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# Flowmeters

## The Exclusive Large Line Size Meter Club



**Dr. Jesse Yoder**  
President, Flow Research, Inc.

Except for open channel flowmeters, most flowmeters are mounted in or inserted into a pipe. For extremely large pipes, insertion flowmeters are used. These are more economical than inline flowmeters because they do not have a meter body and are simply inserted into an opening in the pipe. However, insertion flowmeters tend to be less accurate than inline meters so end-users often select inline meters for critical applications.

### Stack Gas Measurement

One application requiring the use of large line sizes is measuring flue gas, exhaust gas, stack gas and flare gas. These measurements occur in large pipes that vent the flue or exhaust gas to the air. Some of these pipes are relatively small, but others are 6 feet in diameter or larger. An insertion meter is the most practical solution for these types of measurements.

Three main technologies dominate these types of exhaust and stack measurements: differential pressure flowmeters using Pitot tubes, ultrasonic flowmeters and thermal flowmeters. All three technologies are widely used. Averaging Pitot tubes use multipoint technology to measure flow at different points in the pipe. This type of measurement is becoming more important as emissions monitoring requirements become more stringent and as countries seek to reduce their CO<sub>2</sub> emissions.

### Coriolis Flowmeters

Another area where large line size measurement has become important is in Coriolis flowmeters. It used to be that only one company, Rheonik, offered line sizes over 6 inches. In the past several years, Micro Motion, Endress+Hauser and KROHNE have all started producing Coriolis flowmeters in the 8 to 12-inch diameter range. Endress+Hauser has even introduced a 14-inch Coriolis meter. Rheonik itself has been absorbed by GE Sensing and is continuing to produce large line size Coriolis meters.

The large line size meters being produced by the above companies are still quite large, heavy and unwieldy. In this respect, KROHNE has an advantage because their large line size meter is a straight-tube rather than a bent-tube meter. While their meter is quite long, it is not nearly as tall or bulky as its bent-tube competitors. Another company in Israel, PreCim, aims to produce smaller, more compact large line size meters, but they have not yet released any products.

### Vortex Flowmeters

Vortex flowmeters come in various flavors, including insertion, water and flanged. While insertion vortex meters can be used in large line sizes, the largest vortex flowmeter is for 16-inch lines. Yokogawa offers such a meter, while Emerson Rosemount's largest vortex flowmeter is 12 inches. These line sizes are adequate to handle a wide range of applications, including steam flows. Vortex meters are uniquely designed to measure steam flow because they can tolerate the high temperatures and pressures associated with steam flow measurement.

While Coriolis suppliers have manufactured flowmeters larger than anyone previously imagined was possible, this does not appear to be the case for vortex suppliers. This is somewhat ironical since in 2007 the American Petroleum Institute (API) approved a draft standard for using vortex flowmeters in custody transfer applications. This standard was revisited in 2010. One of the main reasons for developing large size Coriolis flowmeters was so that they could be used for custody transfer.



# 8 Flowmeters

**While Coriolis suppliers have manufactured flowmeters larger than anyone previously imagined was possible, this does not appear to be the case for vortex suppliers.**

Vortex flowmeters are already used in line sizes greater than the largest Coriolis meter, but so far the API approval seems to have had only a limited effect on the vortex market.

One possible reason that vortex meters are not more widely used for custody transfer is that they may not be sufficiently accurate for some custody transfer applications. But what are the upper limits on vortex accuracy? Currently the accuracy of many vortex meters is somewhere between 0.5 percent and 1.0 percent. Perhaps by using more information from the measurement context and by measuring more than just the number of vortices, it would be possible to develop a more accurate vortex meter. In any case, it is not clear why the accuracy limits on vortex meters are where they are today.

In terms of developing a 20- or 24-inch vortex meter, it is not immediately obvious why this is not possible. Certainly a bluff body inserted into a larger flowstream would generate vortices. And it seems likely

that these vortices could be detected by a piezoelectric or capacitive sensor. Perhaps there is some non-obvious technical reason that limits the size of vortex meters. However, maybe there is a way to overcome this obstacle with sufficient research and development. If Coriolis flowmeter suppliers can build a 14-inch meter, then why can't vortex suppliers build a 20-inch meter?

Currently the only types of inline flowmeters that can be used in pipes above 20 inches in size are differential pressure (DP), magnetic, ultrasonic and turbine. And since magnetic flowmeters cannot measure non-conductive fluids, they have little application in the oil and gas industry. That leaves DP, ultrasonic and turbine as the only inline meters that can be used for line sizes above 20 inches in the fast-growing oil and gas industry. With a little more accuracy and possibly considerable research and development, perhaps vortex flowmeters could join this exclusive large line size meter club.

Jesse Yoder, Ph.D., is president of Flow Research, Inc. ([www.flowresearch.com](http://www.flowresearch.com)), a company he founded in 1998. He has 22 years of experience as an analyst and writer in process control. Dr. Yoder specializes in flowmeters and other field devices, including pressure, level and temperature products. He has written over 100 market research studies in industrial automation and process control and has published numerous journal articles.

Have a question for Dr. Yoder that you would like to have addressed in his January 2012 column? Email [dennis@grandviewmedia.com](mailto:dennis@grandviewmedia.com).

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