

TYPHONIX PUMPS

ROBUST LOW SHEAR AND COALESCING PUMPS

Introduction and user benefits

Conventional centrifugal pumps break oil droplets while pumping produced water. The consequence is reduced efficiency of downstream treatment processes. Positive displacement pumps (PDP) are sometimes used to avoid breaking droplets. PDPs have, however, other major drawbacks such as expensive and frequent maintenance requirements, high noise levels and vibrations. This makes centrifugal pumps the more robust and attractive solution. Typhonix Pumps combine the low shear features of PDPs (i.e., avoids or reduces breaking oil droplets) with the operational robustness and reliability of centrifugal pumps.

Overall user benefits of Typhonix Pumps are:

- Increased reliability, reduced mechanical maintenance and increased lifetime.
- Normally no need for noise protection enclosures or pressure relief valve systems.
- Smaller and lighter than progressive cavity pumps in most applications.
- 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.

What makes Typhonix Pumps so special?

Generally speaking, Typhonix Pumps are high hydraulic efficiency multistage centrifugal pumps with an innovative Low Shear trim. This means that the layout and configuration of the individual stages are custom designed to control shear forces, minimize oil droplet breaking and optimize droplet-droplet coalescence. The Low Shear Trim is specially engineered for each individual application, considering factors such as the head requirements, crude viscosity and produced water treatment system requirements. **Figure 1** shows a principal sketch of the Typhonix Pump internals.

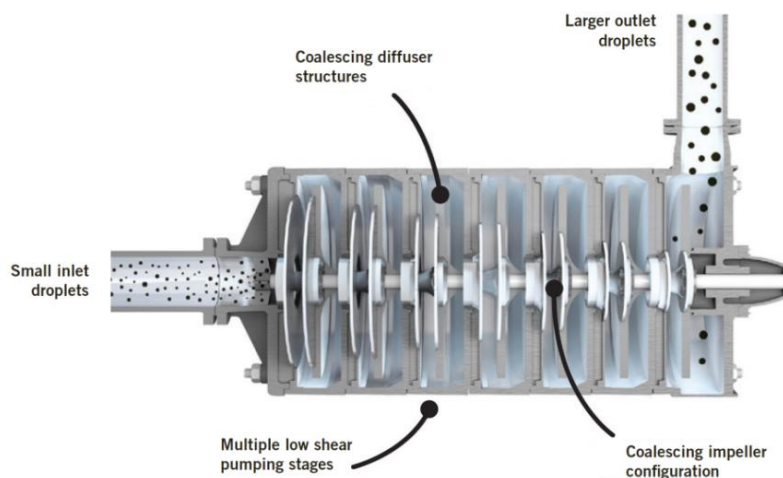


Figure 1. Principal sketch of the Typhonix Pump internals.

The development

The Typhonix Pump is a result of several years of development work, through Joint-Industry-Projects, financed by oil companies and the Norwegian Research Council. Initially, the objective was to develop a pump possessing the low shear feature of a positive displacement pump (new, with minimal slip flow), combined with the operational benefits of a centrifugal pump. During the development work, innovative new solutions to control turbulence and shear forces were found.

With these new solutions, Typhonix Pumps not only reduce droplet break up, but are also designed to let the oil droplets collide and coalesce. Coalescence means that two small droplets come together and form one big droplet. These larger droplets are much easier to separate, meaning that a pump with coalescing features will increase the efficiency of downstream water treatment.

During the development work, comparative tests with other commercial pump types were performed. These tests involved a variety of test conditions, including light, medium and heavy crudes, low and high oil concentrations, and small and large inlet droplet sizes. The tests demonstrated how positive displacement pumps generally maintained the droplet size, while the single-stage centrifugal pump always broke the droplets further. Typhonix Pumps either maintained or enlarged the droplet size, depending on the operating conditions.

Field installations and experiences

In 2017, two Typhonix Pumps were installed on a platform offshore in Malaysia. The pumps deliver produced water to a filter system. So far, the only maintenance required has been to change the oil in accordance with the manufacturer's required intervals. **Figure 2** shows results from a *Droplet Performance Test* conducted at Typhonix Test Center in 2017, upon delivery. The pumps were designed to not break droplets with a diameter of 15 μm or smaller. An offshore verification program was executed by the end-user some months later, verifying this performance. Operating conditions are: OiW concentration 200 to 1000 ppm, API 42 crude, high concentration of corrosion inhibitor.

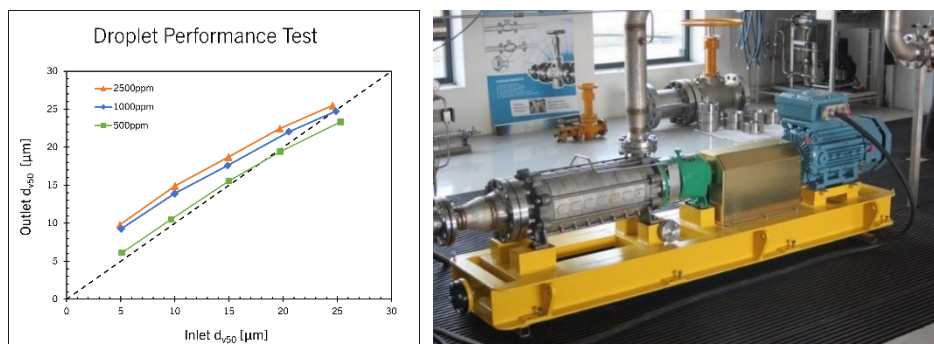


Figure 2. Results of *Droplet Performance Test* at Typhonix Test Center, and the API 610 Typhonix Pump.

Since the installation in 2017, more and more major operators have become aware of Typhonix' robust low shear pumps. Especially brown field operators that are experiencing maintenance issues with their old pumps are contacting us. They are looking for alternative solutions to maintain and improve the performance of the process plant while minimizing maintenance requirements and failure; this is exactly what Typhonix Pumps are made for!

One good example of a major brown field installation was a delivery to an Equinor field on the Norwegian Continental Shelf. Here the operator was suffering high maintenance load from the existing PDPs and was looking for an alternative low shear pumping solution. **Figure 3** shows a 3D sketch of the Typhonix Pump for this installation.

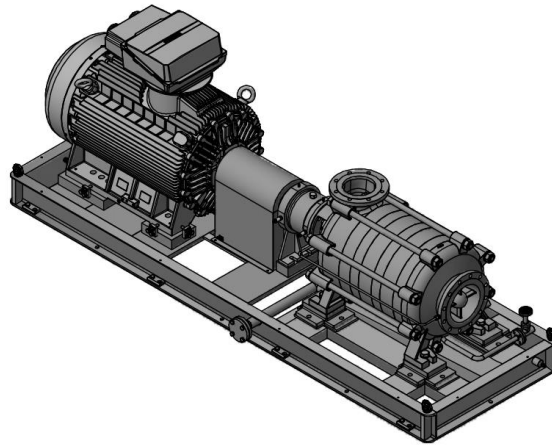


Figure 3. 3D sketch of a Typhonix Pump.

This is a produced water application where the pump is feeding hydrocyclones. Minimizing droplet breakup is therefore very important. The pump can receive water either from the 1st or the 2nd stage separators, resulting in a wide range of operation (410 m³/h, 40 to 125 m head). The supplied pump has high efficiency (> 75%), low noise (< 78 dBA), low vibrations (< 1,2 mm/s RMS) and low NPSHr (3%, < 4 m).

In conclusion

The low shear and coalescing performance of a Typhonix Pump are design factors. A well-designed pump will simultaneously match both the hydraulic duty point and the required droplet performance. Typhonix Pumps are built according to API 610. The main target applications are within produced water treatment, upstream separation processes depending on oil droplet sizes. We supply pumps both for green field and brown field installation and are happy to design the perfect pump for your specific application.

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