Ultrasonic flowmeters have gained a lot of attention over the past five years, primarily because of their ability for measuring custody transfer of natural gas. They are replacing differential pressure (DP) and turbine meters in many natural gas applications. But ultrasonic are replacing differential pressure because of their ability for measuring liquids with many impurities.

How They Work

Ultrasonic flowmeters are one of the most interesting types of meters used to measure flow in pipes. The most common variety, transit time, contain both a sending and a receiving transducer. Both sending and receiving transducers are mounted on either side of the flowmeter, or on the pipe wall. The sending transducer sends an ultrasonic signal at an angle from one side of the pipe to the other and back.

Some ultrasonic flowmeters send more than one signal and have more than one pair of transducers. The flowmeter measures the time it takes the ultrasonic signal to travel across the pipe and how long it takes the signal to travel back the other way. When the signal travels with the flow, it travels more quickly than it would in conditions of no flow. On the other hand, when the signal travels against the flow, it travels more slowly. The difference between the “transit times” of the two signals is proportional to flowrate.

Some ultrasonic flowmeters send hybrids, incorporate both transit time and Doppler technology. Which technology is used depends on the flow-stream. Hybrid meters are used to handle varying conditions, including both clean and dirty liquids.

How It All Began

The story of ultrasonic flowmeters began in 1963, when Tokyo Keiki introduced them in Japan for industrial use. Since that time, Tokyo Keiki has become Tokimec (www.tokimec.co.jp), and the company still offers ultrasonic flowmeters for sale. Tokimec is located in Tokyo, Japan. However, much has changed in the days since ultrasonic flowmeters were first introduced.

Controlotron (www.controlotron.com) became the first U.S. manufacturer to market ultrasonic flowmeters in the United States in 1972. In the late 1970s and early 1980s, both Ultraflux (www.ultraflux.com) and Panametrics (www.panametrics.com) experimented with the flow of ultrasonic signals to measure gas flow. These were the early days in the development of ultrasonic flow technology.

Initially, ultrasonic flowmeters were sometimes misapplied, and were not well understood. This gave the meters a black eye in the minds of some people. Many technological improvements have been made in the past 10 years, and the limitations of ultrasonic meters are now better understood. Advances in transit time technology have broadened the types of liquids and gases, and steam. Magnetic flowmeters available in the market can meter the flow of conductive and non-conductive liquids. Magnetic flowmeters have very limited use in the oil & gas and refining industries because petroleum-based liquids are nonconductive. For the most part, magnetic flowmeters are limited to pipelines six inches and larger, ultrasonic flowmeters in most cases perform better than Coriolis meters.

Ultrasonic flowmeters have an advantage over magnetic flowmeters in that ultrasonic meters can measure the flow of nonconductive liquids, gases, and steam. Magnetic flowmeters have very limited use in the oil & gas and refining industries because petroleum-based liquids are nonconductive. For the most part, magnetic flowmeters cannot be used to meter hydraulic fluids, oil, or natural gas, flare gas, or process gas. They cannot be used to measure steam flow. This is one of the most important reasons why the ultrasonic flowmeter market is growing faster than the market for magnetic flowmeters. Magnetic flowmeters are unable to participate in the fast-growing gas and steam flow measurement markets.

Ultrasonic flowmeters have an advantage over vortex flowmeters in that ultrasonic flowmeters can measure gas flow rates over two inches or less. While Coriolis meters have successfully been used in four-inch and six-inch lines, they become unwieldy and quite expensive in those larger sizes. Size is actually an advantage for ultrasonic flowmeters, since larger pipes provide the ultrasonic signal more room to cross. For pipes six inches and larger, ultrasonic flowmeters in most cases perform better than Coriolis meters.
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