

22. May 2015

Designed and manufactured in Finland

1 GENERAL DESCRIPTION OF INNOVATION: THE SAOXFUGE

A spiral separator, which separates liquids and solids of the liquid to different layers based on gravity or density of the materials.

The separation is based in spiral flow of the liquid, which provides sufficient centrifugal force to a sediment organization of the components in the tube. The liquid material particles are organized according to specific weight so that heavier particles move to the outer periphery of the material.

Heavy components are separated by the centrifugal force of the spiral flow towards outer surface of the spiral pipe, and further to the final destination, which is an extension of the spiral and the outlet pipe. The outlet tube skims away the desired heavier material layer and leads it to the desired location or further processing. The discharge pipe is installed in the direction of extension of the tangent and spiral stream of the spiral tube.

Lighter components are organized in the direction of the smaller diameter of the spiral, from which they are directed past the outer periphery of the extension of the exhaust pipe. Extension and heavy particles outlet pipe is determined by the size of the substances to be separated from each other.

There might be turbulences in the spiral flow with high speed that resist sediment process. In case of high flow speed, the turbulences can be reduced and separation performance increased by pressure increase in the spiral tube that is not affecting in hydro cyclones nor other related separators.

The spiral tube and the extension can be manufactured of round, square shaped or other type of profiles. The apparatus is shown in figures 1a, 1b, and 1c.

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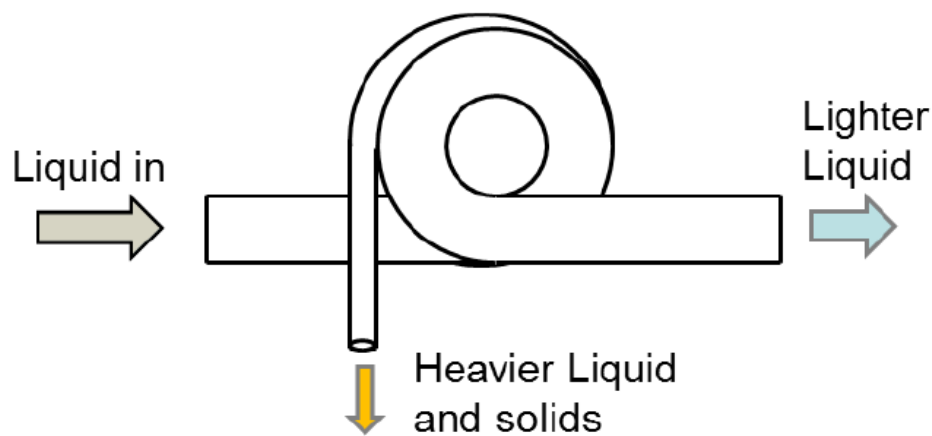


Figure 1a: Spiral Separator and working principle

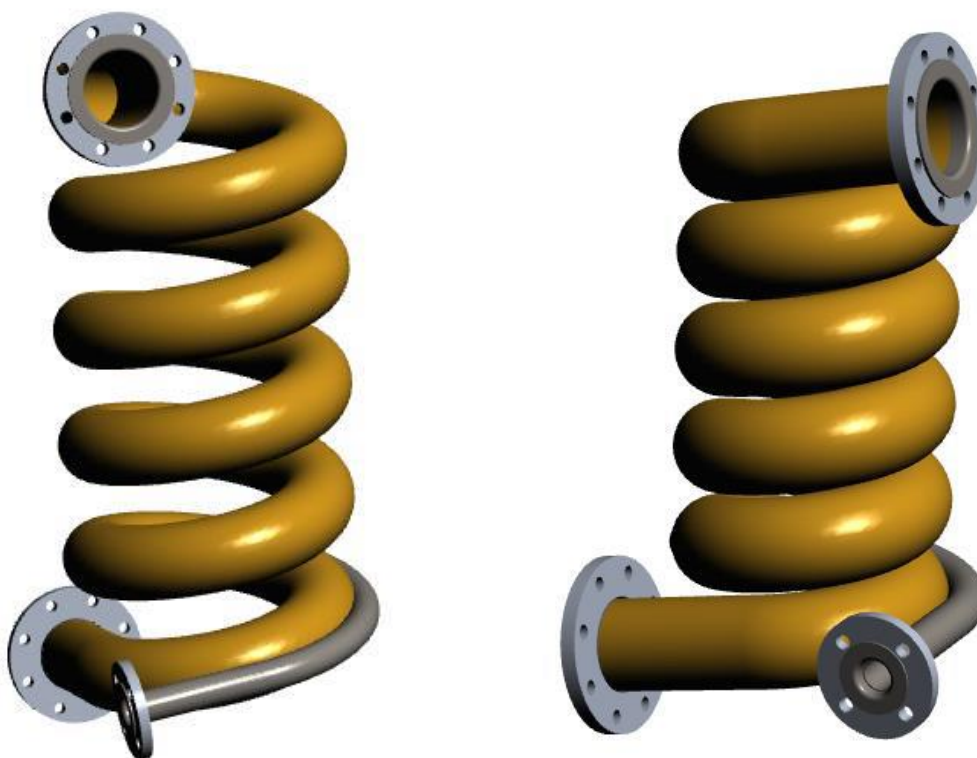


Figure 1b: Spiral Separator SaoxFuge DN100; prototype on the left and the end product on the right

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Figure 1c: The prototype of Spiral separator SaoxFuge DN100

2 DEMONSTRATION OF INNOVATION: THE SAOXFUGE

Working principle of the SaoxFuge

The liquid in question is directed into the spiral tube by using suitable flow rate and pressure. The fact that what needs to be separated and the relative difference of the specific gravity of the material particles in question, define the flow, pressure and structural relations.

Spiral flow in the tube creates a strong centrifugal force. This causes the particles of the material to become organized into layers according to their sediment order. Particles in liquid become organized according to their specific gravity so that heavier particles move towards the outer screen of the tube.

Flow rate depends of need for separation of each specific material. The flow speed and separation performance can be raised by pressure increase in the tube.

Heavy particles can be separated and lead out to desired location or further processing through the extension of the spiral and the outlet pipe.

Lighter particles move towards the inner circle of the tube, from where they can be lead past the extension to the exhaust pipe. Separation can be continued immediately by another separator, which improves the result further.

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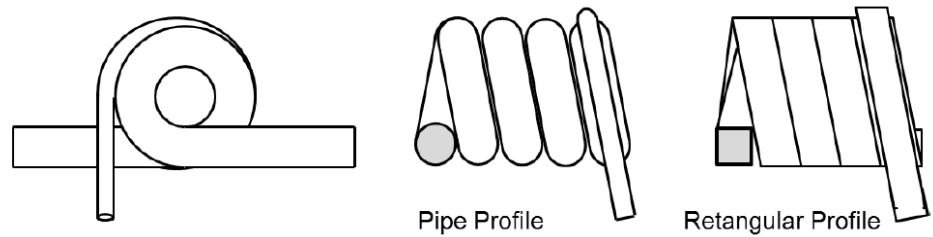


Figure 2: The construction of the spiral tube example profiles

The profile and length of the spiral are determined by the facts that what needs to be separated. Different spiral tubes and extension profiles are presented in figure 3.

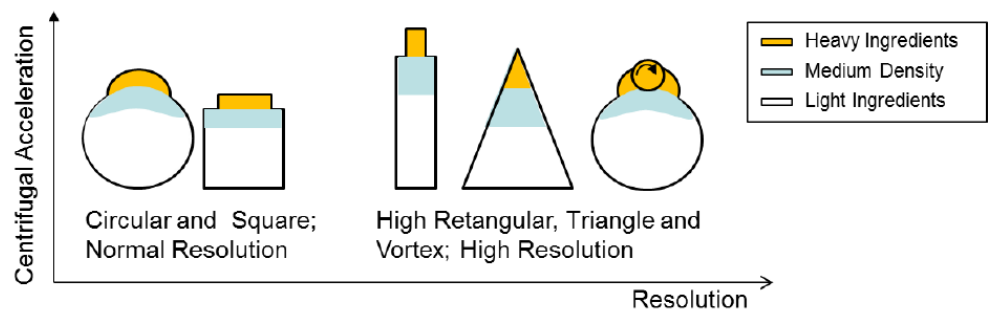


Figure 3: Different profiles and extension parts according to their separating capacity

The profile of the main tube can also be extended / made higher, like in figure 4. Vortex separator is the most efficient tool and besides the whirl keeps the tube clean for a longer time. The whirl is created by a vane controller in the extension part.

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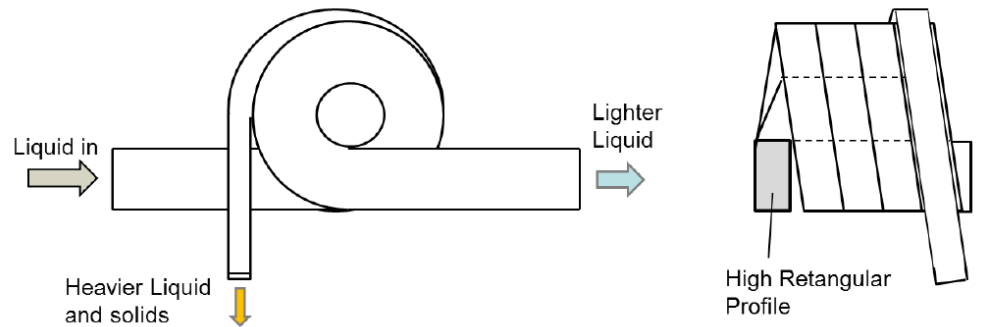


Figure 4: The higher shape of the tube affects to resolution and accuracy of separation

The separator can be modified by different one or several outlet tubes solutions and assemblies as described in figure 5.

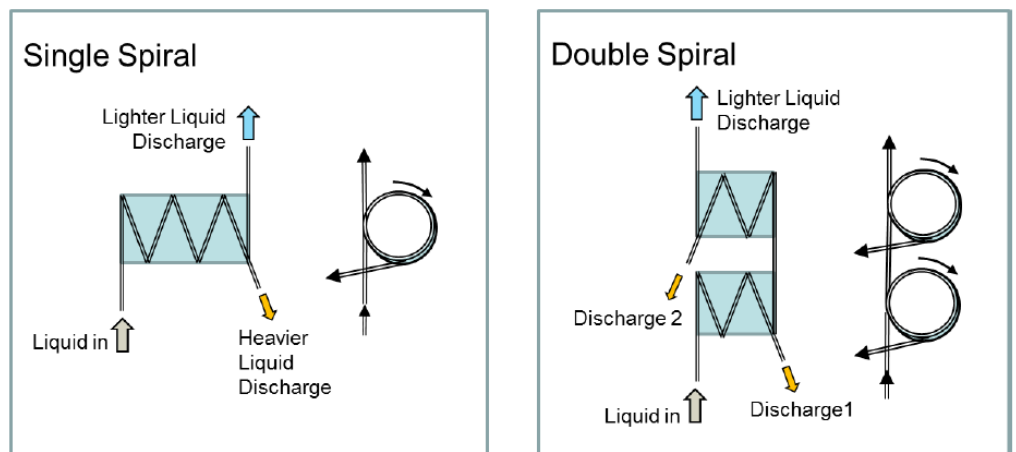


Figure 5: Different outlet tubes solutions and assemblies can be modified easily

Flow rate and the radius of curvature determine the centrifugal force, as shown in figure 6. Vertical assembly does not include this precondition.

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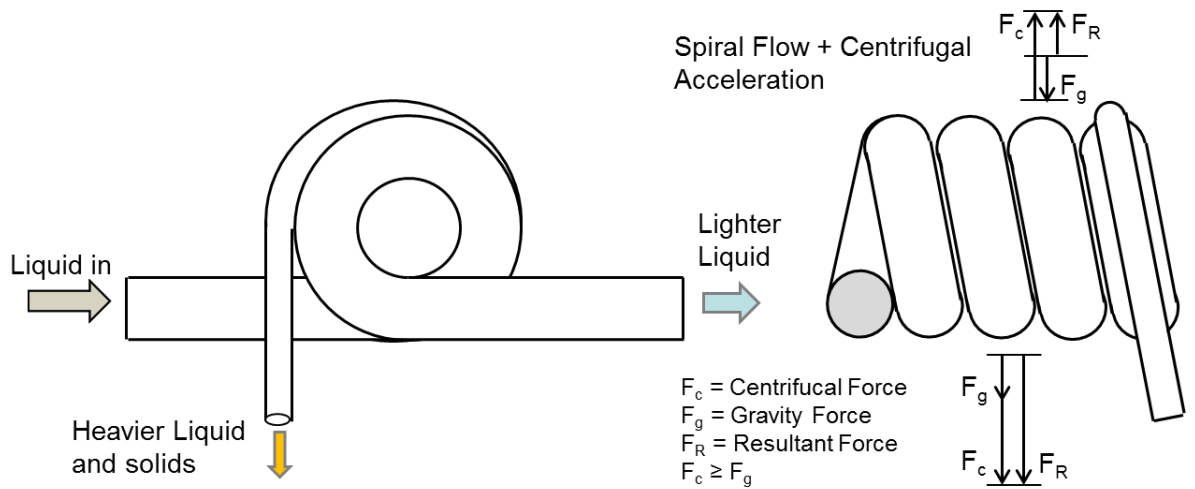


Figure 6: Working principle of the spiral separator

A vertically constructed model or a model assembled to a certain angle can also be manufactured, see figures 7 and 8. In a horizontal assembly the centrifugal force F_c must be bigger or as big at the minimum.

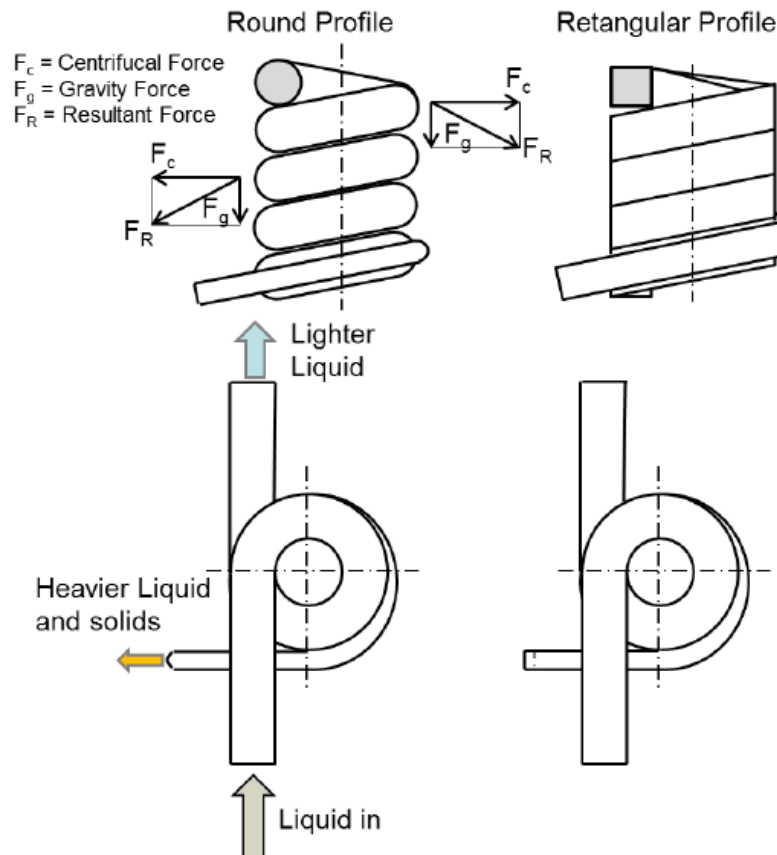


Figure 7: All profiles can be used to vertical models or models assembled to a certain angle

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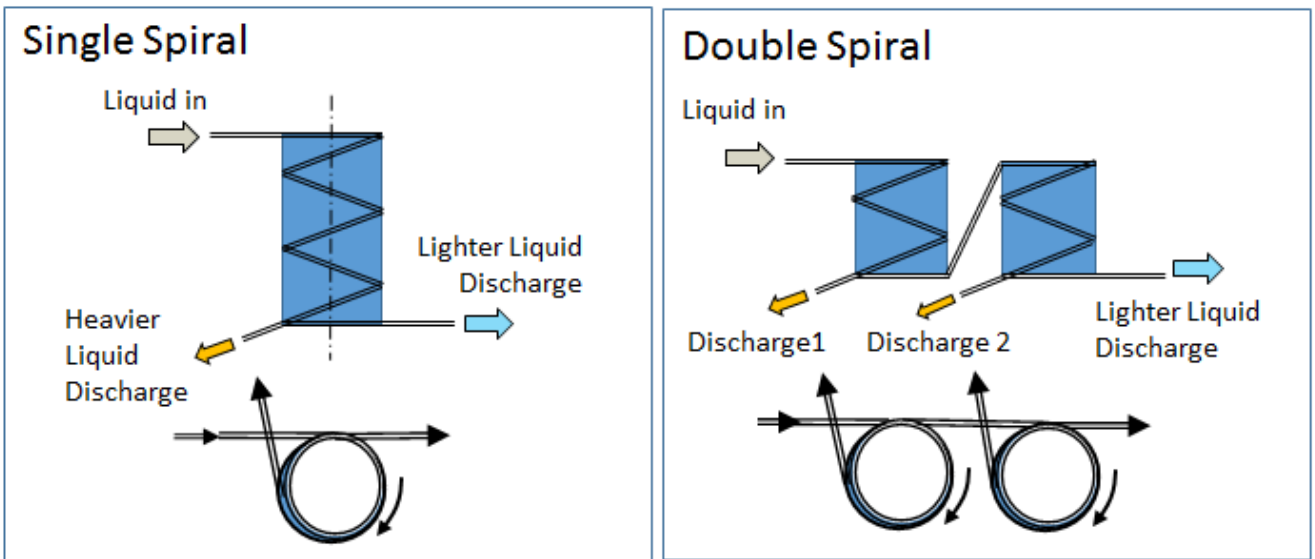


Figure 8: Examples of vertical models and assemblies

A durable tube or half tube can be installed to different tube profiles as in figure 9.

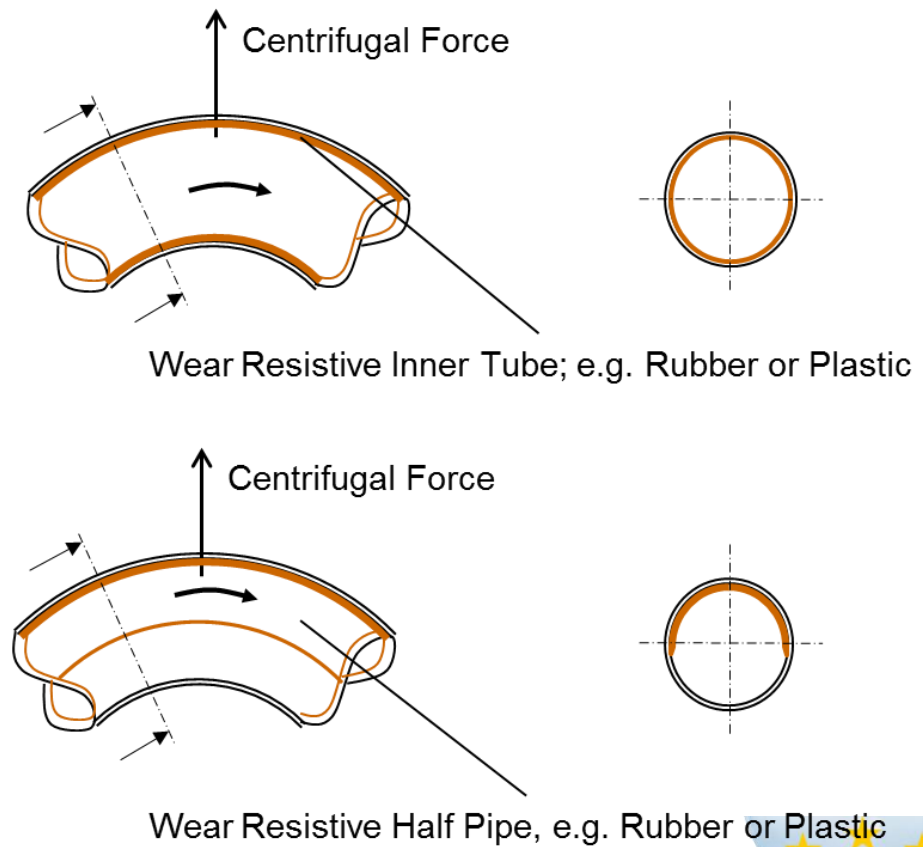


Figure 9: The durability of a spiral separator can be extended by durable tubes or half tubes

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Separating and soaking or saturating of gases

The spiral separator can be combined with soaking and saturating of gas effectively, e.g. aeration or oxygenation, into the liquid which will be separated. The pressure of liquid is low on the inner screen of the tube while the flow is strong. Ejector tubes and a pressure chamber can be connected to spiral tube in order to feed gas into liquid. According to several studies it is easier to separate particles from water that is well oxygenated, like various metals.

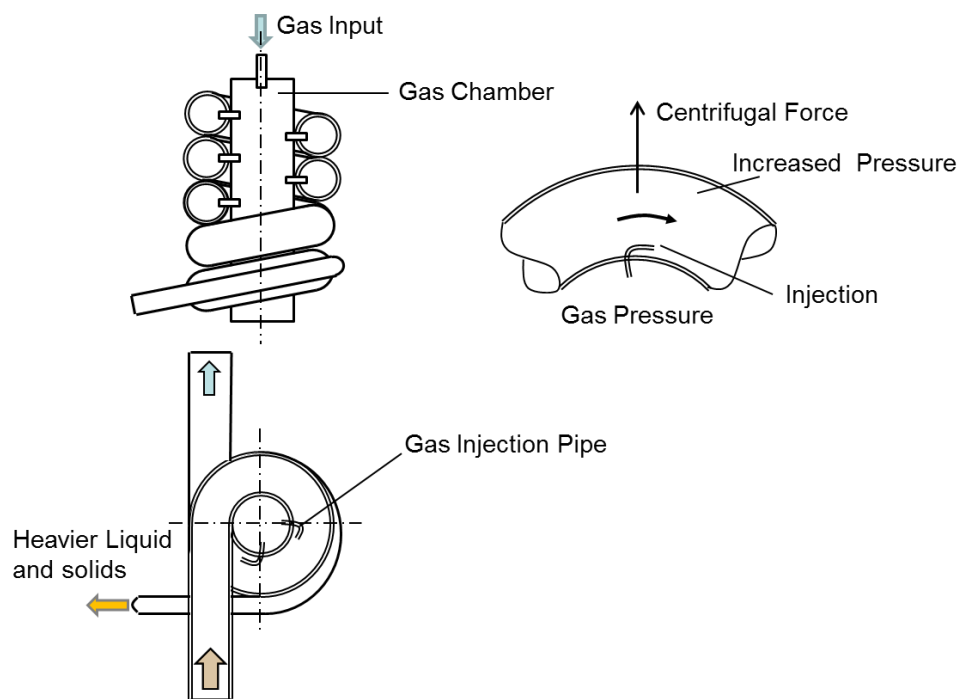


Figure 10: Soaking of gas like air or oxygen in a spiral separator

3 MODIFIED VERSION IN 2016

The SaoxFuge is a screw centrifuge, in which screw and cylinder lead the liquid into cylindrical flow. The separation is based on centrifugal forces and gravity as well as specific densities of different particles. SaoxFuge (DN50, DN100) is designed to flows between 2 – 5 m/s.

SaoxFuge is designed for the 1/7 separation ratio. This is able to have 5 times higher density, for example from 2 % density to 10% density.

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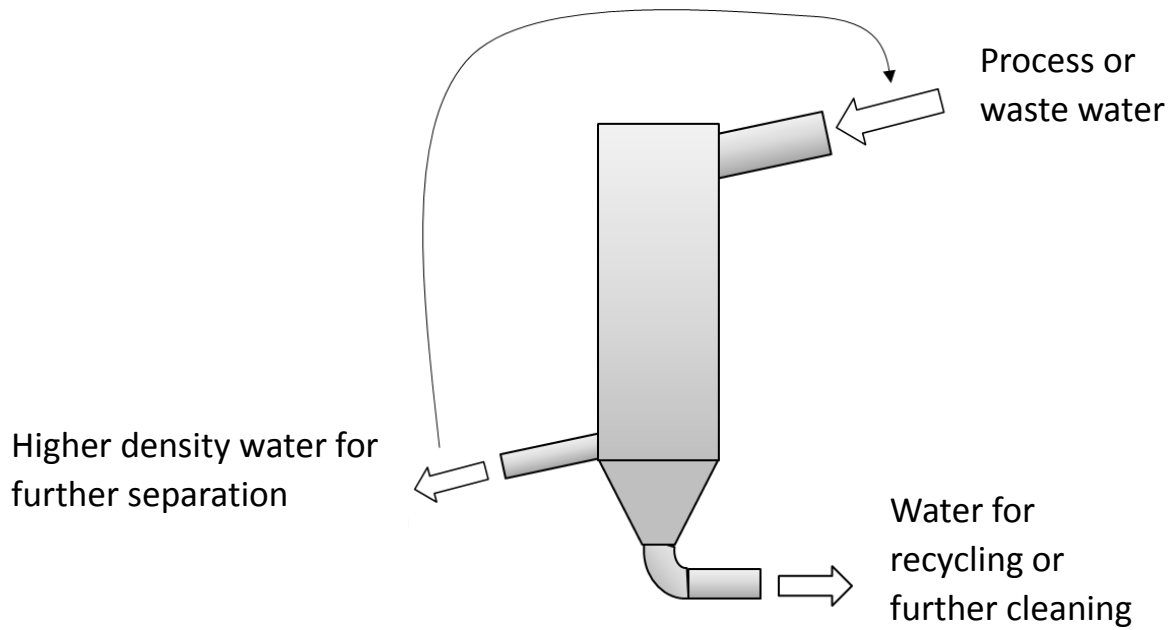


Figure 11: SaoxFuge separator's liquid cycles

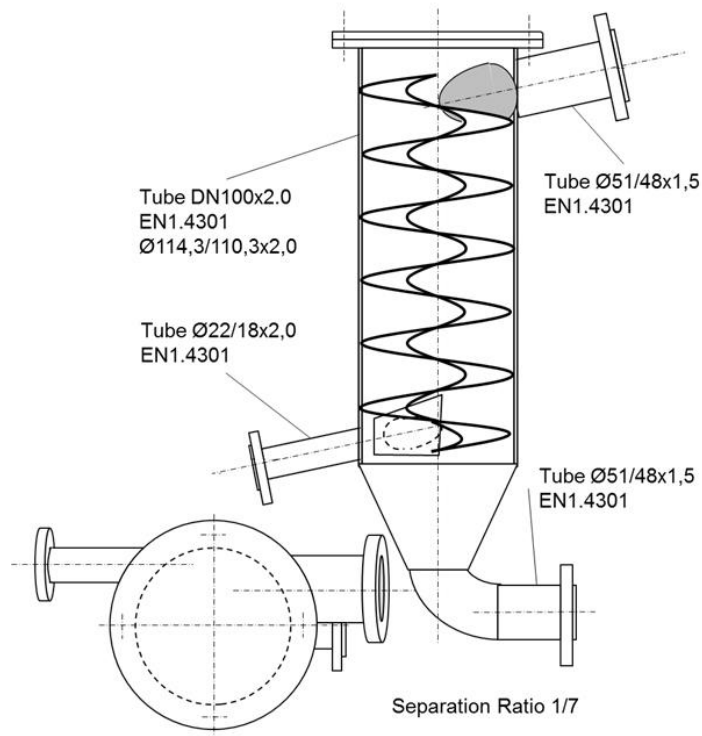


Figure 12: SaoxFuge Model B DN100/50

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SaoxFuge Model B

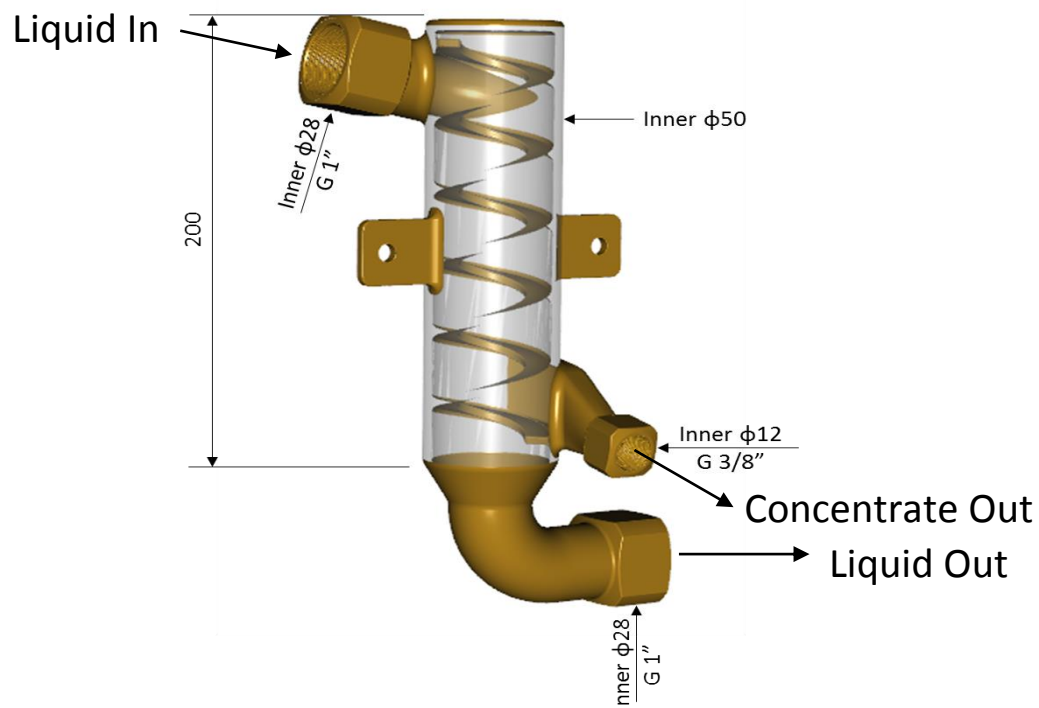


Figure 13: SaoxFuge Model B, smaller version