

# Rock N' Roll Pipelines:

## The cavitation phenomenon

By Megan Larson

Chances are if you use valves for throttling or modulating service, you are familiar with cavitation.

Cavitation is the sudden vaporization and condensation of a liquid downstream of a valve due to localized high-pressure drops. When flow passes through a throttled valve, a localized low-pressure zone forms immediately downstream of the valve. If the low-pressure zone falls below the vapor pressure of the fluid, the liquid vaporizes (boils) and forms a vapor pocket.

As the vapor flows downstream, the pressure recovers, and the vapor bubbles violently implode causing a popping or rumbling sound similar to tumbling rocks in a pipe.

"The bubbles created by cavitation are much smaller and more powerful than bubbles caused by normal boiling. The release of energy by the imploding bubbles can easily be heard as noise in the valve or in the downstream piping," wrote Phil Skousen in *The Valve Handbook*.

The sound of cavitation in a pipeline is unmistakable. The condensation of the bubbles not only produces the ringing sound, but also creates localized stresses in the pipe walls and valve body that can cause severe pitting. Severe or long-term cavitation can cause significant damage to the pipeline's infrastructure including the pipe and valves.

When using valves for flow or pressure control, a complete cavitation analysis should be done prior to the installation. Cavitation is a common occurrence in shutoff valves during the last few degrees of closure when the supply pressure is greater than about 100 psig. Valves can withstand a limited duration of cavitation, but when the valve must be throttled or modulated in cavitating conditions for long periods of time, its life can be drastically reduced.

### Identifying levels of cavitation

Three levels of cavitation have been defined by the AWWA. Incipient cavitation represents the beginning stage of cavitation where light popping noises are heard. Constant cavitation is a steady rumbling sound associated with start of possible valve damage. Choked cavitation is the point where the vaporization of the fluid reaches sonic velocity in the valve port and limits the flow through the valve.

It is recommended that constant cavitation data be used when judging the affects of cavitation on the life of the valve. A cavitation index can be calculated to predict whether cavitation will occur.

The lower the value for the cavitation index, the more likely cavitation will occur. As a rule of thumb, manufacturers typically suggest that when the value for the cavitation index is less than 2.5, cavitation may occur.

Valve manufacturers can perform an analysis to predict when cavitation will occur based on flow test data. When cavitation is predicted, some available remedies include: increasing the downstream pressure by throttling a downstream valve or installing an orifice, decreasing the differential pressure by using two valves in series, using a small bypass line for low flow rates, or installing vacuum breaker ports immediately downstream of the valve to reduce the vacuum pocket. [www](#)

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