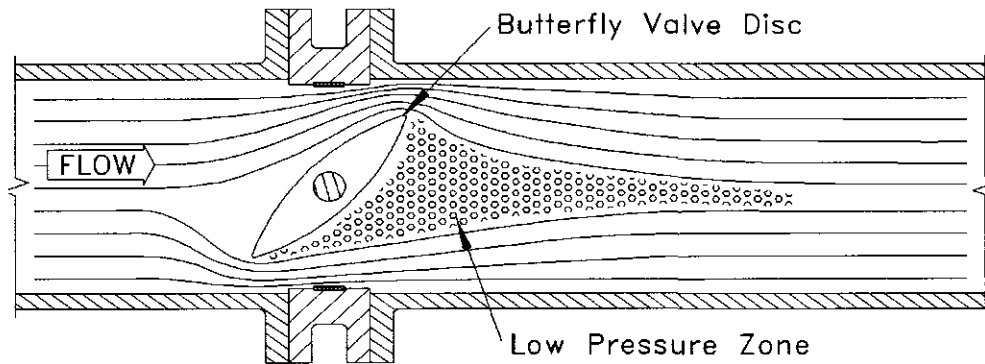


Cavitation in Butterfly Valves

Cavitation can occur in a butterfly valve when it is used for throttling or modulating service. Cavitation is the sudden vaporization and condensation of a liquid downstream of the disc due to high pressure drops. When the localized low pressure area falls below the vapor pressure of the fluid, the liquid vaporizes and forms a vapor pocket as shown below. As the vapor flows downstream and the pipeline pressure recovers, the vapor violently condenses causing a popping or rumbling sound similar to tumbling rocks in the pipe.



Butterfly Valve Cavitation

When a valve is exposed to cavitation conditions continuously, such as during modulation, significant damage can occur to the metal surfaces of the valve or downstream piping in a short period of time. Hence, modulating and throttling applications warrant an evaluation of cavitation conditions.

A cavitation index can be calculated to predict whether cavitation will occur as follows:

$$\sigma = (P_u - P_v) / (P_u - P_d)$$

where:

σ = cavitation index, dimensionless

P_d = downstream pressure, psig

P_v = vapor pressure adjusted for temperature and atmospheric pressure, psig
= -14.2 psig for water at 60°F, sea level

P_u = upstream pressure, psig

When the cavitation index falls below 2.5, constant cavitation may occur. The lower the cavitation index, the greater the likelihood of cavitation damage.

References

1. Tullis, J. Paul, *Hydraulics of Pipelines*, John Wiley & Sons, New York, 1989, p. 135-165.
2. Instrument Society of America, ISA-RP75.23-1995, *Considerations for Evaluating Control Valve Cavitation*. Approved June 2, 1995.
3. Skousen, Phillip L., *Valve Handbook*, McGraw Hill, New York, 1998, pp. 511-517.

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