STANDARD

ISA-75.17-1989

Control Valve Aerodynamic
Noise Prediction

Approved 19 June 1991

ISA-75.17-1989, Control Valve Aerodynamic Noise Prediction

Preface

This preface is included for informational purposes and is not part of ISA-75.17-1989.

This standard has been prepared as part of the service of ISA toward a goal of uniformity in the field of instrumentation. To be of real value, this document should not be static, but should be subject to periodic review. Toward this end, the Society welcomes all comments and criticisms, and asks that they be addressed to the Secretary, Standards and Practices Board, ISA, 67 Alexander Drive, P.O. Box 12277, Research Triangle Park, NC 27709, Telephone (919) 549-8411, e-mail: standards@isa.org.

The ISA Standards and Practices Department is aware of the growing need for attention to the metric system of units in general, and the International System of Units (SI) in particular, in the preparation of instrumentation standards. The Department is further aware of the benefits to USA users of ISA standards of incorporating suitable references to the SI (and the metric system) in their business and professional dealings with other countries. Toward this end, this Department will endeavor to introduce SI-acceptable metric units in all new and revised standards to the greatest extent possible. *The Metric Practice Guide,* which has been published by the Institute of Electrical and Electronics Engineers as ANSI/IEEE Std. 268-1982, and future revisions, will be the reference guide for definitions, symbols, abbreviations, and conversion factors. Certain metric units that are not a part of the SI system are in common accepted use. This standard uses bar as a pressure measurement that is convertible to kilopascals by multiplying by 100.

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Contents

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.