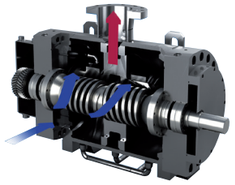
Multiphase pumps pump simplify wellhead oil and gas transfer

Leistritz Pumpen GmbH



Cut-a-way of a high pressure multiphase pump

HANDLING PRODUCTS, LIQUIDS and gaseous fuels at the wellhead of an oil field is a costly procedure. The conventional way is to separate the associated gas from the liquid fraction (hydrocarbons plus water) and convey them in separate pipelines to a gathering point over the surface of the oil field for a first separation process before feeding them into trunk pipelines.

The procedure is relatively easy on land, but it becomes more complicated and costly when the oil field is offshore and space to install the necessary equipment on a platform is limited and expensive.

The use of multiphase pumps, specifically in offshore installations, is gaining popularity because of their ability to handle liquid and the gaseous fuel simultaneously, eliminating the need to provide compression equipment at wellheads and the installation of two parallel sea lines to transport the products separately.

The majority of multiphase pumps are of the twin-screw variety, which is a speciality of Leistritz Pumpen of Nuremberg, Germany. The company's self-priming pumps are of double volute design and hydraulically balanced. The possibility of motor-speed variation by means of variable frequency drives (VFD) offers a wide operating envelope. Leistritz twin-screw multiphase pumps are available for flow rates up to 755,000 cfd (5000 m3/h) and differential pressures up to 2200 psi (150 bar). These pumps are designed to handle high gas volume fractions (GVF) and to tolerate gas slugs with 100% GVF.

Pumping the multiphase fluid directly to the central processing facility eliminates the requirement for separators, heater treaters, pumps, compressors and storage tanks at the field gathering stations. This offers numerous advantages, such as:

- reducing installation space on the platforms;
- consequent reduction of operation and maintenance interface;
- reducing manpower because multiphase pumping systems are suited for remote control;
- removing the bottleneck of existing flow lines by maximizing throughput;
- integration of low and medium-pressure wells into a high-pressure manifold/separator;
- integration of marginal fields or remote tie-backs to existing facilities;
- segregating the production scheme of low and medium-pressure wells by using dedicated multiphase pumps;
- restoring dead wells by reducing well back pressure;
- maximizing the use of existing production facilities on a declining field by adding production from remote wells;
- eliminating flaring and gas recovery by boosting the unprocessed well stream to central separation facility;
- reducing unstable flow regimes in multiphase pipelines to higher superficial velocity.

Multiphase pumps are designed to operate with variable suction pressures. This is a major advantage over conventional separation systems featuring compressors, which are designed to operate solely at a predetermined fixed inlet pressure level.

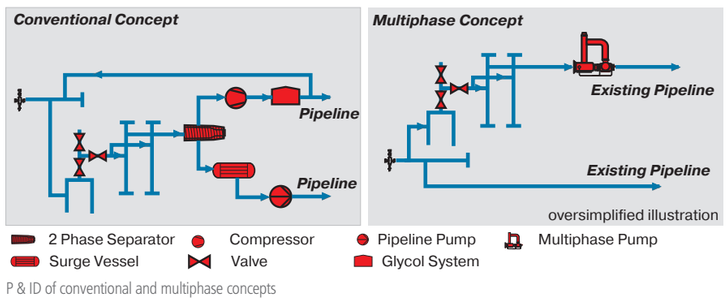
UAE multiphase system

The oil field featuring the installation of the Leistritz multiphase system is located in a few miles from the United Arab Emirates coastline. The offshore field was discovered in the late 1960s, with oil production starting in the mid-1980s.

Around the turn of the century, production showed a decline of oil volume associated with an increase of water cut. To sustain the field's oil production at the current level, short-term development projects were implemented, which consisted of installing electrical submerged pumps and a multiphase pump at selected wellhead platforms.

Leistritz engineers proposed the installation of a multiphase pump as a cost-effective technology to transport multiphase fluid through a single pipeline instead of separating oil, water and gas at gathering stations and exporting oil and gas through separate pipelines to centralized production facilities. Multiphase pumps are essentially a means of adding energy to the unprocessed well stream, which enables liquid/gas mixtures to be transported over long distances without the need for prior phase separation.

Due to the H2S concentration and the high chloride content of the produced water, all wetted parts of the pump and of the following skid components were made from duplex stainless steel, meeting the NACE MR0175 requirements. The casing liner is wet resistant coated with Stellite. The pump shafts are sealed by double-acting, balanced mechanical seals in a back-to-back arrangement. In the case of slug flow, the liquid management system provides a sufficient liquid seal to the area between screw tips and casing liner to guarantee uninterrupted production.



P & ID of conventional and multiphase concepts

Pump bearings, timing gears and the mechanical seals are lubricated and cooled by a combined lube and seal oil system, which is also accommodated on the pump skid. The automatic filter protects the pump internals from wear and damages by solids entrained by the multiphase fluid coming from the well.

Multiphase pump skid on the multiphase pump test bed

Before shipping, the pump skid and all accessories were tested on the multiphase pump test bed at the Leistritz production shop and at the premises of the selected sub-suppliers. All tests have been witnessed by representatives of the end customer.

The application presented serious challenges because of the restricted space available on the platform that has impacted the skid design. The sour components of the wellhead stream imposed a careful selection of the pump and component materials.

The multiphase pump skid was successfully commissioned during the third quarter of 2008. A new product manifold was installed to separate the flow between the high-pressure flowing wells and the low-pressure flowing wells. The low-pressure wells are connected to the suction line of the multiphase pump, resulting in a reduction of back pressure for the weak wells and a considerable increase in production. ■

Offshore platform with a Leistritz multiphase pump

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