

TYPHONIX LOW SHEAR PUMP

Introduction and user benefits

Conventional centrifugal pumps break oil droplets while pumping produced water. Often the consequence is reduced efficiency of downstream treatment processes. Positive displacement pumps (PDP) sometimes counteract oil droplet breaking. However drawbacks of PDP's (maintenance requirements, noise and vibration, gearboxes etc.) makes centrifugal pumps more attractive. Overall user benefits of the Typhonix Low Shear centrifugal pumps are:

- More energy efficient produced water treatment and increased capability to handle process upsets and variations in produced water quality.
- Cleaner produced water and reduced oil and chemical discharges to the sea.
- Increased reliability reduced mechanical maintenance and increased lifetime compared to positive displacement pumps.
- No need for noise protection enclosures or pressure relief valve systems.
- Smaller and lighter than progressive cavity pumps in most applications.

How does it work

The Low Shear pump is a multistage centrifugal pump with high hydraulic efficiency. The layout and configuration of the individual stages are custom designed to control shear forces and minimize oil droplet breaking. The low shear performance of the pump is designed for each individual application, taking into account the head requirements, crude viscosity and produced water treatment system requirements. **Figure 1** shows, to the left, the principles and configuration of a typical Low Shear pump. The diagram to the right demonstrates how a Low Shear pump uses an increasing number of stages to match increasing pumping pressure while maintaining droplet sizes. In this empirical example, the pump performance of the Low Shear pump (blue curve) is contrasted to that of a single stage centrifugal pump (red curve).

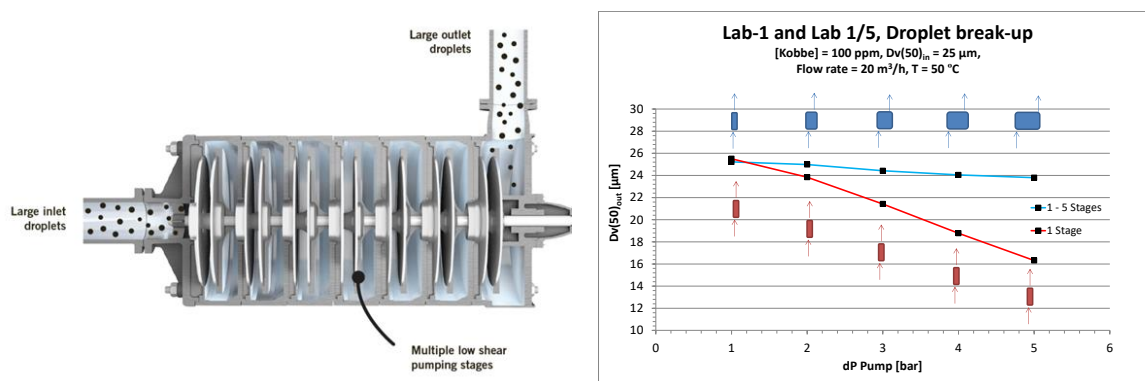


Figure 1. Left: Illustration of the Low Shear Pump principle and layout. Right: Lab-demonstration of low shear performance of multistage centrifugal pump.

The development

The Low Shear centrifugal pump is a product from years of development work through several Joint-Industry-Projects, financed by oil companies and the Norwegian Research Council. Particularly, work has focused on comparative studies with commercial pumps. **Figure 2** presents an example of a comparison test between a Low Shear pump and a commercial single-stage pump. This test reflects typical results achieved with an API 44 crude (highly shear sensitive) at concentrations of 200 and

600 ppm. Generally, the shear-performance of the Low Shear pump is a design factor. Hence, a well-designed pump will simultaneously match both the hydraulic duty point and the required droplet performance. The Typhonix Low Shear Pumps are BB4 style, built according to API 610. The photo of Figure 2 shows a Low Shear API 610 pump during a factory test at Typhonix.

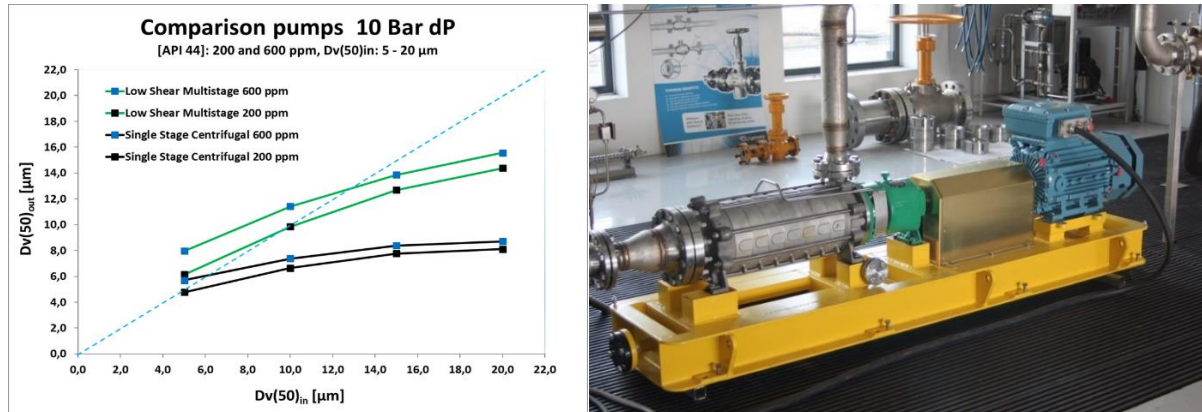


Figure 2. Left: Example of typical test results of the pump development project. Right: API 610 Low Shear Pump during factory test at Typhonix.

Field installation and experience

In 2017, two Low Shear pumps were installed on a platform offshore Malaysia. The pumps deliver produced water to a filter system and was acquired to improve separation performance. The platform reports (October 2019) that the pumps are still running fine after more than two years in continuous operation. **Figure 3** shows, at the left, the results of a *Droplet Performance Test* done at Typhonix in 2017, upon delivery. The pumps were designed to not give any droplet break-up of oil droplets of 15 μm or below. The right diagram is the result of an offshore verification test executed by the end-user some months later. Operating conditions OiW concentration 200 to 1000 ppm, API 42 crude, high concentration of corrosion inhibitor.

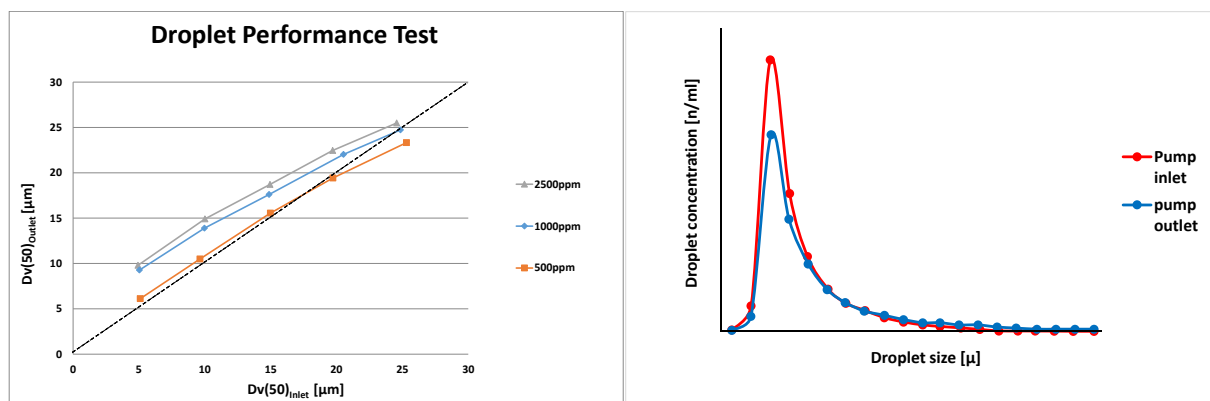


Figure 3. Left: Results of *Droplet Performance Test* at Typhonix upon pump delivery. Right: Results of offshore verification test executed by end-user on site.

Engineering Manager, Typhonix
 NIELS VAN TEEFFELN
 Mobile: +47 482 78 442
 Niels.teeffelen@typhonix.com