PROCESS INSTRUMENTATION

Advantages of Siemens Ultrasonic Flow Transducers

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The key to achieving accurate flow measurement with clamp on ultrasonic flow meters is dependent on creating a harmonious pairing of ultrasonic transducers and the pipe itself, working in unison to produce a stable and coherent ultrasonic signal.

Many ultrasonic flow meters are supplied with Shear Wave (Narrow Beam) (AKA "fixed frequency") transducers, (see Figure 1). These may be less expensive to employ but performance will be degraded by variations in operating conditions and are not designed to match the acoustical properties of the pipe. This is because Shear wave transducers inject a fixed signal into the pipe wall without regard to pipe thickness or material, essentially forcing the signal through the pipe to the receiving transducer. This method creates substantial beam interference in the pipe wall which results in poor acoustic signal wave shape, unpredictable refraction angles, and unstable calibration. Their performance limitations are most noticeable where application conditions (temperature, flow velocity, viscosity, and/or pressure) vary during normal process operations.

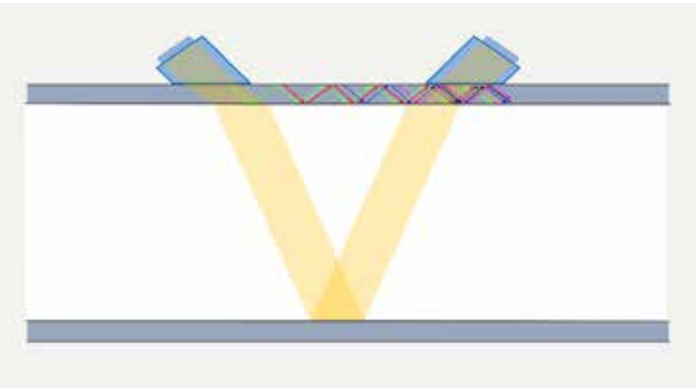

Figure 1

Some ultrasonic flow meters employ Lamb Wave, or "Wide Beam" transducers, (see figure 2). They are designed to "match" the pipe's acoustical properties (frequency and phase velocity). The Lamb Wave transducers inject the sound wave at an angle that is matched with the pipe material's refraction angle (Snell's Law). Lamb wave signals require a lower transmit voltage and

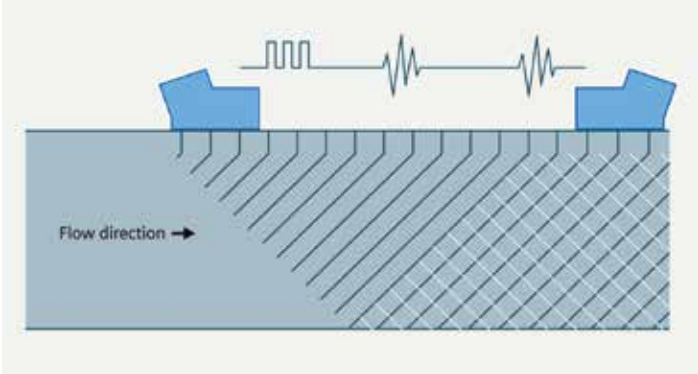

Figure 2

produce a very focused signal covering a large area of the pipe. This makes them immune to variations in temperature, pressure, flow velocity, and even liquid type. However, not all ultrasonic flow manufactures who promote Lamb Wave transducers are equal; some continue to use the fixed frequency approach. Lamb wave research has demonstrated that flow measurement errors increase if the transducer frequency is not specifically matched to the pipe's resonant frequency.

Siemens, the pioneer of Lamb Wave Ultrasonic flow measurement, utilizes a proprietary process to "tune" our transducers to the sonic waveguide properties of the actual pipe being measured. All Siemens meter types automatically perform a frequency sweep of the transducers at installation to determine the natural (resonant) frequency of the customers' pipe. The frequency sweep along with the transducer/pipe phase-angle match turns the entire pipe into a flow transducer. For this reason, any Siemens transducer can be used with any Siemens transmitter, without the need to perform special tuning or calibration of the transducers when being connected to the transmitter. All the technology needed to achieve maximum transducer performance and accuracy is designed into each flow meter.

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