in research & development on their respective flowmeters because the health of their company rests on those product lines. What the vortex flowmeter market needs is a large supplier that cares about vortex flowmeters more than any other type of meter, and will invest correspondingly large resources into improving the product line.

What is Needed: A High-Accuracy Vortex Flowmeter

What improvement would spur growth in the vortex flowmeter market? Many of the improvements that have been made in the past few years address the issue of vibration and solve this problem with digital signal processing software. These advances are important, and they make vortex meters more reliable and better able to withstand noisy environments. But it's time for a new round of innovations in vortex meters.

Probably the most important feature would be a vortex flowmeter with a very high degree of accuracy. This would make vortex meters a good candidate for custody transfer, and would cause end-users to look at vortex meters with new respect. Creating a highly accurate vortex meter, even if is significantly more expensive, could be the major breakthrough that finally makes the vortex flowmeter market pick up steam.