INSERTABLE PROGRESSING CAVITY PUMPS

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INTRODUCTION

National-Oilwell is the Distributor for a newly patented line of ***Insertable*** Progressing Cavity Pumps. This new technology allows the producer to install and remove **both** the rotor and stator with the sucker rod string. The tubing string contains a down-hole seating assembly attached to the bottom, which stays in place until the tubing is removed from the well. The improved efficiencies and state of the art elastomer materials are all combined to significantly reduce the lifting costs for today's producer. These pumps have the ability to move many different fluids including: oil, water, high viscosity fluids, and fluids containing solids such as sand, coal, or formation fines.

FEATURES AND CHARACTERISTICS

The National-Oilwell insertable P.C. Pumps maintain all the advantages that the tubular P.C. Pumps present, plus the benefits of the insertable system -

- **No need to remove the tubing column from the well to substitute the downhole pump**
- **The downhole pump substitution can be done with the help of a small workover rig**
- **Time and rig rental costs are reduced**
- **Well shutdown time reduced with lower production losses**
- **Service and maintenance costs are reduced**
- **Reduction of accident risks due to faster/easier servicing of the well**
- **Reduced elastomer problems due to reduced cross-sectional area**
- **Less wear and tear on tubing threads that must be torqued tighter than normal to prevent backoff**

APPLICATION TECHNOLOGY

The insertable P.C. Pump can be applied anywhere that the regular tubular P.C.Pump has application. Current technology is limited to flow rates of 500 bfpd and pressure limits of 2400 psi. This is changing rapidly and we expect higher flow rates and pressure capabilities later this year.

The insertable pump is composed of a reduced O.D. rotor and stator system that inserts and seals in a downhole seating assembly attached to the bottom of the tubing string (See Figure 1). The stator contains an elastomer seal at the top, three seating cups at the lower end, and a seating guide at the bottom. During installation the outside seating assembly is attached to the bottom tubing joint and the rest of the tubing is run in the hole and secured at the well head. Then, the rotor and stator assembly is attached to bottom sucker rod and run into the hole. It is very important that the tally of the sucker rods is accurate, to know when the pump is nearing the seating assembly. When the proper depth is reached, the pump is inserted into the seating assembly with adequate force to insure that the pump guide is seated on the bottom pin in the seating assembly. This insures that the top and bottom seals are in the correct place as well as the guide pin which will prevent the stator from rotating. The operator then pulls up on the rod string to properly space the rotor and the polish rod is clamped in place.

The start up should be closely monitored for current flow to the motor thus insuring proper rotor spacing. Adjustments should be made accordingly if excessive current loads are monitored.

CASE HISTORY

The patented insertable pump design has been in production since 1990. Over 100 pumps are in place and pumping in Brazil, Venezuela, Argentina, and Trinidad Tobago. In June 1994 the insertable pumps were introduced to the U.S. The first test pumps were installed in the Coal Bed Methane application in the Black Warrior Basin of Alabama. The first pump installed is a model **9.20-100I** pump installed on 6/21/94. This pump was installed on Taurus Exploration, Inc. well #293 under the supervision of Mr. Carlin Vines - Superintendent.

The pump intake is at 1740' with a 1740 rpm, 7.5 h.p. electric motor, using 12.5/13.5 amps. The well is producing 32 bfpd fluid from 1568' along with 73 mcf methane gas/ day. The drivehead is a National-Oilwell model AVO-2-5/8" vertical drive. The pump was started at 184 rpm which produced 16 bfpd from 1360' depth. The rpm was increased to 233 which increased the production to 30 bfpd at 1440' and 53 mcfd methane. On 7/8/94 the rpm were again increased to 284. This lowered the fluid level to 1728' with production levels increasing to 42 bfpd and 68 mcfd methane.

In August , although the pump was running well and producing above expectations, we decided to pull the pump to insure the ease of removal and inspect for wear. The rotor and stator were pulled out on the rod string that pump was found to be in perfect working order with little or no wear detected by micrometer measurements. The rotor and stator were reassembled and reinstalled into the well. In September, the fluid level of the well had been lowered enough to reduce the pump rpm to 241. This provided 31 bfpd, which is the approximate maximum amount of fluid that this formation is capable of to keep the fluid level static. The pump and drive are still operating perfectly and being tested for longevity of the rotor and stator. Since that time several other pumps have been installed.

This technology is particularly applicable where one has a troublesome well that needs frequent pump inspection and pulling for clean out or hot oiling due to paraffin build up. The technology provides much quicker retrieval of the pump as well as less down time and less wear and tear on the tubing threads.

CONCLUSION

In conclusion, the insertable P.C. pump has wide and varied application throughout the Oil industry as well as the coal-bed methane dewatering operations. With the simplicity of the pump design and the efficiency of being able to retrieve the rotor and stator on the rod string, the system truly lends itself to the maximum efficiencies and operating cost reductions required by today's operators.

Although there are limits to the volumes and pressures currently available, technology is being tested that will greatly increase both of these factors in the insertable as well as the tubular pump models.

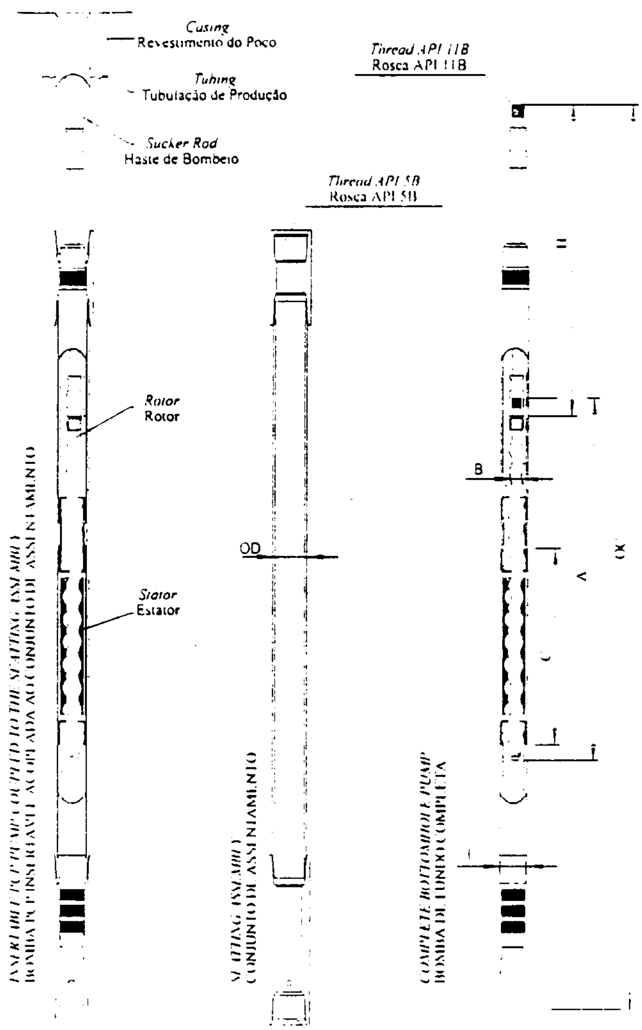


Figure 1 - Downhole Pump Crossview
Vista Em Corte Da Bomba De Fundo

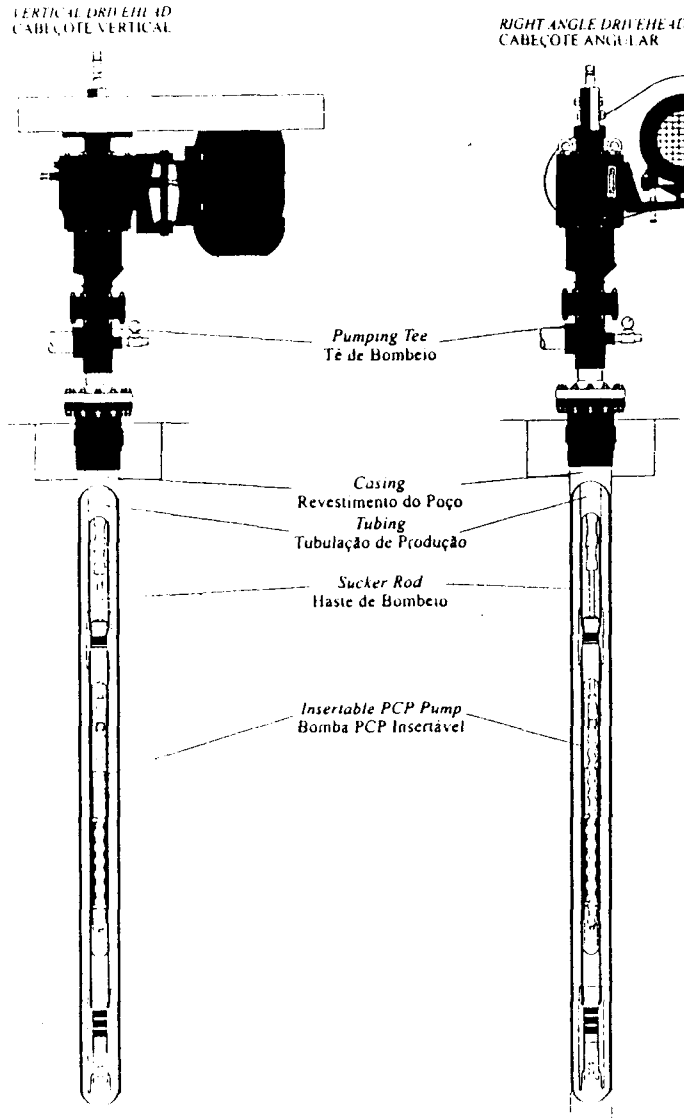
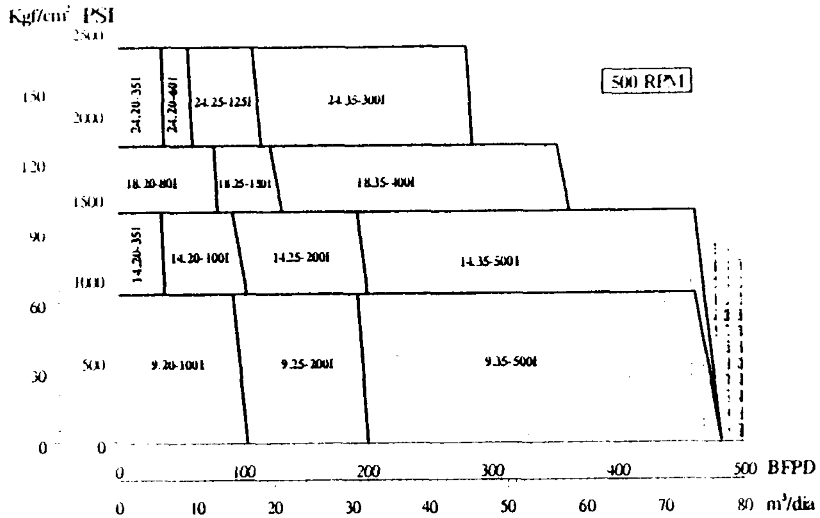


Figure 2 - Complete Insertable PCP Lift System
Conjunto Completo de Bombeio PCP Insertável



Modelos	A (mm)	B (mm)	C (mm)	OC (mm)	OD (in)	H (mm)	I (mm)	Rosca de Conexão: Tubo API 5B (in)	Rosca de Conexão: Haste API 11B (in)	Tubo: Min. Diam. (in)	Tubo: Min DRIFT (mm)	Revestimento: Min. Diam (in)	Revestimento: Min DRIFT (mm)	Cabeçote: Angular	Cabeçote: Vertical
9.20-1001	1941	20	1434	3156	2 3/8"	687	48	2 3/8" EU 8rd	15/16" 10rd	2 3/8"	48.28	4 1/2"	94	-	AV0-2 5/8"
14.20-351															
14.20-1001	2753		2264	3966											
18.20-801															
24.20-351														BH 1-4-7/8"	AV1-4-7/8" AV0-2 5/8"
24.20-601															
9.25-2001	2296	25	1778	3590	2 7/8"	704	59	2 7/8" EU 8rd	1 1/16" 10rd	2 7/8"	59.61				
14.25-2001	3233		2715	4527											
18.25-1501															AV1-4-7/8"
24.25-1251															
9.35-5001	3084	32	2453	4593	3 1/2"	818	72	3 1/2" EU 8rd	1 3/16" 10rd	3 1/2"	72.82	5 1/2"	115.44		
14.35-5001	4396		3765	5905											
18.35-4001															
24.35-3001														BH 1-9-7/8"	AV1-9-7/8"
[illegible]	4396			7155		1318									

Important recommendation: never use a rod centralizer at the rod that is directly connected to the rotor
Recomendação importante: nunca use um centralizador de hastes na haste conectada diretamente ao rotor

Figure 3 - Selection Chart
Carta de Seleção