1 Scope

This standard establishes a method to predict the noise generated in a control valve of standard design by the flow of compressible fluid and the resulting noise outside of the pipe and downstream of the valve. The transmission loss (T_L) equations are based on a rigorous analysis of the interaction between the sound waves that exist in the pipe and the many coincidence frequencies in the pipe wall. Commercial pipe specifications allow a relatively wide tolerance in pipe wall thickness. This limits the value of the very complicated mathematical methods required for a rigorous analysis; calculations prove that a simplified expression is justified.

The equations in this standard make use of the valve sizing factors defined in ANSI/ISA-S75.01 and ANSI/ISA-S75.02.

This method was developed from the fundamental principles of acoustics, fluid mechanics, and mechanics.

2 Limitations

The method presented in this standard considers only single-phase dry gases and vapors; it is based on the perfect gas laws. Predictions are limited at this time to a downstream maximum velocity of Mach 0.3. Ideal straight metal pipe is assumed downstream. Uncertainties become greater as the fluid behaves less perfectly for extreme temperatures and for downstream pressures far different from atmospheric or if near the critical point.

The method can be used with all conventional control valve styles including: globe, butterfly, cage type (but not with low-noise trim), and modified ball types. Specifically excluded are multistage proprietary low-noise valves and full-bore ball valves.

This standard addresses only aerodynamic noise and does not consider any noise generated by mechanical vibrations, unstable flow patterns, and other unpredictable behavior.

In the typical control valve, little noise travels through the wall of the control valve. The noise of interest is that which travels downstream of the valve inside the pipe and then escapes through the wall of the pipe to be measured typically at 1 meter (3 feet) downstream of the valve body and 1 meter (3 feet) away from the outside surface of the pipe.

The majority of the test data available to validate the method is from air at moderate downstream pressures and temperatures; however, it is believed that the method is generally applicable for other gases and vapors and at higher pressures. The equations include terms that account for fluid density and ratios of specific heat.