ENGINEERING YOUR SUCCESS.

Hydraulic Pump Division **SUCCESS STORY: Columbia Industries**

PARKER VANE AND GOLD CUP® PUMPS "WALK" 25 MILLION POUND LAND OIL RIGS INTO POSITION

CUSTOMER
Columbia Industries LLC

APPLICATION
"Walker" and "wheeled" land oil drill rig moving systems

SOLUTION
Parker T6CC vane pumps and GOLD CUP® hydrostatic transmissions

VALUE
High efficiency; reliable performance in extreme operating conditions; precision slow-speed control; easy to trouble-shoot and service

ABOUT COLUMBIA INDUSTRIES

Columbia Industries LLC (Hillsboro, Oregon) was instrumental in pioneering the oil drilling rig transport industry in 1974 by putting heavy land rig modules on large axle systems. In 1982, the company introduced their mobile self-propelled wheel systems. Columbia's first "walking" system utilized two separate modules weighing a total of 10.5 million pounds.

Today, after successfully designing and building more than 40 active land rig walking systems that are deployed throughout North America and in Saudi Arabia, the largest to date can "walk" a four-module land rig in a full drilling configuration that weighs approximately 25 million pounds. As Scott Van Raden, Engineering Manager for Columbia Industries notes, "there may be a limit as to how much weight our walkers can carry, but so far we have not found it."

"Walking systems," Van Raden explains, "are less expensive per pound moved than a self-propelled wheeled system. They move very slowly and are best suited for pad drilling, batch drilling and island projects. The key here is that they can support nearly unlimited weight and still apply low ground bearing pressure to the surface below. This is very important for island projects and poor soil types as it reduces preparation costs before drilling."

The Parker vane pump is also very quiet. This is important for communications between the operations team while walking the platform.

HOW THEY DO IT

"Walking" the land rigs is accomplished with a combination of Parker Hannifin T6CR and T6CC double vane pumps, hydraulic lift and travel cylinders, rollers, valving, and lifting and traveling circuits. "Our largest system to date," points out Van Raden, "has drill, utility and mud modules that are lifted by six hydraulic cylinders each. The pipe barn module is the largest load that we have mobilized to date with nine lifting zones and 18 hydraulic lift cylinders. When all four modules are assembled into the drilling configuration, the lift capacity of the fully loaded system is approximately 25,000,000 pounds."

Vane pumps provide both the lift and travel pressure for the hydraulic cylinders of the Drill, Utility and Mud modules. Two vane pumps are utilized for the six-lift cylinder modules. For the pipe storage module, the electric motors on the HPU drive a Parker T6CR-010 pump with a through shaft that drives a T6CC-010-010 double pump. There are three motors involved to raise the nine lifting zones. Lift pressure is approximately 1,500 psi. Each lifting circuit is individually set to ensure that the load, which can vary in weight from lifting zone to lifting zone, will go up level and at the same speed until all lift cylinders have raised their load.

Once the load is lifted (from two to four inches), all weight is transferred to rollers under each of the lift cylinders. The rollers travel on a 4-ft. wide by 60-ft. long sub beam, or foot. Depending on individual module weight, from two to six travel cylinders and the rollers underneath them act together as an integral unit.

"The 4-ft. 'walk step' is a two-minute cycle," points out Van Raden, "of lift, travel, lower and

re-set of the sub beam. The vane pumps are used for both the lift and travel steps because the two circuits are not used at the same time." Pump pressure for the traveling cylinder is approximately 1,000 psi. A separate hydraulic power unit (HPU) for the walking system is incorporated into each of the four modules.

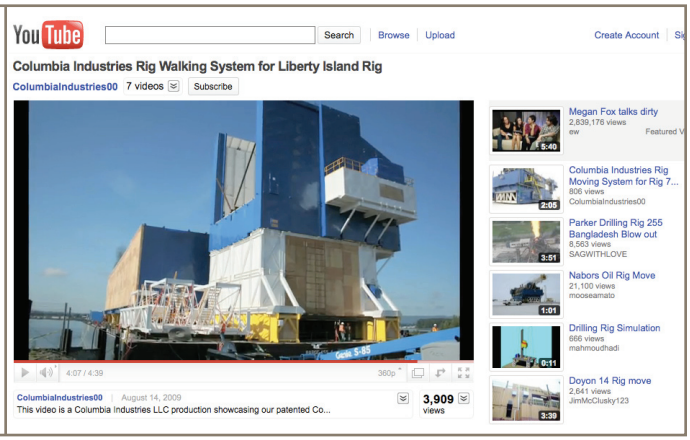
The rollers are also part of the steering system and are turned and positioned before weight is applied. Each module can be steered from the front, back or both ends when sharp turns are required. This linked steering system is very precise. Steering, lifting, travel and set down operations are performed by the cab operator.

"In our 25 million pound system," notes Van Raden, "the walking modules for drilling, utility and power measure about 50-ft. by 100-ft. The pipe barn module is 170-ft. by 180-ft. with a footprint of 3,600 sq. ft. for the module's sub beams. The nine lifting zones and 18 hydraulic lift cylinders inside the walking system beams are needed because of the weight and the way the weight is configured inside the barn. There can be a full load of heavy 90-ft. drill pipe, a light pipe load, or no pipe. Yet, the module still has to be able to 'walk' in a level condition. In batch drilling, for example, the objective is to take the entire load of drill pipe needed to drill the well. The pipe is stacked vertically in the derrick, or setback. This allows the operator to drill a well quickly, utilizing a continuous feed of 90-ft. long pipe sections connected together."

In an island application the independent rig modules receive their final fabrication and assembly into the drilling configuration. Then the modules are independently "walked" in a semi-linked condition within several inches of each other at the same pace, but without contact. This coordinated effort keeps all of the connections in place.

WATCH IT MOVE

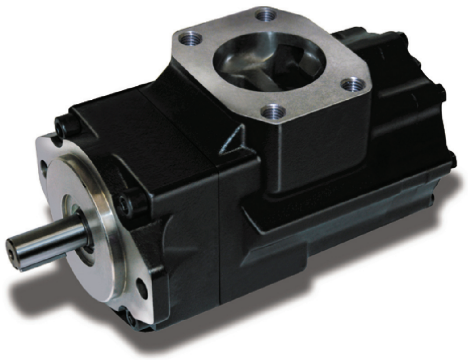
Watch one of Columbia Industries' modules "walk"



In a four-module application, there are four module operators – two operators per cab – where they can speak and hear each other as they coordinate the move. Once assembled into the drilling configuration, the whole unit is "walked" and set to drill the first (injection) well. On completion of the injection well, the linked drilling configuration is then "walked" to drill the first production well.

In the drilling configuration, the walking system allows rig operators to move a fully loaded rig including fluids, full set back load and all tools from well to well. This eliminates the need to rig down for each move, and greatly increases operating efficiency for batch drilling.

"The linked walking system," Van Raden stresses, "allows the interconnected modules to be moved simultaneously with steering options that include forward, backward, right, left, crab and complementary movement for precise pad positioning."



HOW PARKER VANE PUMPS HELP

Parker high performance vane pumps have been recognized as the highest performing product in their technology arena for many years. The pumps used are T6CC pumps providing a single inlet and two outlets. They are ideal for heavy-duty applications in extreme operating conditions such as the North Slope of Alaska.

Designed to be self-wear compensating, these pumps resist contaminants and maintain high efficiency over their service life. High efficiency means a longer life of the hydraulic system overall. High lifetime efficiency means a safe and reliable output from the pumps throughout their service.

The Parker vane pump is also very quiet. This is important for communications between the operations team while walking the platform. The 4,000-psi pressure capabilities of this pump operated at Columbia's system pressures make it only more reliable and quieter as the pump is hardly working to its full potential. The inlet and fluid capabilities of the pump are features that make it a top choice for the elevation and temperature conditions that these machines must operate in.

"We continue to use GOLD CUP® pumps for our wheeled systems for their proven service and reliability track record."

— Scott Van Raden, Engineering Manager, Columbia Industries

HOW PARKER GOLD CUP® PUMPS HELP

"In 1997," notes Scott Van Raden, "our redesign of the drive system for our self-propelled wheeled systems incorporated the very impressive Parker GOLD CUP® hydrostatic transmission. The jacking and steering system incorporated Parker PV series piston pumps. And, a Parker vane pump was designed in for the braking circuit."

An HPU and high pressure hydraulic system is used to propel these 50-ft. wide by 100-ft. tall rig-mounted modules that have 40- x 57-inch tires (12-ft. tall x 4-ft. wide) mounted on wheels bolted to Columbia drive axles with a maximum capacity of 680,000 lbs. each. Total carrying capacity for a self-propelled wheeled module is approximately 2.5 million pounds. Each module is powered by a diesel generator that supplies power to the electric motors on the hydraulic power unit. Module steering and braking control is by an operator from a cab on the front with the ability to drive straight down a road. Or, if necessary, each axle can be turned 90 degrees to drive the configuration sideways.

"The low pressure piston pump system used for jacking and steering," Van Raden explains, "has a maximum of 1,650 psi for the jacking circuit and 2,000 psi for the steering circuit. Each circuit has separate pumps."

"With a 5,000-psi. GOLD CUP® hydrostatic pump," continues Van Raden, "the drive system gives us forward and rearward travel with speeds up to 2.5 mph maximum, and down to an absolute dead creep speed of 100-ft. an hour. Such a slow speed is needed as the drilling rig module approaches the well to ensure that the center of the drill pipe is directly on the well center to be drilled. Placement accuracy has to be within 1/16-in.

"In addition to the GOLD CUP® pumps having a built-in charge pump which provides the required replenish/flow pressure to the closed circuit transmission," Van Raden stresses, "the visual indicators mounted on the outside of the pump and motor cases allow our technicians to see if the internal components of these mobile units are following the control signals sent to them. This makes it considerably faster and easier to troubleshoot any problem that might arise. Finally, we continue to use GOLD CUP® pumps for our wheeled systems for their proven service and reliability track record."

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