Factsheet 7

Twister SWIRL Valve

Twister
Supersonic Gas Solutions

The Twister SWIRL Valve™ improves the HC dew-pointing performance of existing JT-LTS plants:

– Increases plant flow capacity.

– Reduces ΔP required for JT cooling.

– Reduces hydrocarbon dew-point.

– Reduces glycol carry-over.

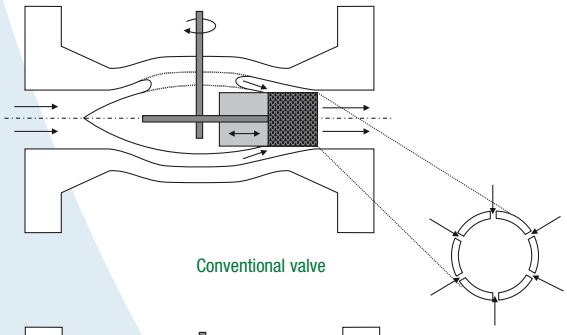
The Twister SWIRL Valve avoids turbulent mixing of fluids

Valves are used in the oil and gas industry to control pressure, temperature and flow. In many cases fluids will expand in the valve, once sufficient pressure drop is created over the valve. This throttling process normally results in a flashed liquid or a condensed gas, which needs to be separated afterwards.

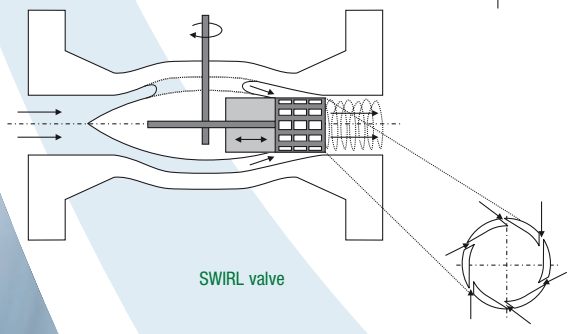
A side effect of throttling in choke valves is an intensive mixing of the gas and liquid phases, which can diminish the efficiency of the separators downstream of these chokes.

The Twister SWIRL Valve is a modified choke valve design, which minimises the mixing of gas and liquid phases and enables agglomeration of the dispersion present after pressure let down.

The SWIRL Valve uses the available free pressure to create a strong rotational motion in the liquid, resulting in immediate segregation of the formed phases.



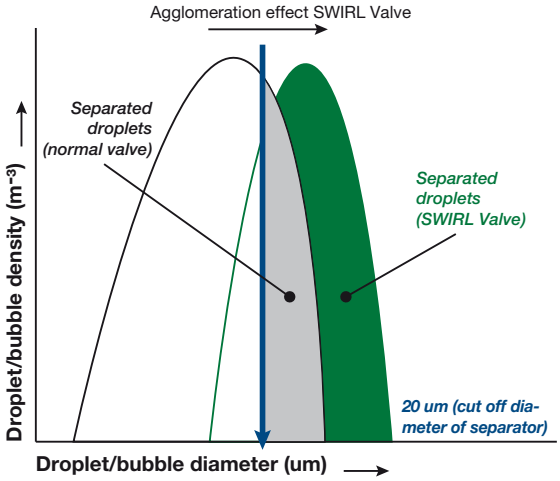
Conventional valve



SWIRL valve

The Twister SWIRL Valve enlarges the mean diameter of the dispersed phase

Most separators – such as gravity, cyclone and filter separators – can be characterised by a typical separable diameter (i.e., cut-off diameter). The improvement of the SWIRL Valve in conjunction with a separator is illustrated below.



Compared to a traditional valve, the SWIRL Valve enlarges the mean diameter of droplets and bubbles with at least a factor of 5. Only droplets with a diameter smaller than 0.2 micron will not be separated by the SWIRL Valve.

The Twister SWIRL Valve working principle

Tangential slots in the cage valve trim forces the choking flow into a strong rotational motion, causing small droplets to concentrate and agglomerate along the perimeter of the pipe wall.

The free pressure energy is dissipated through dampening of the vortex along the extended pipe length downstream of the valve. The advantage of creating a swirling flow in the valve is twofold:

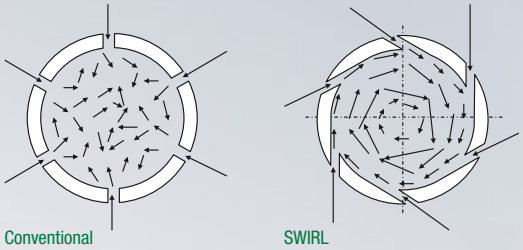
1. Regular velocity pattern > less interfacial shear > less droplet break-up > larger drops.
2. Concentration of droplets in the circumference of the flow area > increased number density > improved coalescence > larger drops.

The flow is normally throttled over a perforated cylinder (cage). These perforations, either slots or holes, normally have a radial orientation which are perpendicular to the cylinder surface.

Twister SWIRL Valve

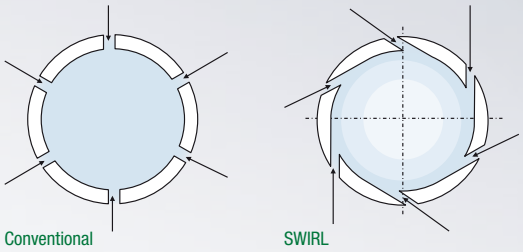
Plant data	
Feed pressure	99 bar
Max. design capacity	670,000 Nm3/d
Cold separator data:	
- Vertical SMSM separator	—
- Operating temperature	-18 °C
- Operating pressure	68 bar
- Operating flow rate	600,000 Nm3/d
Export specification:	
- PHLC specification	5 mg/Nm3 @ -3 °C
- HC d.p.	-3 °C @ 27 bar
- Water dew point	-10 °C @ 70 bar
Operating limits	< 650,000 Nm3/d

Qualitative stream patterns



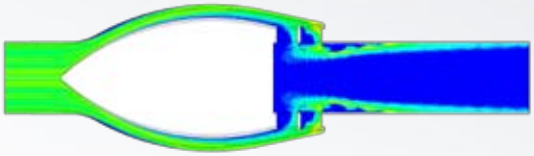
Conventional SWIRL

Droplet/bubble distribution

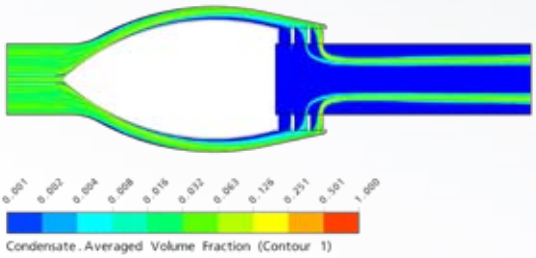


Conventional SWIRL

Simulation results SWIRL Valve



Simulation results normal valve



Two phase flow simulation has been performed to assess the segregation performance of the SWIRL Valve compared to a conventional valve operating at a feed pressure of 100 bar and a back pressure of 65 bar. The above figures show the liquid volume fractions of a fine dispersed liquid phase in a gas flow, typical for a Joule Thomson process. The liquid dispersion in the SWIRL Valve is agglomerated along the circumference within 3 pipe diameters.

Field test results

A Twister SWIRL Valve was installed and operated in a JT-LTS plant in September 2008 replacing an existing JT valve. The LTS or cold separator utilises a state-of-the-art separator internal (type: SMSM). The installation was completed within one day, with minimal disruption.

The export gas quality was monitored for two months utilising an online hydrocarbon dew point analyser and a mobile GACOM unit, which measured the liquid drop-out at -3°C and 27 bar.

These measurements demonstrated that by using the SWIRL Valve as a JT choke:

- The HC dew-point was reduced by 7°C at design capacity.
- The flow rate was increased by 20% of max. flow capacity.
- The cold separator temperature was increased by 5°C, indicating that the pressure drop over the JT valve could be reduced by 20%.
- The SWIRL Valve noise level was 70dB(A) at design capacity.
- The SWIRL Valve had a linear control characteristic similar to other traditional cage valves.

Twister value added

Twister BV has developed the SWIRL Valve using our extensive knowledge of expanding multi-phase flows. This knowhow has been gained during the 10-year development of the Twister™ Supersonic Separator. Twister BV has therefore bridged the instrumentation discipline (which specifies valves in process modules) and the process engineering discipline (that specifies the separation performance of vessels, but not the flow details inside the valve). Twister BV offers tailored SWIRL Valve designs that meet specific customer performance criteria.

SWIRL Valve applications

SWIRL Valves can be applied in the following production scenarios:

- Joule Thomson expansion of gas flows.
- Flashing oil/condensate flows in stabilisation processes.
- Oil/water separation processes.

When applied to existing facilities, the application of SWIRL Valve technology offers:

- Flow debottlenecking of separator trains.
- Reduced pressure drop in JT-LTS processes.
- Less liquid carry-over/gas carry-under.
- Higher liquid recovery, reduced chemical loss.

For further information: www.TwisterBV.com or email: office@TwisterBV.com

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