

**NOISE & VIBRATION DESIGN GUIDANCE**  
***PIPE SYSTEMS***  
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**Introduction**

The purpose of this document is to provide guidance for the quiet design of fluid systems.

**General Requirements**

Fluid systems should be designed with the lowest flow velocities consistent with other system requirements. A maximum velocity of 6 feet/second should be used as the design parameter for all water systems with 13 feet/second being the maximum flow velocity allowable.

All piping and components should be as clean and smooth internally, as possible. All systems shall be thoroughly flushed and cleaned to minimize internal roughness. Abrupt changes in flow direction and pressure should be avoided and all mechanical parts exposed to the flow should be as secure and rigid as possible. Avoid ill fitting gaskets and other flow discontinuities. The radius of pipe bends should be a minimum of five (5) diameters for low noise generation.

Orifice plates in a piping system should be avoided wherever possible. Do not use single, high pressure drop orifice plates for system balancing. Use multiple plates in series at mismatched distances. Follow orifice plates with straight pipe for at least seven (7) diameters. An alternate to single hole orifices is multiple hole orifice plates.

Globe and angle valves are known to cause noise problems and should only be used where it is impractical to use any other system and/or on systems that do not affect the acoustic environment of the vessel. Throttling valves are also known to cause severe noise problems under all conditions where local cavitation can occur. If throttling is necessary in a system, the quietest method is the use of multiple pressure drops.