HOW OPTING FOR CORIOLIS FLOWMETERS CAN MAKE YOU MONEY

Choosing the best flowmeter for measuring the flow of a gas or liquid through an industrial process often presents a series of technical challenges, but it is often also a decision that can impact business. David Bowers, Product Manager Pressure and Process Flow for ABB UK Measurement & Analytics, provides some tips on how to simplify the selection process and explains how Coriolis flowmeters are increasingly ticking the boxes when it comes to helping users to achieve cost savings through accurate and versatile flow measurement

Well over a dozen technologies are used as the basis of measuring flow, each with their own strengths and weaknesses. But there are also so many variables that selecting the best technology for a given application can be a difficult exercise in managing compromises.

It doesn't have to be this way though. One way to simplify things is by summarising these variables into a 'selection triangle', comprising of three key values, specifically:

- Capacity: The most important value, capacity refers to how much flow a meter of a particular size can handle, and the extent of the resulting pressure drop.
- Accuracy: Most applications demand a high degree of consistency in results, but not all require the same level of accuracy. In slimming down the choice of flowmeter, ask yourself which types of device most closely match your accuracy requirements.
- Physical dimensions: the space occupied by a flowmeter is assuming increasing importance, especially when a system is being upgraded and a new meter needs to fit into the same space as the old one that it's replacing.

Satisfying each of the values within this 'selection triangle' can provide a useful path to selecting the appropriate type of flowmeter for a given task.

In a growing number of cases, this three-sided approach to flowmeter selection is pointing to Coriolis-type meters as a viable technology for a given increasing range of applications, particularly given the advances that have occurred in the design of the latest generation of devices.

Commercially introduced in the 1980s, the Coriolis mass flowmeters have become one of the most versatile and reliable means of measuring the flow of liquids or gases. Their main strength is in their ability to measure multiple attributes over sustained periods with high repeatability and very little maintenance.

In their earliest days, Coriolis meters had a few widely recognized weaknesses. First, accuracy suffered in instances when flow was extremely low. Further, extreme changes in ambient temperatures could affect accuracy, so use was limited in locations where temperature extremes were present. Their sensitivity to noise and vibration also required rigorous installation standards.

With advances in technology, these problems have all now been overcome, making current-generation Coriolis flowmeters among the easiest to deploy of available technologies in a broad range of applications and industries. The impact of this is that many industries that previously bypassed Coriolis flowmeters in favour of other meter types are now taking a second look and recognising their value for deployment in a growing range of applications.

Fundamental versatility

Coriolis meters work by measuring the mass flow rate and density of a fluid or gas as it flows through a vibrating tube. By also measuring temperature, the meters enable additional calculations about the substance's concentration.

By measuring mass flow, density, concentration and temperature, a single Coriolis meter can do the work of multiple instruments, eliminating the cost of purchasing separate devices and minimising the requirement for spare parts and overall maintenance.

This combination of measurements can be highly useful in many applications. In oil extraction, for example, the combined measurements available using a Coriolis meter can help determine how much water is coming out of the ground with the oil, providing a useful indicator of overall production efficiency."

The working principles of Coriolis meters offer several distinct advantages. With no moving parts that come in direct contact with the measured substance, whether gas or fluid, they require little maintenance or upkeep.

Once calibrated at the factory, they also tend to remain calibrated throughout their lifecycle.

In addition, because Coriolis is the only principle capable of measuring mass flow of gas and liquids without any calculation, results are independent of changes in temperature or pressure. The use of Coriolis flowmeters also allows for density measurement, making them a true multi-variable metering solution for filling operations in chemical, food and other such process industries.

Coriolis flowmeters are increasingly ticking the boxes when it comes to helping users to achieve cost savings through accurate and versatile flow measurement

Furthermore, the multi-variable nature of Coriolis meters enables them to deal with issues that cripple other technologies. One example is in applications with turbulent flow. Where flow is turbulent, other metering technologies may require a run of straight pipe to smooth the flow before it's measured. With no need for such measures, Coriolis meters can be installed in a small footprint, with the added option of the meters being able to work equally well when mounted either horizontally or vertically. For operators, this not only minimises the space required for installation, but also opens up financial savings through reduced expenditure on pipework alterations and overall engineering.

The use of Coriolis meters can also deliver benefits where the density of the measured substance isn't uniform – such as in upstream oil and gas operations. Traditionally side-lined in favour of mechanical meters, Coriolis meters are now starting to appear in greater numbers in upstream oil and gas applications, particularly as mechanical meters lose accuracy over time and entrained gases can destroy them. Coriolis meters are proving the ideal solution to these problems, especially in remote locations where their low maintenance and stable calibration benefits are a major advantage.

The inherent technical and operational benefits of Coriolis flowmeters enable them to deliver real and significant savings in a wide variety of applications such as tanker filling

New-generation capabilities

Even where Coriolis meters have been in use for years, organisations are finding reasons to upgrade. Older generation Coriolis meters required a lot of care in installation and called for specific compensation or countermeasures to offset external influences that affected accuracy. These issues have been solved over the years. ABB's new CoriolisMaster range, for example, represents the latest evolution of a meter that is hardly influenced by environment or installation. Newer devices are more compact, easier to operate, and increasingly accurate.

Accuracies of the new ABB CoriolisMaster flowmeter models, for example, range from 0.1 to 0.4 percent of reading for liquids and 0.5 to 1 percent of reading for gases. Such high accuracies make Coriolis flowmeters obvious candidates for custody transfer applications. They also fit applications such as material balances and blending by weight. Since these meters can monitor a variety of different fluids, they also suit batch operations and tanker truck loading and unloading.

Perhaps most important, designs of Coriolis meters have become more efficient over time. The newest models require up to 25 percent less pump energy to operate and create a smaller pressure drop, often 20 percent less than older models.

One of the great advantages of a Coriolis meter is the reproducibility of its measurement. It will yield consistent results almost indefinitely without requiring maintenance or calibration. On the flipside, a major historical disadvantage has been cost, especially when it comes to calibration; the accuracy of the device is locked in through calibration performed during manufacture. The higher the accuracy, the more sophisticated and time-consuming the calibration process is.

Consequently, older Coriolis meters may have imposed a higher level of accuracy than necessary at a correspondingly higher level of cost.

ABB's CoriolisMaster line is designed around two tiers of calibrated accuracy in what otherwise is essentially the same device. For users, this means paying for consistency and features and not for unnecessary accuracy. It also offers other advantages, not least that one ABB meter is interchangeable with another in terms of installation and operation. For users, this means that they only pay for the level of accuracy their application requires, with less time, cost and effort involved in replacing a unit.

The meters are also designed to be easy to use. An example is their intuitive three-button interface, which makes most routine functions accessible without consulting a manual. Further, when maintenance is required, the electronic module can be quickly inserted and removed, with no need for recalibration or configuration.

Of course, no technology covers every circumstance for measuring flow. In common with any other flowmeter, Coriolis meters have their limitations. With no lining, their tubes are susceptible to corrosive or highly abrasive materials. Further, while ABB does make Coriolis Mass Flowmeters as small as a millimetre in diameter, they generally become cost prohibitive for processes requiring measurement across more than a six-inch diameter.

Saving money with Coriolis metering

The inherent technical and operational benefits of Coriolis flowmeters enable them to deliver real and significant savings in a wide variety of applications. One example is a chemical manufacturer that changed its process for fulfilling customer-specified concentrations of acid, which were sold by weight.

Originally, its process involved pumping a calculated amount of acid into a tanker truck, and then adding another calculated amount of water to reduce the concentration. If all went well, a truck could be filled in 40 minutes to a final weight and concentration that were within contracted tolerance.

Today, using a Coriolis Mass Flowmeter, the acid and additive are mixed inline and pumped into the tanker in single process; the proper concentration is assured by the Coriolis meter's ability to measure density; the proper weight is assured by its ability to measure the flow of mass.

With a small footprint and able to work equally well when mounted either horizontally or vertically, coriolis flowmeters reduce both installation space and cost, with no need for extensive pipework alterations

As a result of the change, the time it took to fill a truck was reduced by half. With 5,000 loads fulfilled a year, the savings amounted to 1,650 hours – about 10 weeks equivalent.

The new flowmeter improved margins on existing business, and created an effective capacity increase that allowed the company to add new contracts.

Summary

The ability of Coriolis flowmeters to deliver versatile, highly accurate measurement in a compact, easy to install and use design, make them the better alternative to other flowmeter technologies in an expanding range of situations.

ABB has extensive experience in the design, manufacture, supply and lifetime care of a wide variety of metering technologies, including Coriolis mass flowmeters. For more information, or advice on how to select the appropriate flowmeter for your application, email moreinstrumentation@gb.abb.com, visit www.abb.com/measurement or call 0870 600 6122 ref. 'Flow advice'.

Author Details
David Bowers, Product Manager Pressure and Process Flow for ABB UK Measurement & Analytics
Tel: 0870 600 6122 • Email: moreinstrumentation@gb.abb.com• **Web: www.abb.com/measurement**