

Reliability Drives Metering Pump Design

By Axel Bokiba, November 2014

HOUSTON—A number of factors are converging to create a “right-place, right-time” scenario for production equipment in the Gulf of Mexico. New fields are being discovered in deep water far off the Outer Continental Shelf that require more—and more advanced—materials and solutions to extract. At the same time, aging platforms on the Shelf are being refurbished and modernized, and operators are engaged in an industrywide commitment to raise offshore safety and security standards.

Collectively, these trends are giving oil and natural gas producers incentives to upgrade their equipment. Fortunately, technology is evolving at the right pace and at the right time to help oil and gas producers find and deliver oil and gas reserves from reservoirs with world-class hydrocarbon potential in the deeper waters of the Gulf of Mexico.

For oil and gas companies active in the Gulf, safety and security are job one. The landscape for operators as well as equipment providers and engineering, procurement and construction (EPC) contractors working in the Gulf has changed forever. While safety always has played a major role, in today’s operating climate, safety, security and environmental regulations have ratcheted up to a new level. These enhanced safety requirements come at a time when the industry is exploring deeper in the subsurface and in deeper water farther from the coastline in the quest to find and develop new reserves.

While this new operating environment certainly introduces some challenges, proactive operators are viewing it as an opportunity to modernize infrastructure and deploy new technology to improve efficiency, optimize asset performance, and ultimately, drive additional value to the bottom line.

With more than 48,000 wells, the Gulf of Mexico is one of the most heavily drilled offshore provinces in the world. Yet, even with all the development that has taken place, new plays

continue to emerge across the Gulf—from the ultradeep Shelf to the Lower Tertiary Wilcox below the salt weld in ultradeep water.

The potential to find significant oil and gas reserves exists across virtually all water and subsurface depths. In the shallowest waters on the Shelf, for example, many operators are successfully targeting untapped reservoirs in conventional geology around existing infrastructure. In deep water, companies are focused on subsalt structures at total vertical depths of 25,000 feet-plus below the seabed with high pressures and high tem-



FIGURE 1
Vertical Metering Pump Configuration with
Metallic Liquid End and Metallic Double Diaphragm

peratures, and finding some of the largest discoveries in decades.

Although the product that is locked into deeper sediment layers is essentially the same as what is found in shallow water zones, the processes and the equipment needed to reach and extract it are quite different. Operators and EPCs working in these environments require upgraded rigs with greater load capacity, larger casing strings that can reach down to 30,000 feet, and new pumps that can deliver 20,000 psi to withstand the extreme temperature and pressure profiles that accompany such depths.

Critical Role

A number of “standard” technologies play a critical role in deepwater offshore production operations. One of the key issues in any deepwater field development is flow assurance. Metering pumps keep oil and gas flowing by injecting chemicals such as methanol, monoethylene glycol and corrosion inhibitors into mainlines to prevent hydrate formation, wax and scale deposits, and corrosion to improve flow and ultimately boost product recovery rates. If the flow of these chemicals stops, the entire production of the platform can come to a halt.

In addition to the need for new and improved hardware, deepwater production poses new challenges in the areas of compliance, safety and security. Aging equipment in the Gulf of Mexico is being upgraded continuously with new and more robust hardware that can operate safely and reliably for decades. Government regulations require that new equipment deployed in the Gulf must be manufactured to the highest standards. And the attention paid to preventative maintenance is greater than ever. All this means that the equipment must be made to exacting standards to assure long-term safety and reliable performance.

Although metering pumps are relatively small components on a platform, they play a critical role. It is analogous to a rivet on the wing of an airplane. If that small component fails, the entire enterprise can be compromised. Considering that the value of a single day’s production can vastly exceed the cost of a pump system, the reliability of the equipment becomes paramount.

Metering pumps are positive-displacement, chemical-dosing devices with the ability to vary capacity manually or automatically as process conditions require. They feature a high level of repetitive accuracy and are capable of pumping a wide range of chemicals, including acids, bases, corrosive or viscous liquids, and slurries.

The pumping action is developed by a reciprocating piston, which is either in direct contact with the process fluid or is shielded from the fluid by a diaphragm. Diaphragms are actuated by hydraulic fluid between the piston and the diaphragm. A necessity for flow assurance in deep water, metering pumps provide highly accurate feed rates with precise dosing controlled by a computer, microprocessor, distributed control system, programmable logic controller, or flow proportioning. Pumps can tolerate high system pressures as well as corrosive, hazardous, or high-temperature fluids.

The latest generation of metering pumps extends capabilities to even the most challenging operating environments (Figure 1). Rated to 20,000 psi to withstand the extreme pressures associated with operating at greater water and subsurface depths, these pumps pack a range of features into a reduced deck footprint to ensure reliable chemical delivery to prevent hydrate formation, wax and scale deposits, and corrosion in even the deepest subsea wells.

Designed with multiple liquid ends, packed plungers, metallic or polytetrafluoroethylene double diaphragms, the modularity of the entire line provides customized solutions for all pump applications. With the advent of new liquid ends, which is one of the key design elements that extends overall pump capabilities, the newest designs also increase the performance of the drives within the pumps. As shown in Figure 2, liquid ends increase

performance ratings whether a pump uses a conventional drive system or an advanced drive (represented by the red line), with maximum pressure of more than 1,300 bar and increased flow rates.

Ensuring Reliability

Reliability matters in the Gulf. And not just for flow assurance, but also in regard to preventing chemical leaks. Failed or leaking methanol injections could lead to the formation of hydrates, which in turn, could result in clogged production pipes and flowlines that cause environmental degradation or even a release of oil or gas.

Equipment manufacturers must guard against such failures through reliable, field-tested product designs, and through manufacturing processes that are second to none. The newest pumps are engineered based on decades of experience in designing metering pumps for challenging oil and gas production projects, and utilize ISO-certified manufacturing processes to meet new regulatory requirements as well as the stringent expectations of operators working in the Gulf.

Consequently, every decision and every choice made while developing the most advanced metering pumps started with reliability, since the need for reliability becomes magnified as drilling extends into ever-deeper waters and subsurface geology with increasing temperature and pressure challenges. Regardless whether it is the Gulf of Mexico

or any other offshore basin in the world, operators need to reach far below the seabed, where back pressure can measure five to seven times greater than pressure present at the seafloor. Metering pumps in these environments must deliver 20,000 psi, along with the control needed to dose wells consistently and accurately while adapting to the changing conditions throughout a well's full life cycle.

Delivering massive amounts of hydraulic power is another requirement. But in doing so, pumps must be highly efficient to conserve electrical power, which is a precious commodity on an offshore platform. Any piece of equipment used in this environment must be efficient.

To accommodate the space limitations and the requirement for increased safety, today's metering pumps are engineered to not only provide the greatest efficiency possible, but also to fit into vertical or horizontal motor configurations to provide a smaller deck footprint that can accommodate different space requirements. The weight of a pump (or any piece of equipment) is a significant concern to platform integrators and EPCs. Even adding 10 pounds to a particular piece of equipment can make a big difference.

Reliability, performance and efficiency often can pose conflicting design requirements. Striking the right balance between the three is the key to a successful pump design to accommodate any pump pressures or flow rates, from fewer than three to more than 16,000 liters per hour.

For operators in the Gulf, new metering pump technology represents an engineered, customized solution for exceptional safety and reliability. The inherent design modularity and flexibility give producers new capabilities to meet their production objectives while enhancing health, safety and environmental performance.

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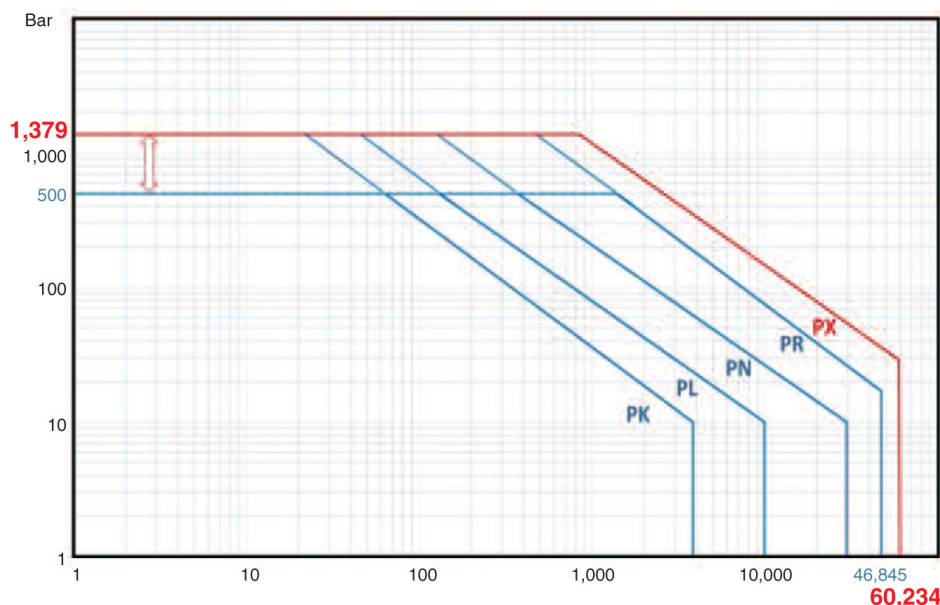


FIGURE 2
Increased Performance Ratings (Maximum Pressures and Flow Rates)