

Liquid Speed of Sound and Density

The speed of sound as it travels through a process fluid is used in fluid flow calculations. Process simulation, pressure relief system design, and PRV stability assessments all require accurate flow prediction. The liquid speed of sound and density are two of the properties critical to these calculations, as well as other thermodynamic properties that can be estimated from them.

Why measure?

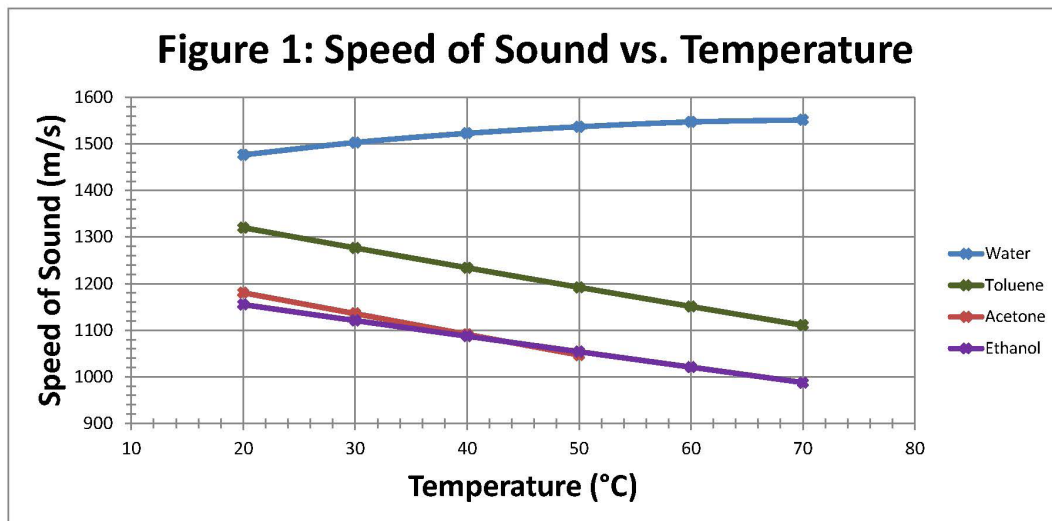
Most applications rely on estimation of the liquid speed of sound through a given liquid. These calculations are dependent on a number of properties of the liquid and process conditions, which all have their own associated uncertainties. Measuring the liquid speed of sound directly reduces these uncertainties, allowing for more accurate calculations to be performed. Pressure relief valve stability calculations, especially for liquids, can be very sensitive to small changes in the value of the speed of sound. Measuring the value directly can allow designs to be less conservative and more accurate (therefore, less costly in many cases), especially for existing installations.

Properties Measured and Predicted

Speed of sound
Liquid density
Heat capacity
Isothermal compressibility
Transport properties

Liquid speed of sound and density vs. temperature

The liquid speed of sound and density measurements can be completed at a specific temperature point or various points over a range of temperatures. Additional properties can be calculated. Directly measured data of the liquid speed of sound and liquid density are shown in Figures 1 and 2, respectively. The plots show how the liquid speed of sound and density vary with temperature for some common materials.



Technical Specifications	Speed of Sound	Density
Range	1,000 - 2,000 m/sec	0 - 3 g/cm ³
Accuracy	± 0.1 m/sec	± 0.01 g/cm ³
Sample Required	10 ml	10 ml

