

Compact Inline Separation: SwirlSep



3D Model of the SwirlSep

Product Definition

Frames has extended their product portfolio with a new member in the family of physical separators: the SwirlSep. This product results from the combination of two technologies and offers cost effective inline separation solutions for a wide range of applications. The SwirlSep is the solution for separation processes where compactness, controllability, and a large turndown range is required.

Product Description

The SwirlSep is a compact separator and is the combination of a special flow control valve, the SwirlValve, and an inline separator, both complementary in their advantages.

SwirlValve

The SwirlValve is a low shear valve that can be utilized as a choke valve and/or (level) control valve. This valve is similar to a conventional valve, however, having one distinct feature: the design of the valve trim is such that a swirling flow (a vortex) is created downstream of the valve.

The major advantages of the swirling flow compared to the intense mixing and chaotic flow created by conventional valves are:

- Smaller pressure drop over the valve
- Minimized shear on the fluid
- Droplet/bubble break up is reduced
- Coalescence is promoted
- Drainage is stimulated
- Erosion is minimized

The SwirlValve is available in axial and angled configurations. The axial configuration is pressure balanced and therefore requires a much smaller actuator. The angled configuration allows for a higher flow capacity.

SwirlSep

The SwirlSep extends the SwirlValve with an inline separator unit. The advantages of the SwirlValve are fully exploited in the downstream inline separator.

In addition, the centrifugal acceleration that results from the swirling motion is directly utilized by the inline separator to facilitate separation of phases like gas and liquid.

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Swirl Trim Cage and Piston of the Swirlvalve

Process Description

Control valves and choke valves are commonly used in the Oil & Gas industry to control pressure, temperature, and flow. Fluids expand in a control valve due to the pressure drop over the valve. This process normally results in a flashed liquid or a condensed gas, which needs to be separated further downstream.

In the SwirlValve, the pressure drop is partially over the trim cage and the remainder over the downstream vortex. The pressure drop over the SwirlValve itself is therefore smaller compared to a conventional valve and turbulence and shear are greatly reduced, resulting in:

- Larger droplets/bubbles
- Less foaming
- Less formation of emulsions

Moreover, the droplets / bubbles coalesce into larger ones making downstream separation more effective. Additionally, if solids are present, erosion is less pronounced compared to a conventional valve due to the smaller impact angles of particles.

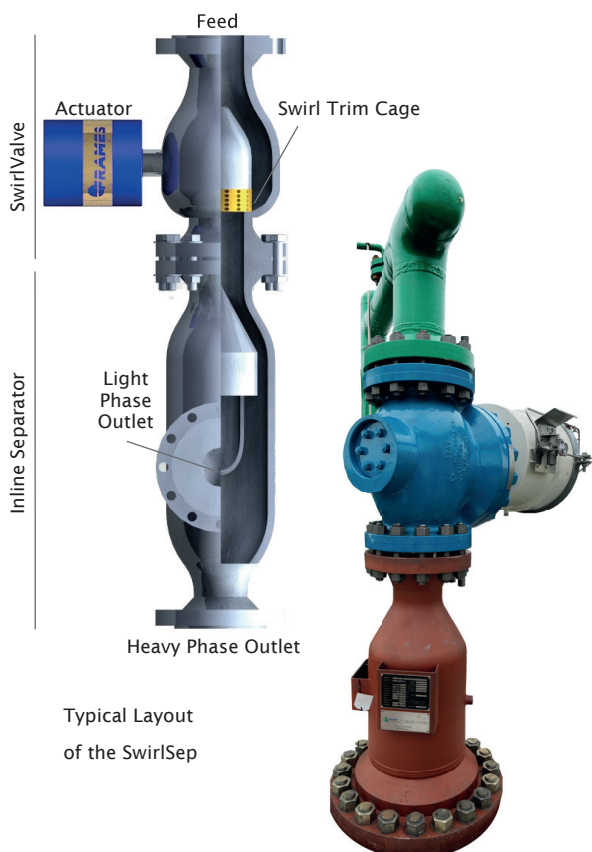
Replacing a conventional valve by the SwirlValve (without inline separator) already has a positive impact on the performance of downstream separators, and could therefore be a technology for debottlenecking applications.

Separation

The centrifugal acceleration that results from the swirling motion created in the SwirlValve is directly utilized by the inline separator to facilitate separation of the phases. Because of the larger droplets and bubbles, the separation efficiency of the SwirlSep is proven to be very high.

Turndown

The flow rate through the SwirlSep is regulated by the SwirlValve. For a certain pressure drop over the SwirlValve, the swirl velocity is independent of the flow rate. In contrast with other inline separators, this unique feature of the SwirlValve allows the SwirlSep to have a far larger turndown (down to 5% of the design flow).



Typical Layout
of the SwirlSep

Gas-Liquid/Solid SwirlSep (8", 900#, Duplex & Inconel, tungstencarbide coating) installed for Well Cleaning

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Applications

As a compact inline separator having a large turndown range, the SwirlSep technique is very flexible and is applicable for:

- Demisting
- Solids removal (e.g. well cleaning)
- Liquid degassing
- Gas/liquid (bulk)
- Liquid/liquid (bulk)
- Liquid/liquid (polishing, e.g. produced water)

Because of its compactness and flexibility, the SwirlSep technology is also very suitable as debottlenecking technology in existing facilities.

Compared to conventional separators for greenfield applications, the SwirlSep can replace both the upstream control valve and the separator by combining them into a simple, compact inline solution.

Project Management

At Frames, we know that dedicated project management is only the starting point for completing complex oil and gas projects. Our clients can rely on sharp thinking and a deep understanding of their operating conditions to find the best solution. Our quality management system focuses on a process of continuous improvement, and our team is always looking for new solutions that improve productivity, cut operating costs, and give our clients a competitive edge.

In a challenging industry, we understand that safety is a priority. We also know that in order to deliver maximum value to our clients we must complete each project on schedule, in spec and within budget.

At Frames, our close-knit team of engineering experts is open, honest, and focused on delivering you the best possible outcomes. We are passionate about the oil and gas industry, and have been a leading provider of safe, highproductivity systems for more than 30 years.

Technical Details

- Large turndown range
- Compact & inline
- Robust and reliable design
- Optimized using advanced computational fluid dynamics
- 2-phase separation

Added Value Frames

- A family of expertise in the Oil & Gas industry
- Customized design according to the clients' unique requirements
- Solutions fully integrated into conventional separation trains
- Design optimization based on in-house knowledge
- Robust and reliable units designed with lean engineering methods, using high-end materials

References

The demisting and solids removal SwirlSep has extensively been tested in the field (NAM, Groningen, The Netherlands) in 2014.

Results have shown very efficient removal of liquids and solids at various flow conditions.

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Frames Family Tree

