TWIN-SCREW PUMPS IN TANK TERMINALS

Axel Jäschke, business development director at Circor explains how twin-screw pumps can improve flexibility, simplicity and efficiency at tank terminals

Axel Jäschke

MODERN twin-screw pumps (TSPs) with variable speed drives provide superior fluid handling flexibility and efficiency over a very wide performance range. Understanding and utilising these benefits can help to reduce system complexity, save energy costs for fluid transport, and improve the flexibility of the entire system to manage all kinds of products.

One of the main cost drivers in the operation of a tank terminal is the energy required for the fluid transport. As part of a complex overall system, pumps are the energy consumers to provide the hydraulic power (flow and pressure) required by the system. In order to save energy, it is imperative to identify the critical consumers of hydraulic energy. The overall system must be optimised by reducing hydraulic losses and, where possible, recovering hydraulic energy. Additionally, each product will have its own challenges. By using pumps that adapt to dynamic challenges, the entire system remains efficient, flexible, and ready for the future.

THE EVOLUTION OF TANK PUMPS

But before the future comes the past. The Archimedes-Screw is one of the oldest rotating pumps, mentioned by Archimedes in 300 B.C. It needs gravity to create the separated chambers in the helix. Modern screw-pumps come with at least two helices interlocked to keep the helices in separate, closed chambers.

All screw-pumps have some things in common: they move the fluid in separate chambers, do not accelerate the fluid, move any kind of fluid that fits into the chambers against the backpressure of the system and can be operated in both directions, both as pump and 'turbine'.

The first screw-machine was patented as a screw-compressor in 1878. However, fabrication technology was not ready to build it at that time. This changed in the 1930s, when the screw-pump became the dominating pump due to its performance and robustness at low speeds. In the 1950s, new sealing technologies enabled higher pump speeds, opening up the market for the centrifugal pump as the simpler and cheaper option.

The centrifugal pump accelerates the fluid, adding kinetic energy and converting it into flow and pressure. Hydraulic effects reduce pump efficiency outside the best operating point.

The screw-pump technology successfully survived in niches where its advantages kept it the preferred solution. The screw-pump moves volume in closed chambers against the system pressure. Any product which fits into the chamber can be transported. The faster the pump rotates, the higher the flow rate – regardless of the backpressure of the system.

MODERN PUMP TECHNOLOGY

Today, technologies are evolving again. New technologies, such as the variable-frequency drive for controlling pump speed, became a proven and attractively priced solution. Now, the speed-controlled screw-pump can revolutionise the way fluids are moved. With no restrictions in changing fluid-characteristics, extremely wide operating range (flow and pressure) at near-constant efficiency, and perfect flow control due to its positive displacement operating principles, it is the most flexible and adaptable solution.

TSPs come as a rotating, timed screw-pump with two rotors and symmetrical, non-contacting screw-twins. A timing-gear synchronises the rotors and transmits the torque. Virtually any fluid can be transported. With the new ability to dynamically change the speed of the TSP, the capacity range expands so that it can still operate at any pressure with superior overall efficiency over the entire operating range. Precise flow control, independent of system pressures and with almost any product, are some of the key advantages of the TSP.

As a full symmetric screw-machine, the TSP can reverse the speed and operate in both flow directions. If the inlet pressure to the pump is higher than the outlet pressure, it operates as a hydraulic twin-screw motor (TSM) – driven by the system pressure, controlled by the speed of the electrical motor – and uses the hydraulic energy to generate electrical power. And if the main purpose of the TSM is to control flow or system pressure, the energy-recovery-control valve (ERCV) is born. Unlike a normal control valve, which would only waste the hydraulic energy of the fluid, the ERCV can convert the excess hydraulic energy into electrical energy.

The better overall efficiency of the TSP, in combination with the wider operating range and the ability to manage a very wide range of product types (fluids), enables innovative design options for the tank terminal layout, such as:

- Standardisation of very few pump types to manage the todays and future products
- Implementation of the variable speed drive technology
- Optimisation of the power grid performance
- Design of symmetric pump hubs with flexible header systems
- Replacement of conventional control valves with ERCVs
- Implementation as smart control system for more dynamic and energy optimised fluid transport

By using a twin-screw pump, the system can be kept simple, flexible, and efficient. Design the system you want and get the pump you need. Minimise your investment and reduce your energy cost and CO_2 footprint.

For more information:

Axel Jäschke, business development director ar Circor will be speaking at StocExpo in Rotterdam on 14-16 March. You can visit the team on stand E23.

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