THE HISTORY OF MULTIPHASE PUMPING IN THE OIL & GAS INDUSTRY

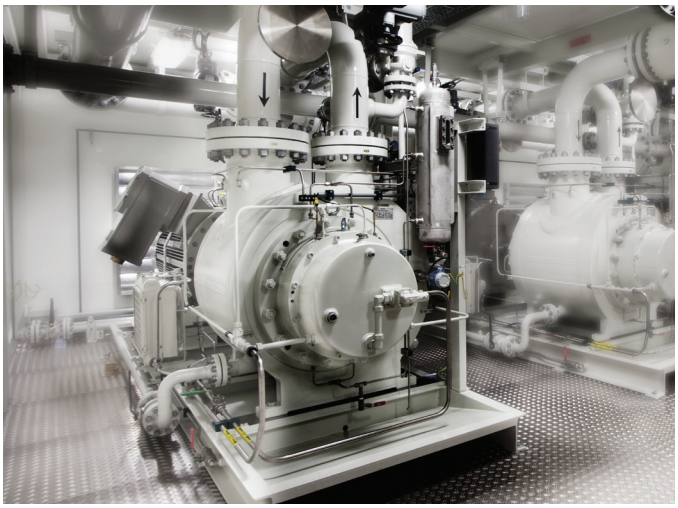
The installed base of multiphase pump systems (MPS) in surface applications is extensive across the globe. But like most petrochemical technologies, MPS first came into use on a limited basis; pioneering producers tested concepts on significant projects to prove the merits of applying variants of liquid pump designs to multiphase flows.

In the mid-1970s, the French Institute of Petroleum and the French state oil company Total initiated the earliest research. They limited technical complexity by first focusing on topside platform and onshore applications, but later branched into artificial lift and subsea applications.

Adapting the two standard types of liquid pumps (rotodynamic and positive displacement) for multiphase applications met with varying degrees of success. Ultimately, for topside platform and onshore applications, positive displacement – and specifically two-screw pumps – emerged as the favorite. This was largely due to their ability to handle high volumes, limited pulsation, wide ranges of gas volume fraction and associated density changes from slugging.

The technology first emerged for commercial applications in the early 1980s. BP, Mobil and Shell jointly developed a multiphase pump using the two-screw concept in 1983. Two-screw pumps split incoming flow into two equal parts that enter the screws from opposite ends of the pump simultaneously. The resulting forces are opposed and hydraulically balance each other. This design makes the pump less susceptible to damage from slugging and pressure swings.

By 1988 a prototype topside two-screw pump logged some 3,500 hours of uptime in an onshore test rig in the UK. The first commissionings of a two-screw pump on an offshore platform occurred in Malaysia (Shell) and the North Sea (BP).



CIRCOR, AS A GLOBAL TECHNICAL LEADER FOR MULTIPHASE PUMPS, HAS AMASSED CONSIDERABLE TECHNICAL EXPERTISE AND CONTINUES TO INNOVATE AND LEAD THE TECHNOLOGY TO NEW HEIGHTS. SOME OF OUR INDUSTRY-LEADING INTELLECTUAL PROPERTY IN THIS SECTOR RUNS THE GAMUT BELOW.

- Pump casing, design and operating mechanisms
- Screw (rotor) profile, design, manufacturing and materials
- Internal and external fluid recirculation systems and multi-pump balancing system
- Screw balancing and complete pump and system assembly procedures
- Selection of proper pumps, motors, materials and product testing

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The need for multiphase production grew as offshore oil production expanded in the 1990s, with major fields developed utilizing this technology in Russia, Venezuela and Canada. In tandem with this, producers needed a solution that could do two things:

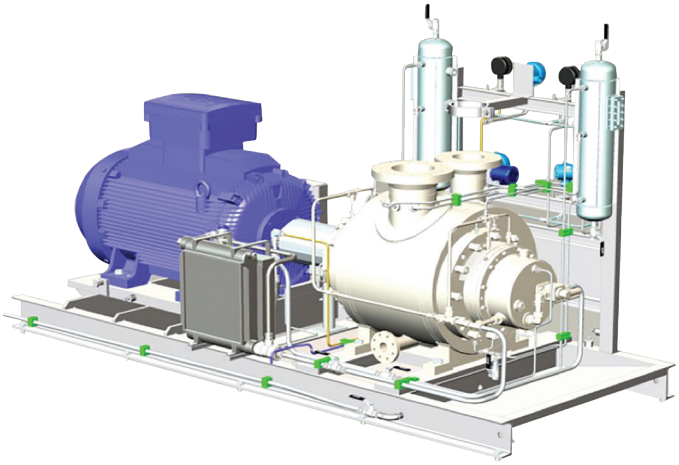
1. Boost full well stream flows from satellite wells to distant central processing facilities especially when wellhead pressures increased beyond design pressures, and
2. Shrink the typical footprint for surface oil field applications (generally a production separator vessel, gas compressor, transfer pump, gas production line, liquid production line and particulate handling system).

By the mid-1990s, multiphase pumping was being deployed in increasingly more challenging environments and process conditions with only the MPS itself and a single production pipeline being needed to transfer gas and liquid and boost pressure. This eliminated the need to separate the multiphase stream and kept CAPEX and OPEX in check, while also proving effective in bringing shut-in wells back into production economically.

Today two-screw pumps are a mature and reliable technology. They have proven highly effective in accommodating different ranges of oil, water, gas, and particulate at once. Installations have operated for years with little operator attention. They are the centerpiece of the most common type of surface-installed multiphase pump system, and the design most often recommended for oil and gas applications.

CIRCOR'S ONGOING PRODUCT DEVELOPMENT EFFORTS FOCUS ON INCREASING THE PUMP'S GVF CAPABILITY RANGE, AND OVERALL EFFICIENCY AND RELIABILITY.

MULTIPHASE PUMP SYSTEM STANDARD OPERATING RANGE:



CHARACTERISTIC	FROM	TO
Oil and Water	100 bpd	500,000 bpd
Gas	60,000 scfd @ 100 psi (7 bar) inlet pressure	20,000,000 scfd
GVF	Up to 99% Continuous with 100% Surges	
Inlet Pressure	Up to 1500 psi (103 bar)	
Outlet Pressure	Up to 1500 psi (103 bar)	
Fluid Temperature	Up to 250° F (120° C)	
H_2S	No limit - vary metallurgy as needed	
Sand	Up to 2% of liquid volume	

FOR ADDITIONAL INFORMATION VISIT:
circorpt.com/multiphase

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