

Twin Screw Multiphase Pumps and Slug Flow

During the past decades the worldwide demand for crude oil and gas has continuously risen. Beside the well-known and proven production technologies new ways to increase the oil production had to be found. The revival of abandoned oilfields or further development and operation of marginal fields are considered by many producers.

BY HANS-JÜRGEN SCHÖNER

The majority of these fields produce high gas flows along with small amounts of hydrocarbons and water at very low well pressures that do not permit the use of conventional separation systems or even require artificial lift by means of downhole pumping equipment, gas lift or other technologies.

Additionally, flaring and venting of so called Greenhouse Gas during the oil production contributes considerably to the climate change and the vast majority of oil producing countries has implemented statutory orders for the ending of flaring and venting.

Hence, new ways of transferring the well flow to the processing facilities had to be introduced.

Multiphase Flow

In the early 1990s Twin Screw Pumps were employed for the first time to handle oil, water and gas mixtures, or in other words, "multiphase flow", successfully. A large number of multiphase pumps have been installed over the past 20 years. With their large operating range that covers many production years without equipment modification, the units have proven versatile, reliable and economical.

Twin Screw Multiphase Pumps are rotary positive displacement



Cut-a-way of a Leistriz Twin Screw Multiphase Pump (illustrations/photos: Leistriz Pumpen GmbH)

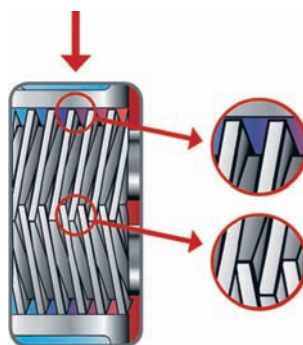
pumps. They are of double volute design and hydraulically balanced with no axial thrust on the bearings. After entering the pump suction, the flow splits and is pressurised within the opposed-thread screw packages. The screws are machined from single piece bar stock, hardened and installed in a replaceable casing insert. The torque from the drive screw is transmitted to the idler screw via oil lubricated timing gears. Both screws are not in contact with each other and carried in heavy duty and lifetime optimised tapered roller bearings.

This makes Twin Screw Pumps particularly suitable to handle non-lubricating, contaminated and high viscous liquids (up to 150,000 mm²/s) as well as products with high gas fractions. The shafts are sealed by single acting or double acting mechanical seals that are exposed to suction pressure only.

Twin Screw Multiphase Pumps

Leistriz Twin Screw Multiphase Pumps are available for maximum flow rates of 5,000 m³/h (755,300 bpd) and differential pressures up to 150 bar (2,175 psi). They have a wide speed control range. By using frequency inverters it is possible to adapt the pumps easily to changing field or well conditions.

Twin Screw Multiphase Pumps are designed to handle high Gas Volume Fractions (GVF) and to tolerate GVF fluctuations. Gas slugs with 100% GVF of different lengths must be expected in many applications. In order to maintain flow and pressure during slug flow, a liquid seal must be provided between screw tips and pump casing. Depending on the actual operating conditions a liquid rate of approximately 3.0 percent of the design flow must be injected to



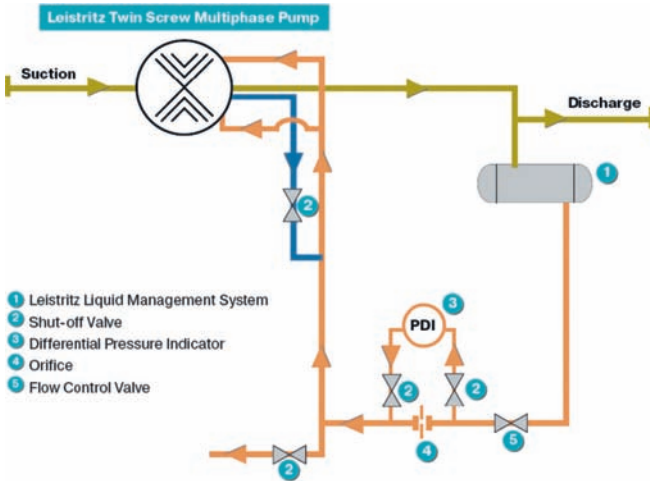
Clearances and liquid seal

assure sufficient gas compression during slug flow periods.

Liquid Management System

This is achieved with the external Leistriz Liquid Management System that can be designed for different gas slug lengths. For the majority of applications a system sized for gas slugs of 10 to 15 minutes is sufficient. Only a few applications require a liquid reservoir for approximately 30 minutes or even more. The external arrangement allows the installation of such oversized liquid reservoirs without problem. The Liquid Management System is located downstream of the pump discharge and within the skid limits. During the pump operation liquid is constantly separated from the multiphase flow with a minimum efficiency of 97 percent. The separated liquid is collected in the reservoir of the liquid management system and injected from the liquid reservoir into both suction areas of the pump.

The large surface of the liquid reservoir supports quick heat dissipation and makes additional cooling unnecessary. For installations in cold environments space heaters, electrical heat tracing and insulation can be provided. The Leistriz Liquid Management System is equipped with a large



P&ID of the Leistriz Liquid Management System for multiphase pumps

inspection port and sediments that have settled on the bottom of the liquid reservoir can be easily removed.

The design of the external Liquid Management System allows easy maintenance. The Multiphase Pump itself must not be disassembled or removed for any work that is performed on the Liquid Management System.

Wide Range of Materials

Leistriz Multiphase Pumps as well as the wetted and pressurised

accessories, such as the Liquid Management System, can be delivered in a wide range of construction materials. Besides standard materials for non-corrosive multiphase flow, special materials for products with corrosive substances can be supplied. Hard facing of the screws and the casing insert is available when erosive materials are handled.

The external Leistriz Liquid Management System with its rugged, simple and service-friendly design offers a maximum of oper-

ational reliability to process and operators. A special benefit is the possibility to size the liquid reservoir for the predicted slug flow conditions with no need for modifications during the entire well or field life.



Leistriz Multiphase Pump skid with liquid management system

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