Cheng Rotation Vane

The Cheng Rotation Vane, or CRV, has been developed by Cheng Fluid Systems in Mountain View, California. Used in piping systems, the CRV can reduce check valve oscillation and control valve noise and vibration by eliminating the turbulence, vibration, noise, flow separation and accelerated and reverse flows caused by elbows.

The CRV technology consists of a specially designed set of stationary vanes in a cylindrical body (see photo), which is placed at the upstream side of an elbow or tee in a piping system. The CRV is claimed to eliminate the elbow induced turbulence (Fig. 1) which negatively impacts the performance of pumps, compressors, control valves, check valves, etc. The CRV imparts to the fluid a gyroscopic motion, which counteracts that induced by the elbow (Fig. 2). This enables the fluid to negotiate the turn uniformly and exit the elbow with a flat velocity profile. The result is an even distribution of the fluid through any cross-section of the elbow, transforming the elbow into the equivalent of a straight section of pipe.

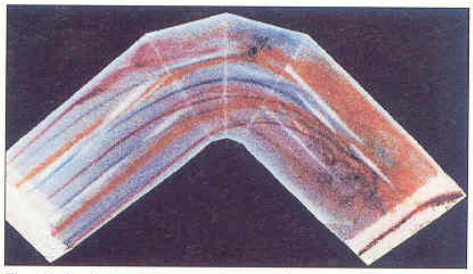


Fig. 1. An instantaneous picture of water flowing through an elbow. The coloured dyes tracing the fluid motion show the gyroscopic turbulence caused by the elbow.

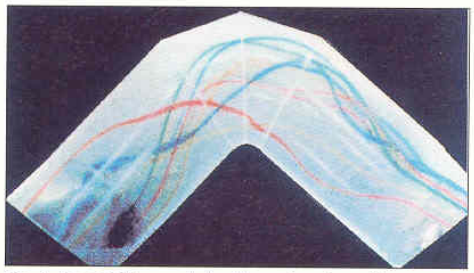
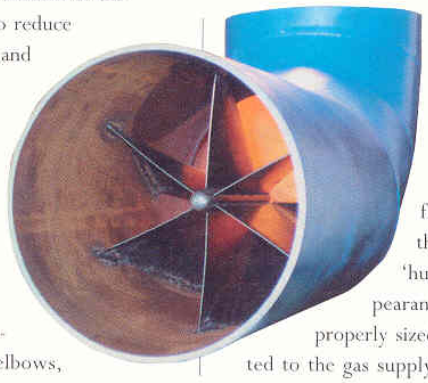


Fig. 2. The CRV pre-rotates the water, imparting a gyroscopic motion to counteract that of the elbow. This produces a uniform flow at the exit of the elbow.

Control valves

When a control valve is seen to act erratically, the immediate assumption is that it was not sized properly. What is often overlooked is the impact of the piping leading up to or away from the control valve. The *Piping Handbook* (Nayyar, 6th edition), states that "all control valve stations should be designed with a minimum of three pipe diameters of straight pipe both upstream and downstream of the control valve in order to reduce the turbulence entering and leaving the valve." In practice, even greater lengths may be required, depending on the control valve in question or the particular application.



If control valves are used immediately downstream or upstream of elbows, they experience the elbow-induced turbulence, separation, and cavitation, with reverse and accelerated flows. This causes the control valve to 'hunt', giving the appearance that it was not properly sized. CRVs recently fitted to the gas supply systems of gas turbines have solved such problems, giving better control valve performance and increased overall turbine efficiency.

Check valves

Similar good results have been booked with check valves. Check valves, by the very nature of their design, respond to flow and pressure disturbances such as turbulence in a piping system. This can result in the disc oscillating back and forth on the pin support. When a check valve is close-coupled to an elbow, the turbulence becomes severe and if the oscillations are of a large enough amplitude, the disc may bang against the stop. Eventually, the pin fails, leakage though the pin starts, and the valve seat will not seal.

Installing a CRV has been shown to reduce the amplitude of harmful pressure bursts. These bursts are damaging to the check valve because they result in a more severe check valve oscillation.

The CRV is particularly recommended for check valves used in combination with vertical pumps. The discharge lines of many vertical pumps are equipped with check valves in order to prevent backflow when the pump is being shut down. The oscillating check valve can generate a pulsating back pressure on the pump which causes excessive vibration, headbox breakage, bearing wear and even shaft breakage. Installation of a CRV prevents check valve oscillation and largely reduces pump vibration problems.

Information

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