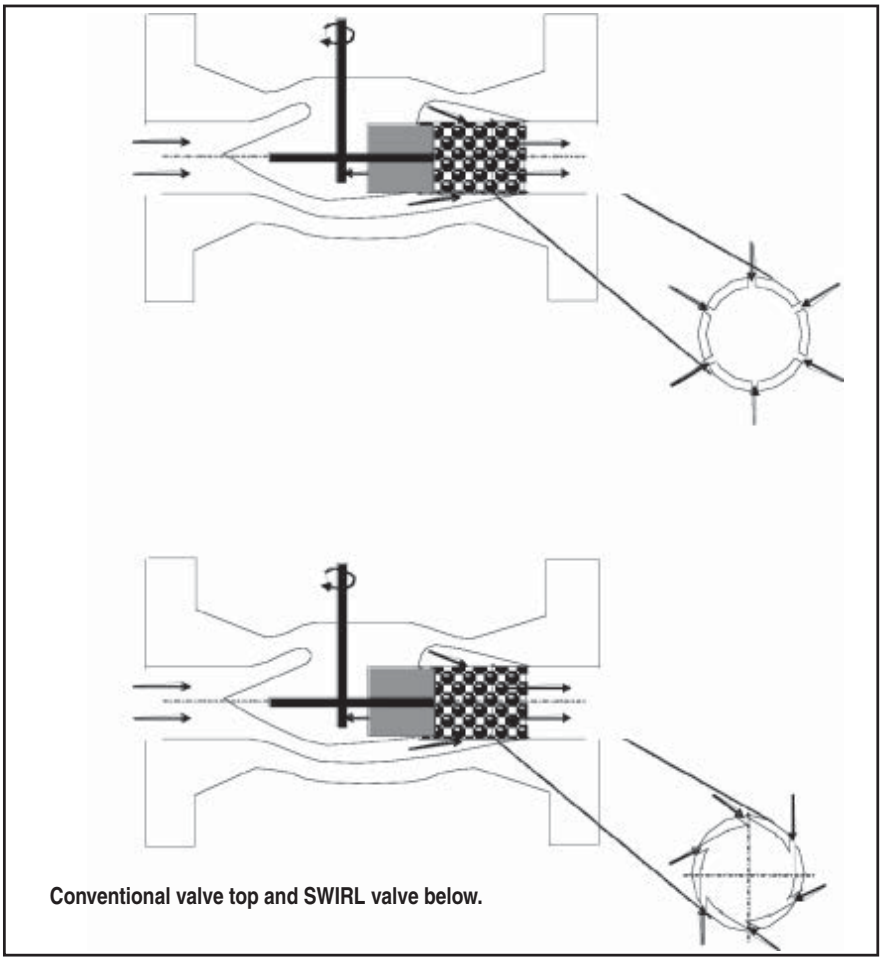


Conventional valve top and SWIRL valve below.

A TWIST TO TECHNOLOGY

New SWIRL Valve Centers on Fluid Streams That Evolve at High Pressure, Including Well Fluids from Subterranean Oil and Gas Reservoirs

By Ian Cameron

Throughout the world's oil and gas industry, valves are employed on a range of control duties including pressure, temperature and flow.

Occasionally though, fluids may expand in the valve if sufficient pressure drop is created over the valve, and this "throttling process" could result in flashed liquid or a condensed gas that will need to be separated afterwards.

Another side effect of such throttling is an intensive mixing of the gas and liquid phases, which may reduce the separator's efficiency downstream of the chokes.

However, a company based in Rijswijk, Netherlands, Twister BV, believes it has come up with a solution to such problems based on its Twister technology. It has recently also launched its newest gas processing product — the SWIRL Valve.

The company said that the SWIRL Valve improves the separation of two-phase flow across a pressure reduction valve such as a choke valve, Joule-Thomson (JT) valve or control valve. This, in turn, maximizes the liquid separation efficiency of downstream separators, which can then be translated into a reduced pressure drop in a JT-Low Temperature Separator (LTS) system, smaller separators and/or more flow throughput.

The pressure reduction over a valve causes the temperature to drop without extracting heat or work from the gas. This isenthalpic expansion process is also known as JT cooling. This JT cooling effect over a valve is used to condense part of the natural gas stream, such that the liquefied fraction can be separated in a vessel — the LTS.

The prime function of a JT valve then is flow rate control, but it is also used to create a separable liquid phase. The mean droplet size resulting from isenthalpic expansion over a JT valve is difficult to determine, hence the separation efficiency of downstream separators is generally also unknown.

According to Twister BV, the SWIRL improves the hydrocarbon dewpointing performance of an existing JT LTS by increasing flow capacity by up to 20%, reducing hydrocarbon dewpoint and reducing glycol carryover.

Since most separators — such as gravity separators, cyclone separators and filter separators — can be characterized by a typical separable diameter (i.e., cut-off diameter), the improvement of the swirl valve in conjunction with a separator can be demonstrated, Twister said.

Focusing on the working principle of the SWIRL, the company said that tangential slots in a cage valve trim forces the choking flow into a strong rotation, causing small droplets to concentrate and agglomerate along the perimeter of the pipe wall.

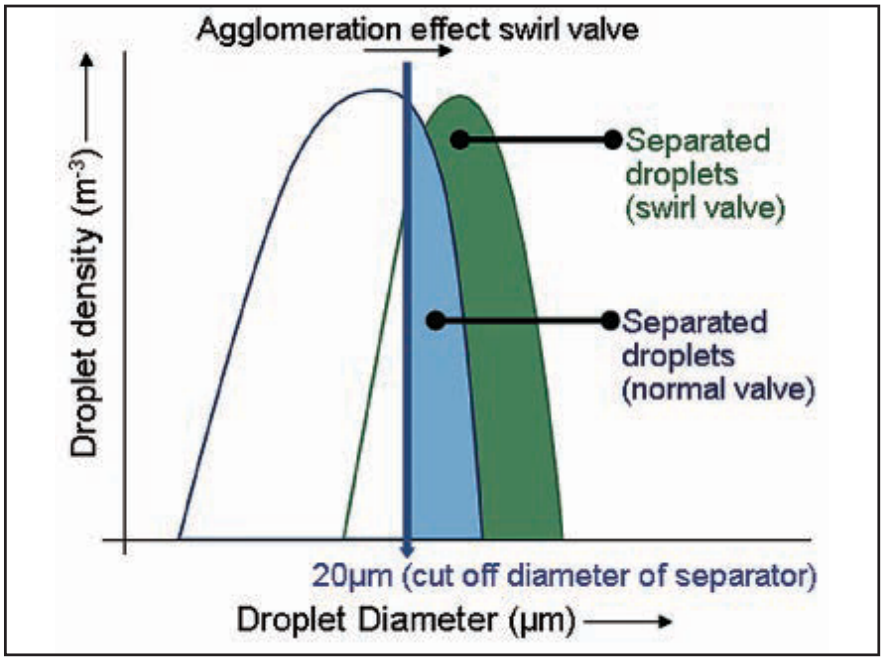
Gas is expanded isenthalpically across the valve and a swirling flow imposed by an engineered geometry of the valve trim and/or valve stem. The kinetic energy is then mainly dissipated through dampening of the vortex along an extended pipe length downstream the valve. The flow is normally throttled over a perforated cylinder (cage). These perforations — slots or holes — normally have a radial orientation, i.e., rectangular to the cylinder surface. The SWIRL-modified cage forces the flow into a swirling motion.

The company added that it can be expected that the flow pattern in a cage valve with radial openings has a highly disordered shear force, whereas the cage with the tangential openings forces the droplets to move to the outer circumference of the flow area, where they easily agglomerate into larger droplets.

Twister BV's Sales Director Hugh Epsom said the SWIRL valve sits between two disciplines — valve characteristic requirements and process design.

He added, "Twister BV is the bridge between these two disciplines as it offers analyzing flow characteristics of valve, piping and cold separator through the use of CFD engineering of the SWIRL valve to optimize droplet formation and separation." He added that the SWIRL principle can be applied to any valve that incorporates axis-symmetrical flow paths such as those established in cage-piston type valves.

The SWIRL valve centers on fluid



The improvement of the SWIRL Valve in conjunction with a separator is illustrated here.

streams, which evolve at high pressure, including well fluids from subterranean oil and gas reservoirs. These fluids mainly comprise hydrocarbon gases and liquids or mixtures that may be diluted with an aqueous fluid such as water. During the processing of these well fluids, the pressure is reduced in a controlled process to cool the fluid (gas) or to evaporate the volatile fluid components (oil).

"In the latter process, the pressure reduction goes down to atmospheric pressure to obtain a stabilized liquid, whereas for gas processing the pressure reduction is partial to restore sufficient mass-density to economically transport the gas through a pipeline," said Epsom. "After all these pressure reduction stages, phase separators are applied to split liquids from gas, gases from liquid (e.g., gas from oil) and liquid from liquids (e.g., oil from water or water from oil)," he added.

As evidence of its potential, Twister BV highlighted a field study it has recently carried out whereby a SWIRL valve replaced an existing JT valve in a JT-LTS plant during a two-day installation period.

The company said that for two months the export gas quality was monitored by an online hydrocarbon dewpoint analyzer and a mobile GACOM unit, measuring the liquid dropout at 26°F (-3°C) and 391 psi (27 bar). Noise measurements were also taken.

According to the company, the conclusions were that the HC dewpoint was reduced by 12.6°F (7°C) at design capacity; the flow rate was increased +20% of maximum flow capacity; the cold separator temperature was increased by 9°F (5°C) — indicating that the pressure drop over the JT valve could be reduced by 20%; the SWIRL valve noise level was comparable to rotating disk chokes and that the SWIRL valve had a linear control characteristic like any other traditional cage valve.

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