

Twin Screw Multiphase Pumps for Offshore Applications

Multiphase pumping has experienced increasing popularity during the past years. Their ability to keep ageing and matured fields alive combined with low investment costs make them an ideal tool for today's oil production.

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Rotary positive displacement pumps, in particular twin screw pumps have been the base for the development of multiphase pumps during the past 20 years. These pumps handle products with high and low viscosity gently with low shear. They are self priming and almost pulsation free. The pumped products can range from 100 percent liquid to 100 percent gas content (GVF).

By varying the pump speed a large operational envelope can be maintained. This allows a flexible reaction to changing well conditions. Maximum flow rates up to 4,000 m³/h (604,000 bpd) can be achieved at differential pressures of up to 100 bar (1450 psi).

Twin Screw Pumps

Twin screw pumps are of double volute design and hydraulically balanced with the bearings not exposed to any thrust loads. The hardened pump screws, manufactured from single piece bar stock, are installed in a replaceable casing insert and have neither contact with each other nor with the casing insert. Oil lubricated timing gears transmit the torque from the drive screw to the idler screw. Each screw is sealed by either single or double acting mechanical seals which are exposed to suction pressure only and carried in lifetime optimised bearings.

Conventional methods to produce

oil and gas can be replaced today by a much more efficient method - multiphase production systems. With the multiphase pumps as the heart of the systems, the untreated well flow consisting of the liquid phase, gas and small amounts of solids can be handled within one machine. Their ability to operate at very low suction pressures make them particularly suitable to extend the production life of matured fields with low well pressure. Additional treatment equipment at the well site is usually not required and artificial lift can be scaled down or even eliminated. The entire multiphase flow can be boosted by the multiphase pump over long distances, such as from an offshore platform to a central processing facility on shore.

Multiphase Pumping Systems

Multiphase pumping systems do not only improve the oil and gas production but also contribute to the reduction of greenhouse gas released to the atmosphere. Carbon dioxide or methane emissions from flaring and venting rank among the main reasons for the continuous global warming. Multiphase pumping systems can efficiently handle the entire well flow and account for the elimination of flaring and venting at the well sites which will be statutory in the majority of the oil and gas producing countries.

Since the majority of multiphase pumping systems has been installed onshore there is now an increasing number of systems determined for offshore platforms. Most of these packages go to small unmanned platforms with no electricity available. While smaller units are usually diesel engine driven, gas engines are installed on the larger skids.

On the Skid

Pump and engine are mounted on a common skid type baseplate together with cooler, exhaust system, on-skid suction and discharge piping with valves and filters and lube and/or seal oil systems. With high gas volume fractions (GVF) or where gas slugs are expected, an external liquid management system will be furnished. These sys-



Twin screw multiphase pump Mexico (photo: Leistriz Pumpen GmbH)

tems are designed to provide always a minimum liquid flow to the inlet area of the pump in order to maintain a liquid seal between screw tips and casing insert. The liquid management system avoids torque fluctuations on the drive shaft during slug flow and renders slug catchers unnecessary. The size



Gas engine driven multiphase pump on an off shore platform in the Gulf of Mexico Mexico (photo: Leistriz Pumpen GmbH)

MULTIPHASE PUMPS

can be adapted to the predicted slug duration. The extensive on-skid instrumentation allows either remote control from a main platform or from a local operator panel. Due to the mostly severe ambient conditions, the control equipment is generally containerised.

Material Selection

Particular attention is paid to the selection of construction materials. The wetted pump and system parts are usually made from fabricated carbon steel or cast steel with the screws manufactured from nitrided steel. Materials in accordance with the latest NACE requirements are supplied for sour services.

These can be suitable carbon and low alloy materials as well as Duplex stainless steels or highly corrosion resistant Nickel alloys. If specified, the construction materials are selected in accordance with NORSOK requirements. The paint coating of the entire systems meet the demands for installation in harsh marine environments.

Beside crude oil, water and gas, most wells produce varying amounts of solids. Despite all efforts to separate these solids from the well flow, limited solid quantities will usually enter the pump. In order to prevent excessive wear of the screws and the casing insert, hard facing, e.g. Stellite or



Electric motor driven multiphase pump with insulation on an offshore platform in China (photo: Leistritz Pumpen GmbH)



Multiphase pump package with gas engine and liquid management system on an offshore platform in the Gulf of Mexico (photo: Leistritz Pumpen GmbH)

Tungsten Carbide coating can be applied.

Lower Cost - Increased Revenue

Versus conventional separation systems with separators, heaters, compressors, pumps and individual flow lines for each phase, multiphase pumping systems offer considerable cost advantages because of equipment reduction and the possibility of operating at lower well pressures. Lower capital expenditure for the equipment and for modifying the platform for installation due to the small equipment footprint as well as revenue increases from higher oil production result in very short payback periods. Less equipment also accounts for reduced expenses for maintenance.

With the decreasing oil reserves and the increasing demand for energy, marginal and declining oil fields become more and more important for the world's oil production. Multiphase pumping systems with their proven technology form an economical alternative to conventional oilfield equipment and offer a wide range of benefits to the operators.