A Offshore Multiphase Pump Installation in the Middle East

Multiphase Pumps have been successfully used for onshore and offshore applications worldwide. The technology gained increasing acceptance among the global oil and gas producers for keeping marginal and declining oil fields producing and to reduce flaring as a contribution to a cleaner environment. The majority of Multiphase Pumps operating are based on Twin Screw Pump Technology (Fig. 1). These self-priming pumps are of double volute design and hence, hydraulically balanced. The possibility of speed variation by means of Variable Frequency Drives offers a wide operating envelope. Twin Screw Multiphase Pumps are available for flow rates up to 5,000 m^3/h (755,300 bpd) and differential pressures up tp 150 bar (2,175 psi). The pumps are designed to handle high Gas Volume Fractions (GVF) and to tolerate gas slugs with 100 % GVF.

One of these installations with Twin Screw Multiphase Pumps has been commissioned on a Wellhead Platform of the United Arab Emirates (UAE) coast line. The production from these fields is pumped from the Wellhead Platforms to central onshore or offshore facilities for processing, storage and export.

To sustain the field's oil production at the current level the implementation of short term development projects were initiated which consisted of installing Electrical Submersible Pumps (ESP) and a Multiphase Pump (MPP) at selected Well Head Platforms (WHP). The engineers proposed Multiphase Pumps as a cost effective technology to transport multiphase fluid via a single pipeline instead of separating oil, water and gas at gathering stations and exporting oil and gas through separate pipelines to central 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 longer distances without the need for prior phase separation.

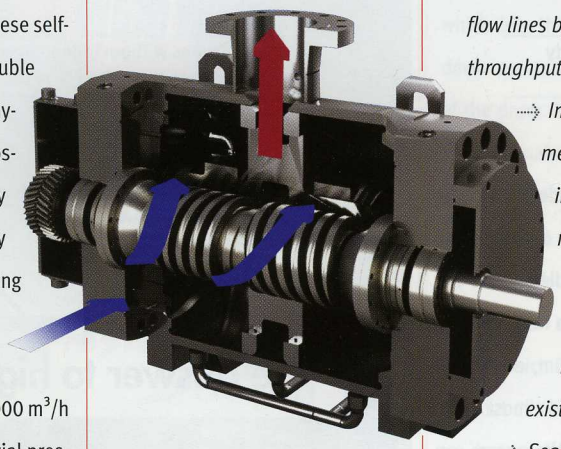

Fig. 1 Cut-A-Way of a High Pressure Multiphase Pump

Pumping the multiphase fluid directly to the central processing facility eliminates the requirement for separators, heater treaters, pumps, compressors and storage tanks at the in-field gathering stations and offers the following advantages:

- *Reduction of installation space requirements due to less equipment*
- *Reduction of operation and maintenance interfaces due to less equipment*
- *De-bottlenecking of existing flow lines by maximizing the 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*
- *Segregated production schemes of medium and low pressure wells by using dedicated Multiphase Pumps*
- *Production restoration of dead wells by reduction of the well back pressure*
- *Maximum utilization of existing production facilities on a declining field by adding production from remote wells*
- *Elimination of flaring and gas recovery by boosting the unprocessed well stream to central separation facility*
- *Reduction of unstable flow regimes in multiphase pipelines to higher superficial velocities*

Multiphase Pumps are designed to operate with variable suction pressures. For the installation of the Multiphase Pump the operators chose production facilities on a Wellhead Platform with 6 wells. There were three low pressure wells intermittendly flowing or not flowing at all due to the high pressure from the remaining wells into the common manifold.

The Multiphase Pump System which is now installed on the Wellhead Platform consists of the following components:

- *Pump skid with the Multiphase Pump, the electric motor, the lube and seal oil system, an automatic filter, the liquid management system, the on-skid piping with motor operated valves and the on-skid instrumentation.*
- *Air conditioned and pressurized control container for the VFD, PLC etc.*
- *Transformer*
- *Low voltage distribution board (LVDB)*

Due to the small surface area for the equipment, the skid had to be designed as compact as possible. Since there were no close limitations

Fig. 2 Multiphase Pump Skid on the Multiphase Pump Test Bed

in the equipment height it was possible to install pump and drive above the liquid management system in order to reduce the width of the skid (Fig. 2). Another challenge was the small space provided for the transformer.

Due to the H_2S concentration and the high Chloride content of the produced water, all wetted parts of the pump and the further skid components are made from Duplex Stainless Steel, meeting the requirements of NACE MR0175. The casing insert (liner) is wear resistant coated with Stellite®. The pump shafts are sealed by double acting, balanced mechanical seals in back to back arrangement. In case of slug flow, the liquid management system provides sufficient liquid seal to the area between screw tips and casing insert to guarantee uninterupted production. 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 travelling with the multiphase fluid from the wells.

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