

The influence of ultrasonic transducer temperature adaptability on the measurement results

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Introduction Portable ultrasonic flowmeter used to measure the fluid flowmeters, it takes the advantage of the propagation characteristics of the ultrasonic. With its advantage of touch free measurement, wide measuring range, ease to install, simpler operation of testing, it's considered to be a better measuring device in reducing runoff. It's widely used in electrical power, petroleum, chemical industry, especially the water supply system. This article discusses the change of temperature effect on the results of the measurement conclusion have realistic meaning for research to improve measurement accuracy.

working principle Portable ultrasonic flowmeter belongs to the method of time difference ultrasonic flowmeter: Portable ultrasonic flowmeter using pairs of acoustic transmitter and acoustic receiver (transducer).

When an acoustic wave propagation in the fluid, along the flow direction of sound waves is accelerated. but against the direction of fluid motion sound velocity is lower. They formed between the time difference is proportional to the fluid velocity.

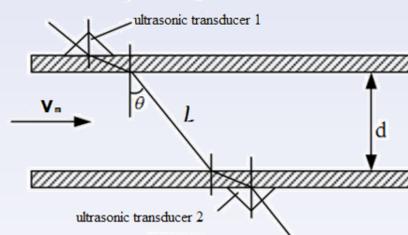


Figure 1 Working principle of portable ultrasonic flowmeter

velocity and temperature Figures and graphics are often helpful in describing the experimental set up and summarising results. All graphs, drawings, and photographs must be referenced in text, in the correct numerical sequence. An example of the figure and caption is shown in Figure 1. The figures should be no wider than the column of text. The ultrasonic velocity in fluid is affected by the density and the temperature of the fluid. For example, in the water when the temperature (0 to 35)°C, Temperature rise per 1 °C, the sound velocity 4.6 m/s increased, the speed of sound varies with the change in temperature is linear; but when the temperature (35 to 70)°C, sound velocity changing with temperature increase slowly slow performance is nonlinear; When further raise the temperature to 70 °C or more, With the temperature rise velocity began to decline, this trend is nonlinear.

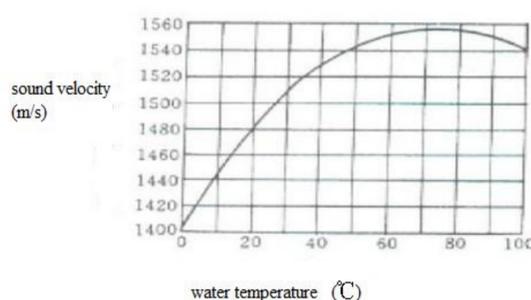


Figure 2: Water temperature corresponding to the sound velocity

The ultrasonic propagation path When using the portable ultrasonic flowmeter for flow measurement, Transducer emit sound waves through the pipe wall first, then enter the fluid through the pipe wall again, sound waves is received by another transducer, Because sound waves through the different material, the ultrasonic propagation path changed direction three times because of refraction. As shown in Figure 3. The obvious, refracting before and after a path to produce a certain deviation. This path deviation, directly affect the measurement result.

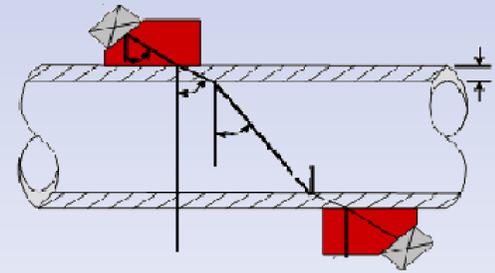


Figure 3 Schematic diagram of ultrasonic propagation path

The influence of temperature change on the ultrasonic transducer By reference [1], With the increase of temperature the optimum working frequency of piezoelectric ultrasonic transducer is reduced. When the temperature over 65°C. The optimum working frequency with the increase of temperature drop is more obvious. This phenomenon leads to receive signal is too weak, can not meet the test requirements, this requires transducer can be adjusted according to the working environment temperature working frequency, realize the temperature of the working frequency compensation.

Conclusion When using the portable ultrasonic flowmeter: The first, the different temperature range to use different ultrasonic transducer, The second, the velocity of sound change were caused by temperature change is obvious, The third, The influence of temperature on the measurement accuracy is embodied in many aspects, So it is very important. In the process of using Portable ultrasonic flowmeter for flow measurement. The temperature change of changes in the speed of sound, not just the change of the transducer working frequency, fluid pressure, density and other parameters will also change. How to make a convenient flow measurement instrument to play its role, is we need to study hard in the future.