Old Pumps: New Challenges

The increasing worldwide demand of hydrocarbons and the subsequent high oil and energy prices are calling for optimization of mid and long distance transfer services.

TWIN SCREW PUMPS with its large working envelope can help improving efficiency in transient or high viscous applications.

Twin Screw Pumps, a very little known and even less understood pump type that was developed in the beginning of the 20th century, are providing benefits over conventional pumping technology especially in heavy oil transfer applications.

Efficiency in pipeline applications has always been important but with raising energy prices the efficiency of the pumps is becoming a key factor especially for mid and long distance transfer applications.
Now that heavy oil fields are being exploited more and more also the economical transportation of heavy crude oil is becoming more important than ever. Twin Screw Pumps can play an important role in the pipeline optimization with its superior performance at high viscosities. Compared to centrifugal pumps the better efficiency of twin screw pumps is becoming most apparent in applications above approx. 200 cSt.

In other transfer applications with lower viscosities (approx. 50 – 200 cSt) the advantages are not as apparent but require a realistic view on the operating conditions of pipelines. The design data of the pumps as the only source for an analysis is not providing a realistic picture as transient conditions are common in these applications. Not only because of the changing production well mix but also because of temperature changes (day/night, winter/summer). The changing operating temperature and subsequently changing viscosities have major impact on the system curve of the pipeline. As a result centrifugal pumps operate most of the time away from its original design point for which it was selected. The efficiency curve of centrifugal pumps has a maximum (design point) and drops significantly in case of changing conditions (see figure 2). Subsequently the average efficiency in transient conditions is much lower than the design point efficiency.

Especially in these transient conditions the advantages of twin screw pumps can help improving overall efficiencies of pipelines. These positive displacement, screw type pumps provide a large working envelope. Changing differential pressure requirement from the pipeline (caused by changing viscosities), density or viscosity has minor impact on the pump performance, the capacity almost remains constant and the pressure capability remains identical as with all positive displacement pumps (see figure 3). A “best efficiency” point as for centrifugal pumps does not exist for twin screw pumps. The efficiency remains almost constant over a wide operating range.
Subsequently applying twin screw pumps can help reducing the energy costs for pipelines but also bears the possibility to reduce the use of diluents and heaters to make the crude oil suitable (reduction of viscosity) for centrifugal pumps.

Additionally twin screw pumps provide an excellent suction lift what eliminates the need for booster pumps as often needed for centrifugal pumps. Elimination of the booster pumps helps reducing the amount of equipment that must be maintained, what results in reduced maintenance costs and down times.

Some pipelines also have positive displacement start-up pumps installed (often piston type) in case the main pumps (centrifugal type) are not able to overcome the friction when starting a pipeline. The use of twin screw pumps as main pipeline pumps eliminates the need for such pump, as flow variation is very simple. The capacity is a linear function of the pump speed, so that a “soft” start of the pipeline can be achieved easily by applying variable frequency drives. Capacity variations can subsequently be done without “burning energy” by re-circulating liquid to the suction as often done with centrifugal pumps.

Heavy oil often times is contaminated with "bad" ingredients such as wax or gas. The separation of entrained gas from the heavy oil is often difficult as the gas is trapped in the liquid. Whereas in centrifugal pumps any gas content bears the potential risk of gas-locking the pump, twin screw pumps are not effected in its performance by a gas content up to 40 %. The same applies to a wax content in the crude oil, there is no effect on the pump performance.

Based on the growing demand for big pumps over the last years the operational range of twin screw pumps has been extended over the last years. Nowadays the pressure capability of twin screw pumps is up to 100 bar and the capacity range goes up to approx. 3000 m³/h.

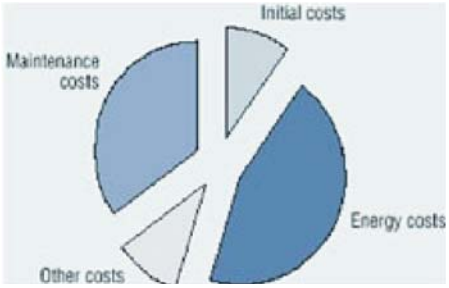

Figure 1: Pipeline operational cost split-up

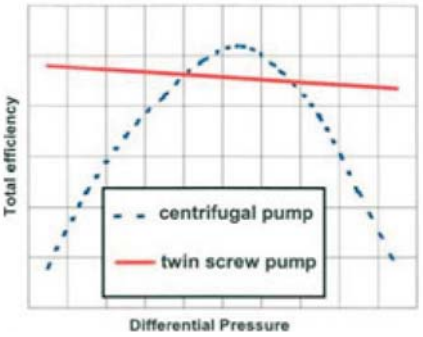

Figure 2: Typical efficiency over differential pressure of centrifugal and twin screw pumps

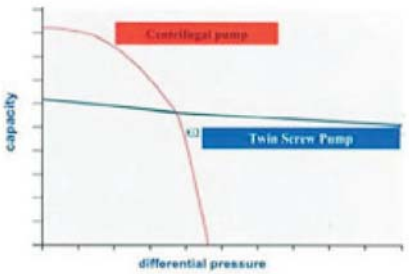

Figure 3: Typical performance curves of centrifugal and twin screw pumps

Bornemann Pumps

Contact details:
Mirko Pakschys
Sales Engineer
0049 5724 390 257

mirko.pakschys@bornemann.com