PROGRESSING CAVITY PUMPS - THE NEW METALLIC STATORS

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Abstract

Since patenting the idea of Progressing Cavity Pumps in the early 1930's by René Moineau, there have been few improvements to the original design of this pump to facilitate expansion of the range of application. There have been dramatic improvements in the elastomer industry and these new elastomers have been incorporated into the stators using the original design. Recently the Geremia brothers, of southern Brazil, perfected a radical new design in this relatively "simple" technology that will allow **PCP's** to enter into a whole new range of performance criteria. This new design is being termed the "Metallic Stator" due the fact that much of the elastomer has been replaced with steel alloy leaving only a thin, even layer of elastomer, which is supported evenly around the inside perimeter by the base metal in the tubing. This provides the industry with numerous advantages over the conventional PCP's including: Higher pressures, lower torque's, shorter pumps, fewer sizes, harsher environments, lower power requirements, and higher flow rates. In addition to the conventional method of driving this pump from the surface with sucker rods, this metallic stator has now been incorporated into a sucker rod free hydraulic design that can be pumped into place downhole, operated, and returned to the surface with only the use of power fluid and the proper well head valving arrangement.

Metallic Stator Design

One of the major disadvantages of the conventional Progressing Cavity Pump design is the fact that there are uneven wall thicknesses around the geometry of the pump (Fig. 1). With this design there is opportunity for the elastomer to react to the environment in varying degrees depending on the thickness of the elastomer. With the metallic stator design the thickness is of the elastomer wall is the same around the entire perimeter of the pump geometry and thus provides the user with an even response to the materials that are being moved by the pump (Fig. 2).

Benefits

The major advantages of this design include the following:

- Lower Starting and Running Torques
- Higher Pressure Capacity per Stage
- Higher Efficiencies
- Less Interference Fit Pressures
- Fewer Rotor Sizes

- ➢ Lower Size Variation of the Stator Cavity in High Temperatures
- ➢ Higher Chemical Resistance
- ➢ Lower Power Consumption
- ➢ Reduction of Pump Lengths
- ➢ Higher Flow Rates
- ➢ Higher Temperature Applications
- ➢ Lower Volume Requirement of High Cost Elastomer Materials

With the higher density support of the metal alloy behind the even thickness of elastomer it is now possible for the geometry of the pump to be changed to allow a lower interference pressure at the elastomer rotor contact. This eludes to lower start up torques (Fig. 3), lower running torques (Fig. 4), higher efficiencies, lower power requirements and a higher pressure rating per stage of the pump.

A key benefit is the even expansion of the elastomer in the difficult environments of high temperature, high aromatic content, high gas content (H2S & CO2) because the expansion and or swelling of the elastomer is significantly reduced and evenly distributed across the elastomer to the point of being predictable. This combination provides the distributor and end user with fewer rotor sizes necessary to compliment the ranges of expected environment and thus equates to a lower inventory requirement for the operations group. A compliment to this benefit is a much lower requirement for the volume of some of the high cost exotic elastomer materials that are being used in some of today's elastomer compounds.

Application

Although the application of pumps with this design is very new, we now have Metallic Stator progressing cavity pumps that are being successfully used in environments around the globe to include high viscosity/high abrasives in Canada, High Temperatures in Indonesia, and wells with High Gas contents of West Texas.

Hydraulic PCP

Another modification of the metallic stator design includes the use of two pumps being placed in tandem with a bearing surface between them (Fig. 5). This design is operated using power fluid to drive the pump into place and then to power the drive pump and thus the producing pump, once they are placed in the downhole latch down device (Fig. 6).

Once again the metallic stator design is very critical to the success of this pumping system because of the above mentioned benefits. This pumping system has particular benefit in remote or difficult to access location because the pump can be installed and removed using only the hydraulic power and the system of valves (Fig. 7) at the well head. It is not necessary to have a workover rig on location to install or retrieve this pump. Pumps of this design have been installed and working successfully for over one year.

Metallic vs Conventional

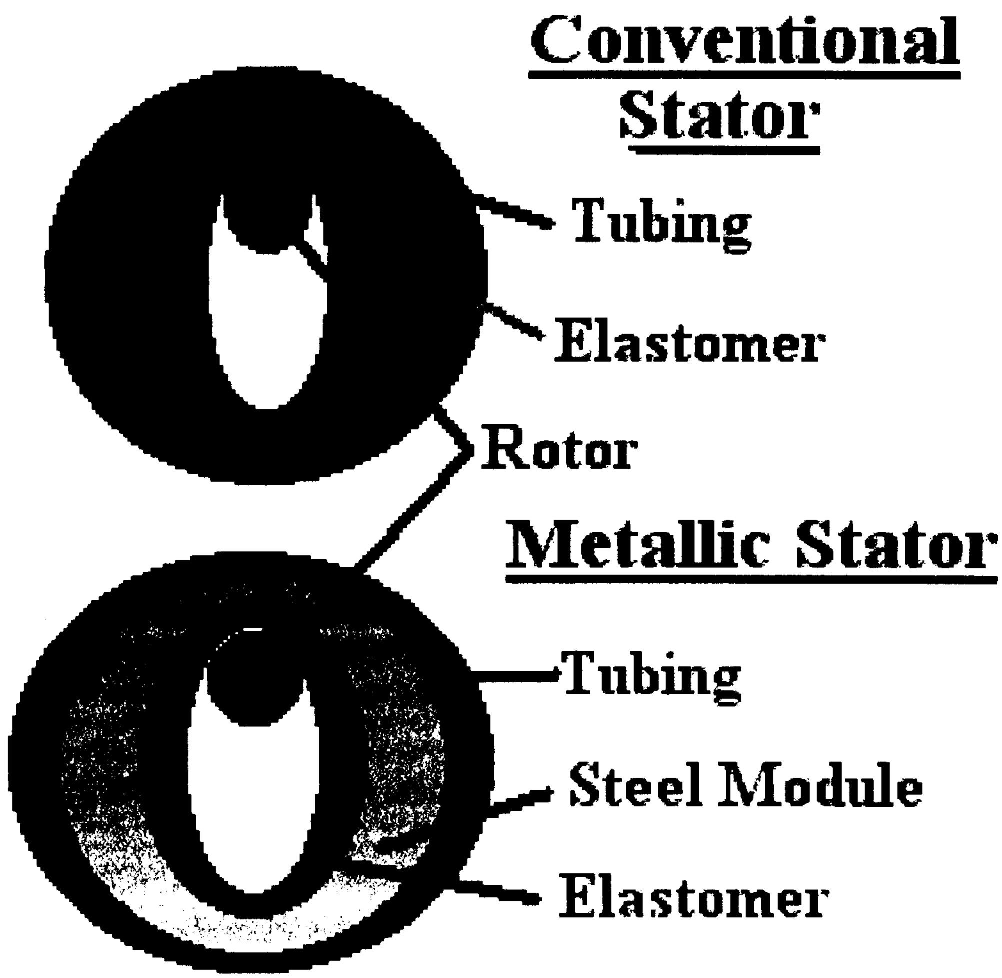


Figure 1

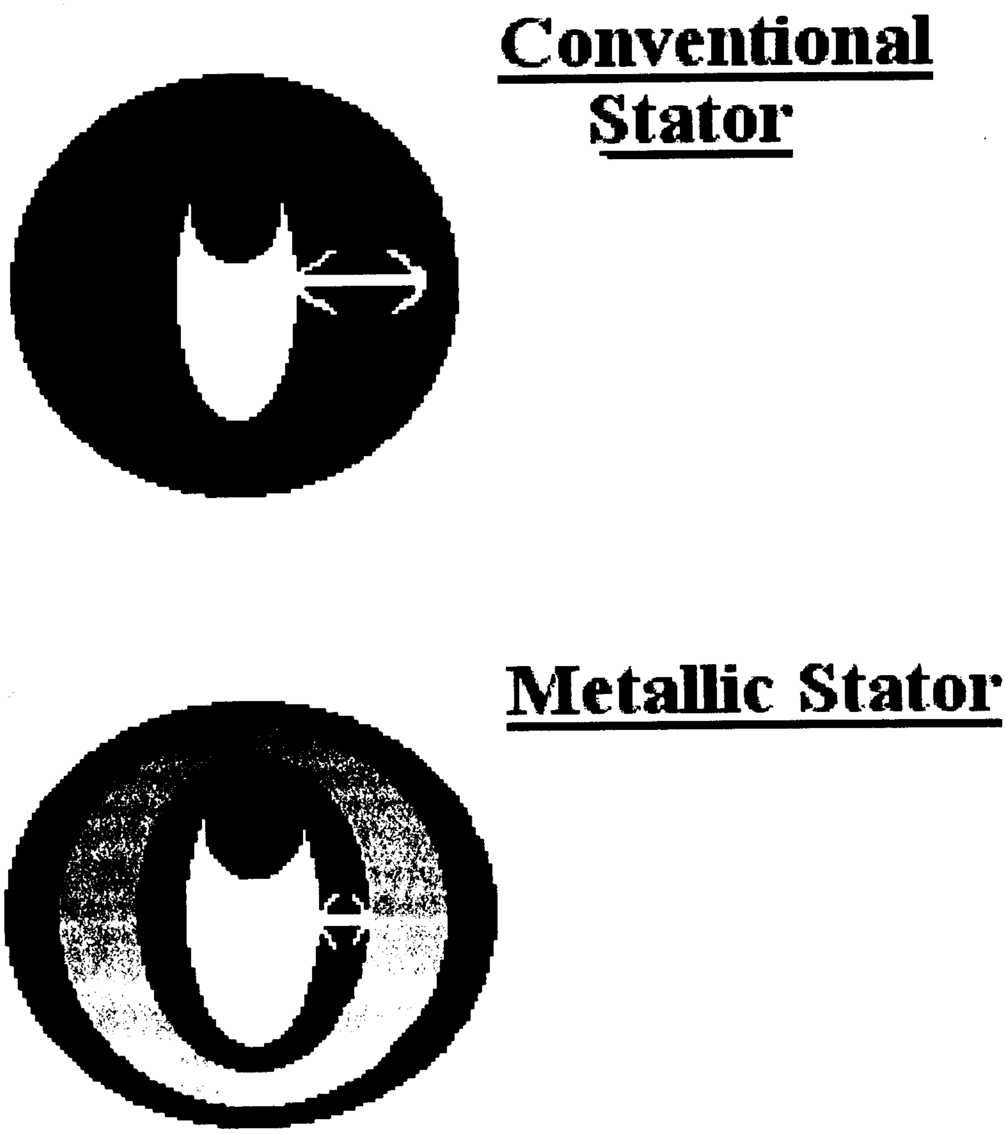


Figure 2

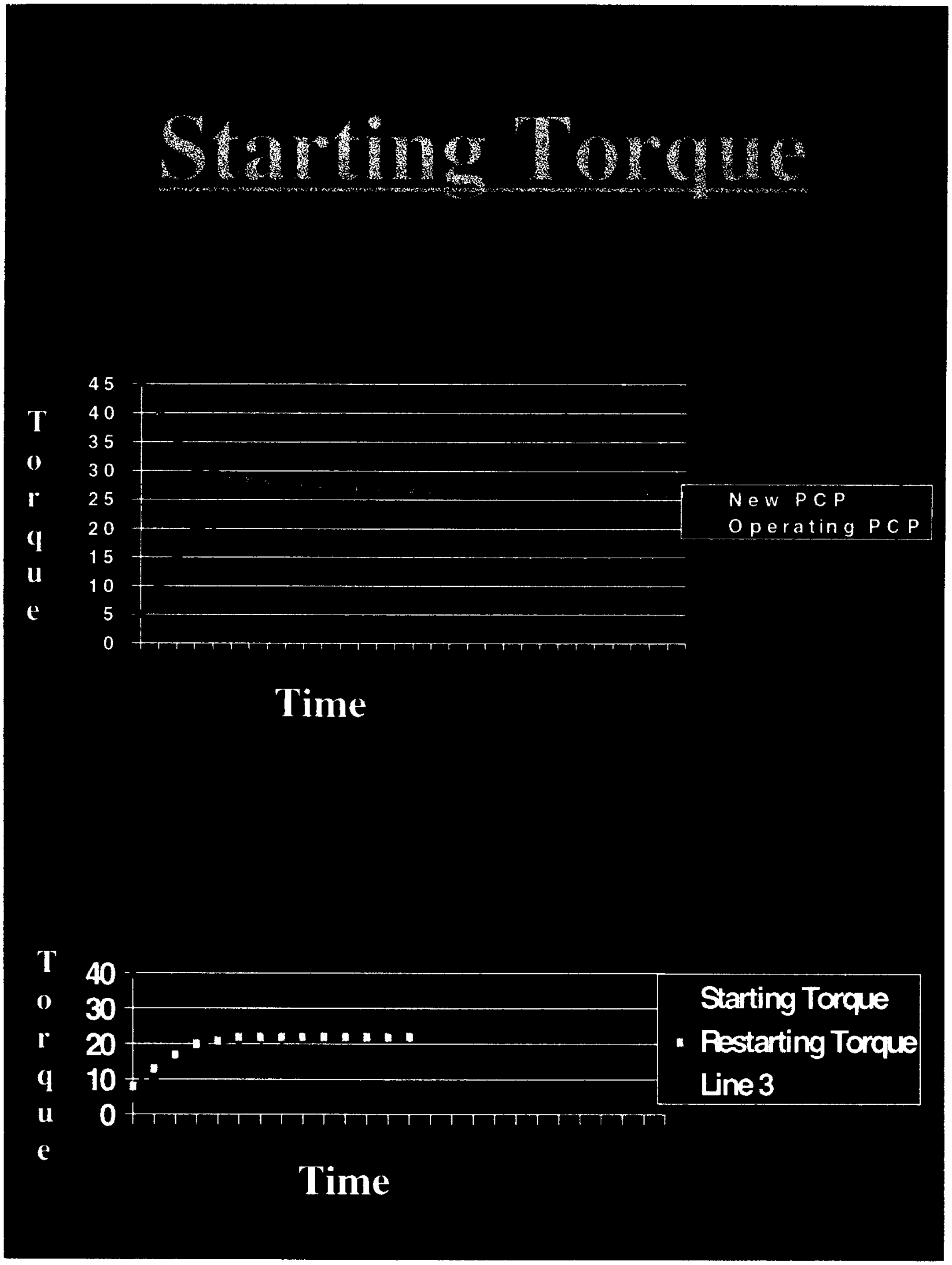

Starting Torque
T o r q u e
45
40
35
30
25
20
15
10
5
0
New PCP
Operating PCP
Time
T o r q u e
40
30
20
10
0
Starting Torque
Restarting Torque
Line 3
Time

Figure 3

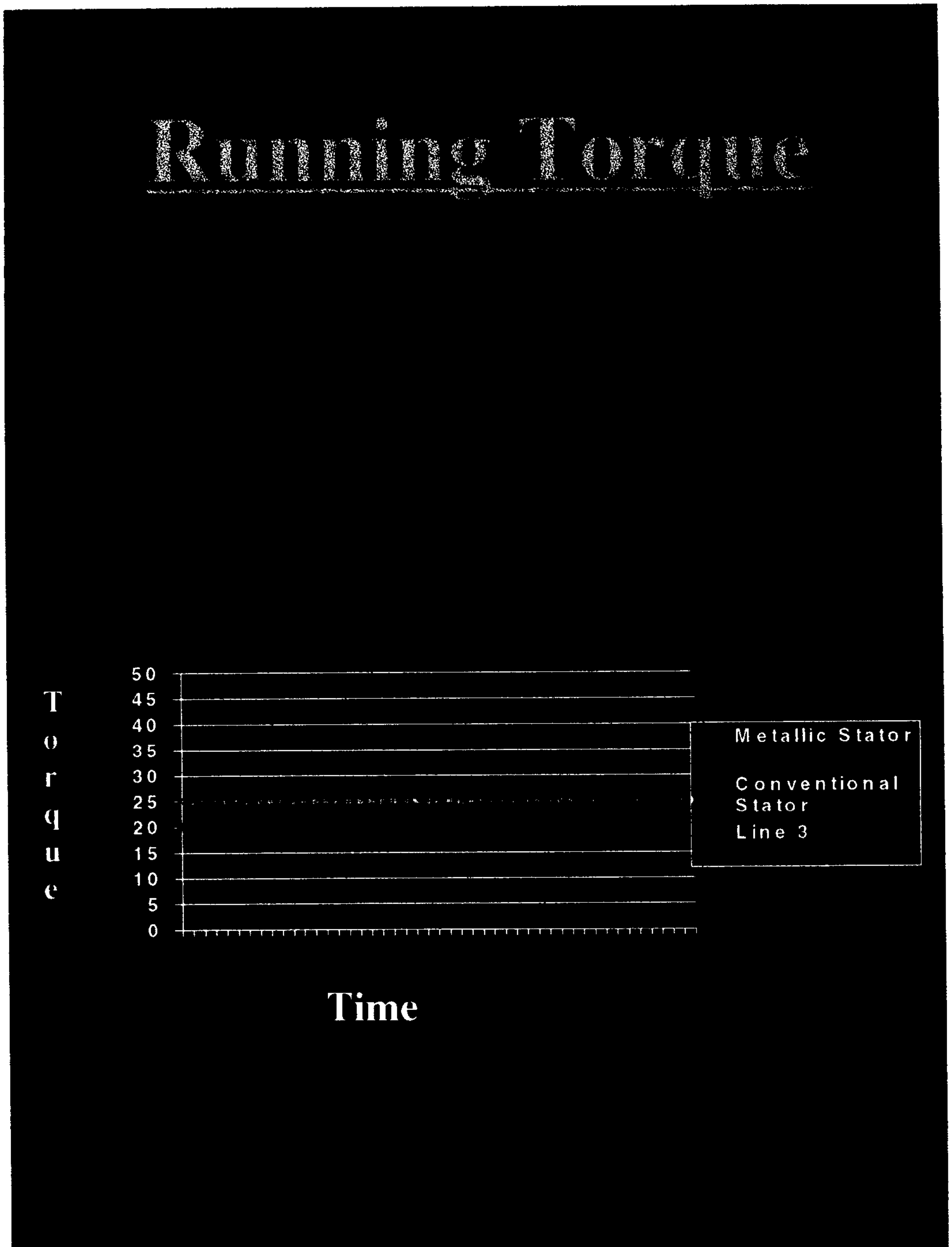
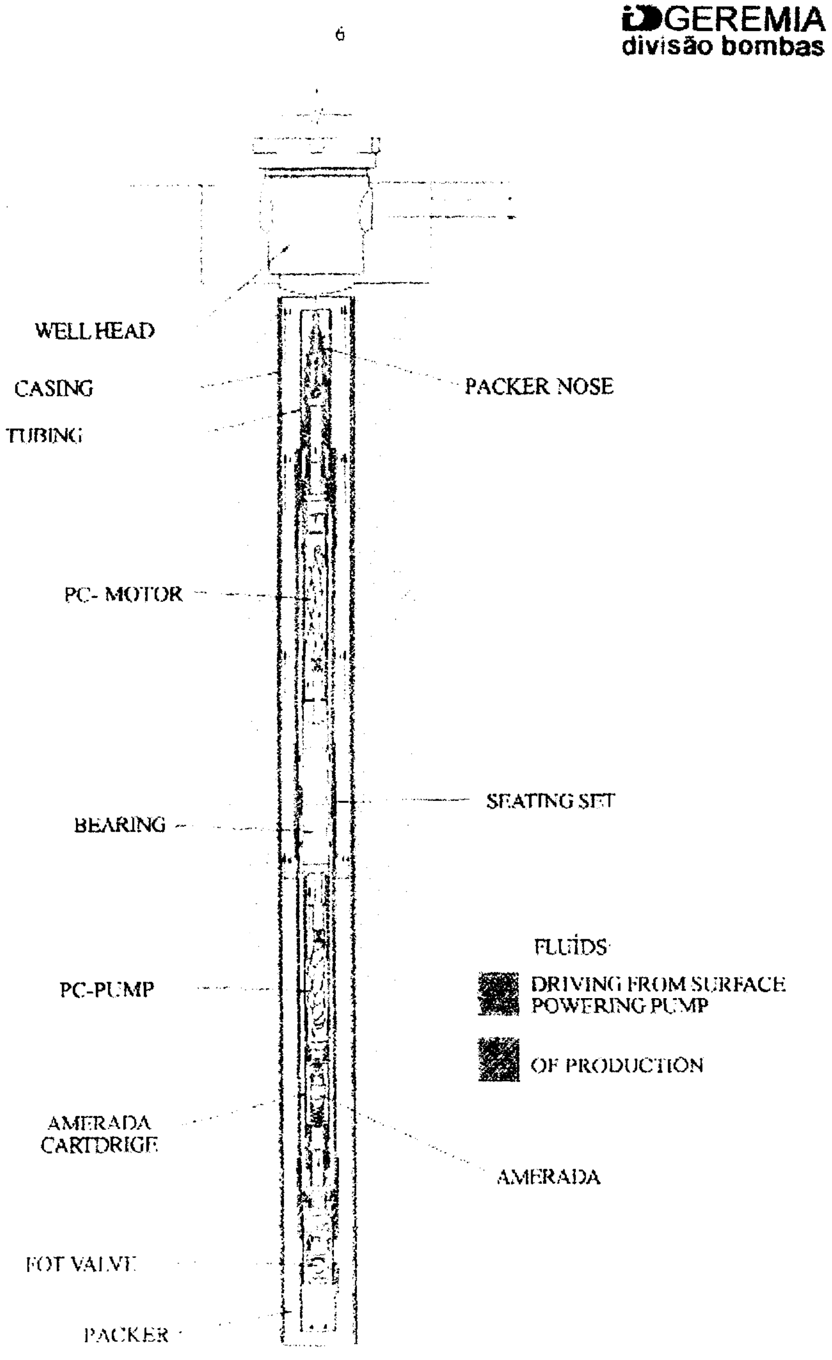

Running Torque
50
45
40
35
30
25
20
15
10
5
0
Torque
Time
Metallic Stator
Conventional Stator
Line 3

Figure 4

6



GEREMIA
divisão bombas
WELL HEAD
CASING
TUBING
PACKER NOSE
PC- MOTOR
SEATING SET
BEARING
FLUIDS
DRIVING FROM SURFACE POWERING PUMP
OF PRODUCTION
PC-PUMP
AMERADA CARTDRIGE
AMERADA
FOT VALVE
PACKER

Figure 5

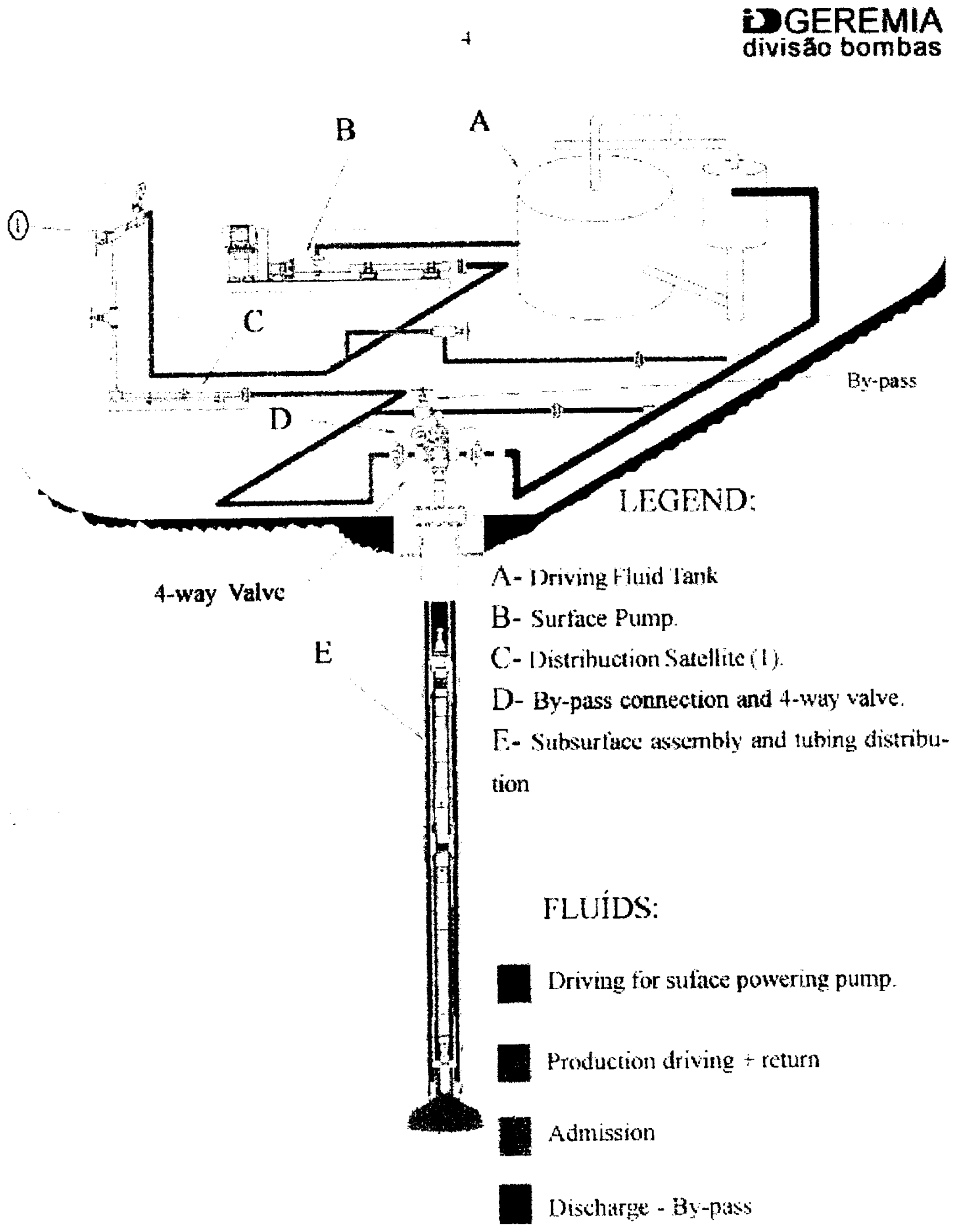
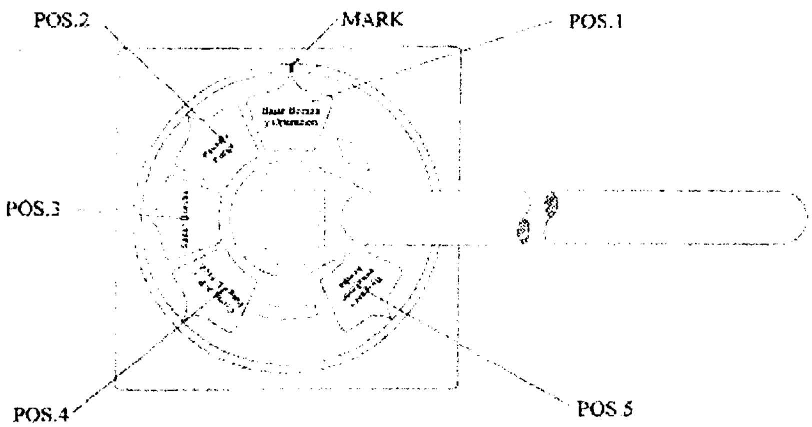
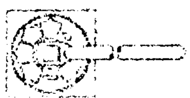

GEREMIA
divisão bombas
B
A
1
C
D
By-pass
LEGEND:
4-way Valve
E
A- Driving Fluid Tank
B- Surface Pump.
C- Distribuction Satellite (1).
D- By-pass connection and 4-way valve.
E- Subsurface assembly and tubing distribution
FLUÍDS:
Driving for suface powering pump.
Production driving + return
Admission
Discharge - By-pass

Figure 6

GEREMIA
divisão bombas

4-WAY VALVE - operational sequence to install, operate and remove the insertable moto-progressive pumping unit

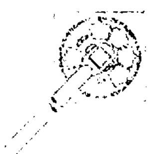




Position 1:
To sink and operate the pump:
The driven fluid is drived to the tubing, making the pump to go to the bottom up to it reaches the assembly. When coupled, the driven fluid will make the pump motor start.

Position 2:
To eliminate the driven fluid pressure from the *tubing and casing.*
The driven fluid passes freely through the vaive and goes to the tank, the pressure of the tubing and casing is released.

Position 3:
To take de pump back.
The driven fluid is drived to the casing. Invert the driven fluid rate, causing the foot valve closing and making the pump to go to the surface.



Position 4:
To eliminate the *tubing* and *casing* pressures.
The driven fluid is stopped on the valve entrance, while the tubing and casing pressures are released
CAUTION: That position can only be used if there is an exoansion valve on the pump exit of the driven fluid.

Position 5:
To remove and/or replace the pump on the well:
The driven fluid passes freely through the valve, allowing the removal and replacement of the pump on the well.

Figure 7