



PETROVALVE PLUS



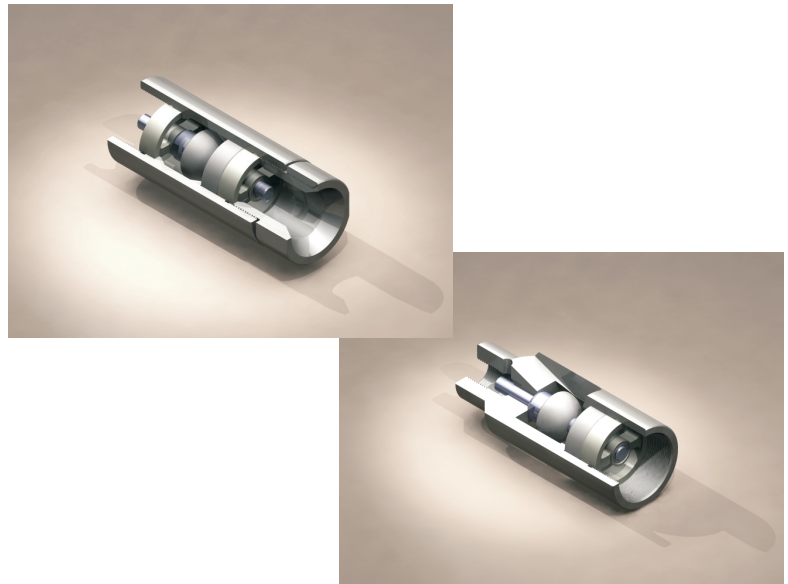
**THE ROD PUMP VALVE SYSTEM
THAT GETS THE MOST
FROM YOUR WELL**



The Petrovalve Plus rod pump valve and the Petrovalve Gas Breaker feature patented technology in sucker rod pump valves. The vast majority of producing wells employ bottom hole sucker rod pumps which operate using at least two valves known respectively as **traveling** and **standing** valves. Ball and seat failure is the most common cause of sucker rod pump down time resulting in recurring costs that consume a significant portion of field maintenance and workover budgets. Our research and engineering has developed the next generation of Petrovalve Plus and Petrovalve Gas Breaker with larger flow areas and improved flow dynamics for all types of artificial lift wells.

The Petrovalve is composed of a hemisphere, penetrated by a stem which projects vertically above and below. This component is called the valve plunger. The stem guide above and below the Petrovalve plunger is manufactured with a single cross member containing an aperture for the stem. This creates a precision guide stroke. Upper and lower guides are identical and are reversible, as is the seat. The guided valve plunger eliminates the inherent problem of violent uncontrolled contact of the ball's multisurface sealing area with the valve chamber, thus eliminating irreversible damage to itself and the chamber.

The Petrovalve promotes longer valve life, increased efficiencies and incorporates larger flow areas than comparably sized API insert ball-and-seat valves. Increases in area range from 27% to 112% in sizes 1.25 through 5.75. This increase may allow for increases in production where reservoir conditions permit.



Petrovalves are applicable on ALL artificial lift wells, including but not limited to high gas/oil ratios, H₂O/oil, heavy crude, and sandy wells. In addition, operators are now able to operate pumps efficiently in deviated and horizontal areas of the well bore. Some high volume wells may show increased production with our guided valves at the same strokes per minute or the same production while allowing the operator to slow the pump down considerably. Reducing the number of strokes per minute translates into reduced lifting costs for fuel/electricity and reduced wear on the complete lifting system. This simple change in operating speed can eliminate millions of strokes per year while maintaining the same production level.

The Petrovalve Plus was initially designed for wells utilizing rod pumps. However, the larger areas and increased run times have shown the advantages of installing Petrovalves in the standing position for other types of artificial lift. These include gas lift, chamber lift, plunger lift, hydraulic and ESP installations, and steam flood. In addition to these applications, Petrovalves are also used as discharge and injection valves, as a discharge valve to protect ESP or hydraulic systems in the event of controlled or unexpected shut downs and as injection/back pressure valves for waterflood or waste injection wells.

Heavy Oil Recovery

“Heavy oil areas” are often characterized by some of the most difficult pumping conditions in the industry, primarily because pumping 8 to 15 API oil is like pumping tar loaded with sand. The Petrovalve Plus design offers better flow dynamics and increased flow capacity, proven with test results from heavy oil fields in Venezuela.

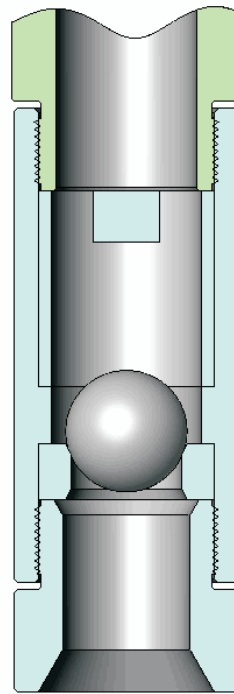
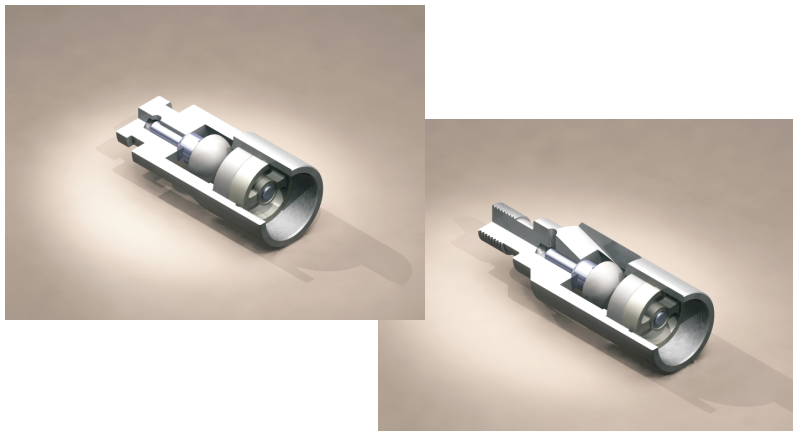
A ball moving wildly in front of the fluid trying to enter the pump barrel greatly reduces the smooth flow required to fill up the barrel. Petrovalve Plus, by allowing the fluid to pass smoothly and equally on all sides, permits greater speed and accessibility for the fluid.

Deviated and Horizontal Wells

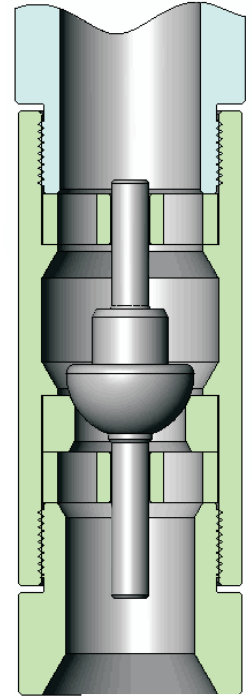
Most ball-and-seat rod pump systems are landed at or near the vertical position in the well bore because of the reduced efficiency and high failure rate of pumps as the angle from vertical increases. Petrovalve Plus valves are unaffected by the angle of installation. The Petrovalve was designed to allow high-efficiency pumping in any position.

Big Bore Pumps

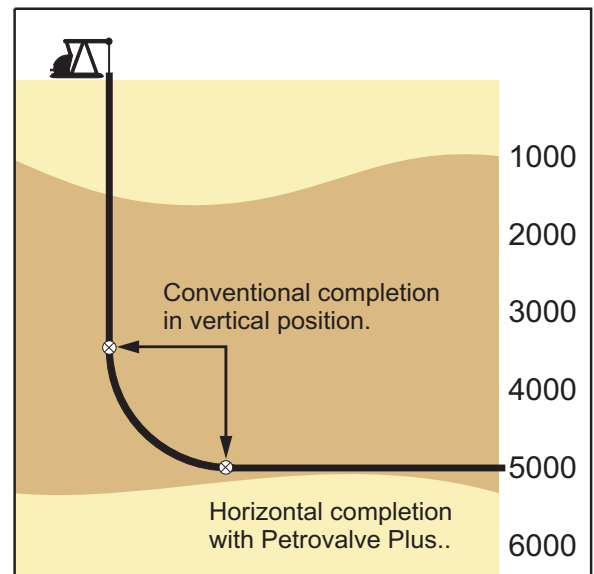
The design problems associated with ball-and-seat valves are nowhere more obvious than in big-bore pumps. A 5 3/4” big bore pump contains a stainless steel ball that weighs 17 pounds. Because of the weight of the ball material selection for large valves has been limited to stainless steel to keep weight in check. However, the Petrovalve Plus allows for the use of harder, corrosion resistant materials which reduces the mass effect on the seat.



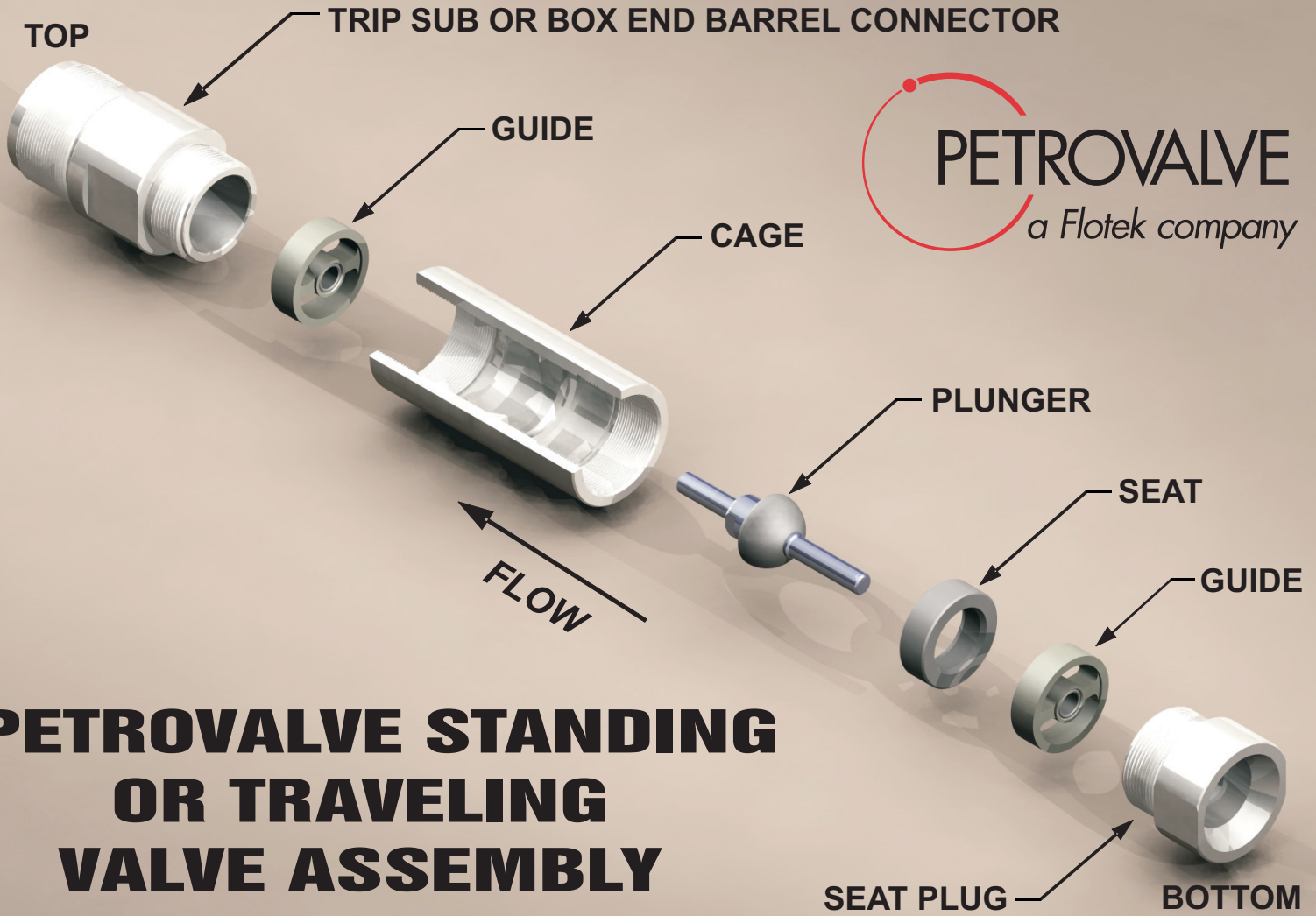
Conventional ball-and-seat action in standard materials results in excessive wear on both the ball and seat.



The improved Petrovalve Plus has greater flow area than existing conventional housings.



This triangle costs producers money by restricting the reservoir's capability to produce fluid. The weight of produced fluid having to rise 2 feet to the 3 foot level will result in lost production.



PETROVALVE STANDING OR TRAVELING VALVE ASSEMBLY

1.25" to 2.75" Petrovalve Plus Installation Procedures

1. Install guide fully against the top profile in the cage (guides are reversible).
2. Tighten barrel connector onto cage.
3. Install Petrovalve Plus plunger with flat side of hemisphere facing top guide.
4. Install seat against the profile in the bottom of cage (seats are reversible).
5. Install bottom guide against seat.
6. Tighten strainer bushing or seat plug onto cage.

Additional Notes

1. Assemble Petrovalve Plus units at the bench.
2. Pump valve spacing per API "Recommended Practice 11AR".
3. Petrovalve Plus recommends API "Torque Make Up Specifications"

Materials – Sphere/Seat

440C	Stainless Steel
TC	Tungsten Carbide
NC	Nickel Carbide
Ti	Titanium
S.L.	Silicon Nitrate
Ceramic	Ceramic

FLOW AREA COMPARISON PETROVALVE PLUS vs. INSERT (API) VALVE

VALVE SIZE (IN)	PETROVALVE (IN²)	INSERT VALVE (API) (IN²)	AREA INCREASE (%)
1.25	0.236	0.166	42
1.50	0.425	0.292	45
1.75	0.598	0.353	69
2.00	0.726	0.569	27
2.25	0.826	0.568	45
2.75	1.432	0.935	53
3.25	2.221	1.068	107
3.75	2.896	1.394	107
4.75	4.863	—	—
5.75	7.703	—	—

NOTE: These calculations are strictly cross-sectional flow areas and do not relate to flow dynamics.