ELECTRIC SUBMERSIBLE PUMPS AS RELIABLE ALTERNATIVE TO ROD PUMPS, IN DEEP, LOW VOLUME, CHALLENGING APPLICATIONS

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Oil and gas producers are frequently faced with deep, low volume applications that challenge today's rod pump technology. There is a growing demand for a reliable form of artificial lift in deep, low volume, hot and aggressive applications. Operators with low volume applications that suffer from deviated well bores or applications that are just too deep and challenging to achieve long run times with a conventional rod pump can now utilize electric submersible pumps (ESPs) as an economical alternative.

Historically, low volume submersible pump designs consisted of production ranges greater than 300 bpd. Those submersible pumps had narrow vane clearances, which plugged up easily, had limited gas handling capabilities, limited thrust washer areas and lower-pressure housings. This created unsafe operating conditions and limited application ranges. New technology such as wider vane stage designs, ultra high pressure housings, higher efficiency gas separators, high temp motors and reliable down hole sensors have greatly contributed to the success of ESP's in this type of application.

This paper will present technological innovations and improvements that created the opportunity to utilize ESPs in low volume, deep applications.

Design Criteria

Setting Depth: 11,423 ft
Production Rate: 150 bbl / day
Water Cut: 95%
GOR: 12,500
GLR: 925
Water Gravity: 1.04
Oil Gravity: 40 API
Casing: 5 1/2, 17 lb
Tubing: 2 7/8

Equipment Installed

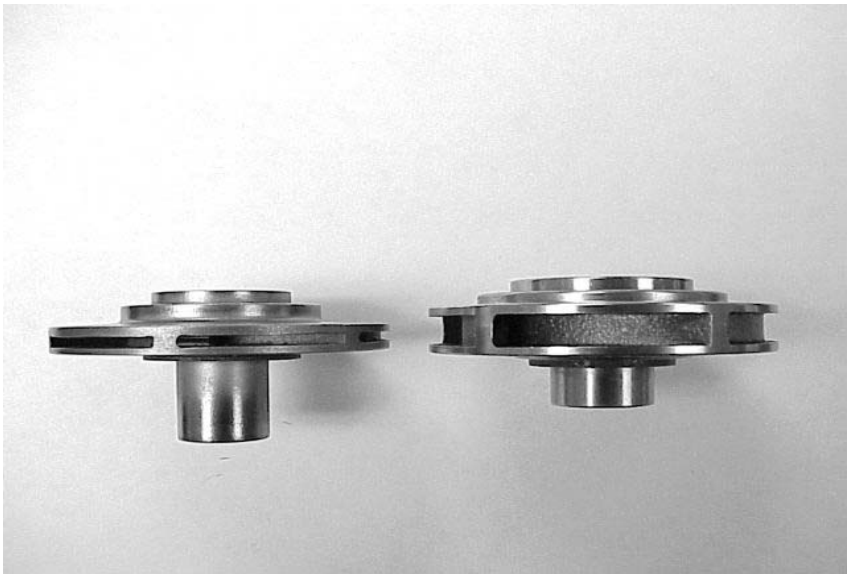
Transformer, VSD 260KVA 480 110-3810*
VSD, 225KVA Vector Series NEMA3 W/opt
MAGS TR4 UHSS GAS SEPARATOR
SENSOR, SMTGUARD V HT STL HDI
MOTOR, TR4-92 HTI UP 80HP 1310V 39A
SEAL, TR4 STD HL HT 98L HSS
SEAL, TR4 STD HL HT 98L HSS
CABLE, MLC TR4-HT KELB #6 MNL 110'
PUMP, TD 150 FLT 226STG #11 HSS AFL
PUMP, TD 150 FLT 247STG #12 MNL UHP STL
PUMP, TD 150 FLT 81 STG #04 MNL AFL

Production Report

Gas Sales (Mcf)	Oil Production (bbl)	Water Production (bbl)
119	12	118
122	33	120
122	8	133
119	2	140
112	10	143

Utilized New Technology

Low Volume, Wide Stage Design Impeller
Ultra High Pressure Pump Design
High Efficient Multi Abrasive Gas Separator (MAGS)
High Temperature Motor
Downhole Sensor (Smart Guard)

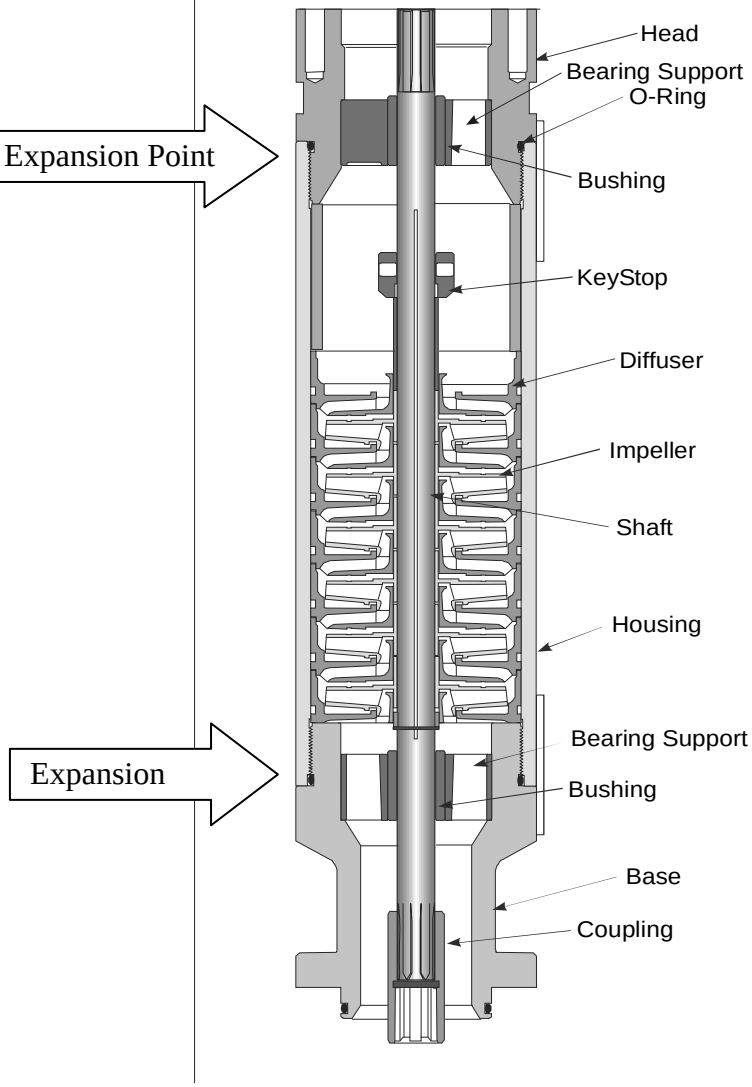


Low Volume Stage Vane Design
New Technology vs. Old Technology

Low Volume Stage Thrust Washer

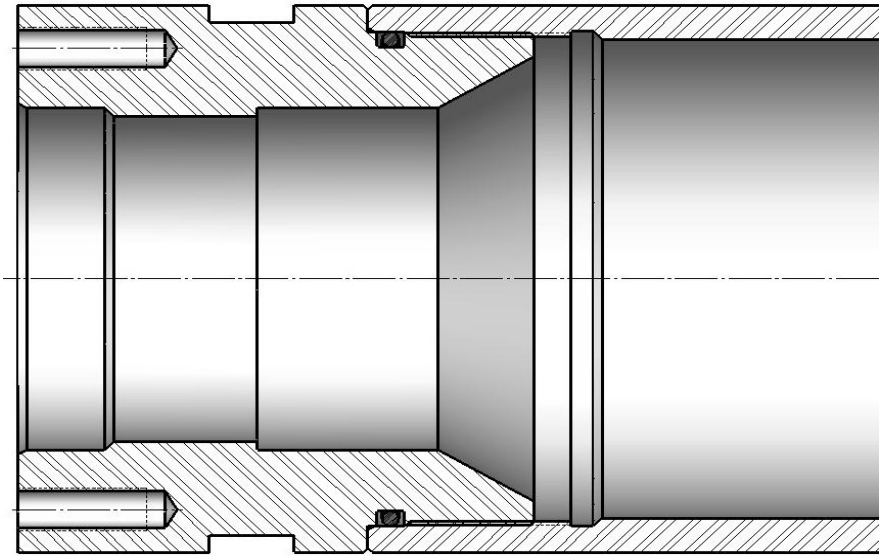
Old Technology vs. New Technology

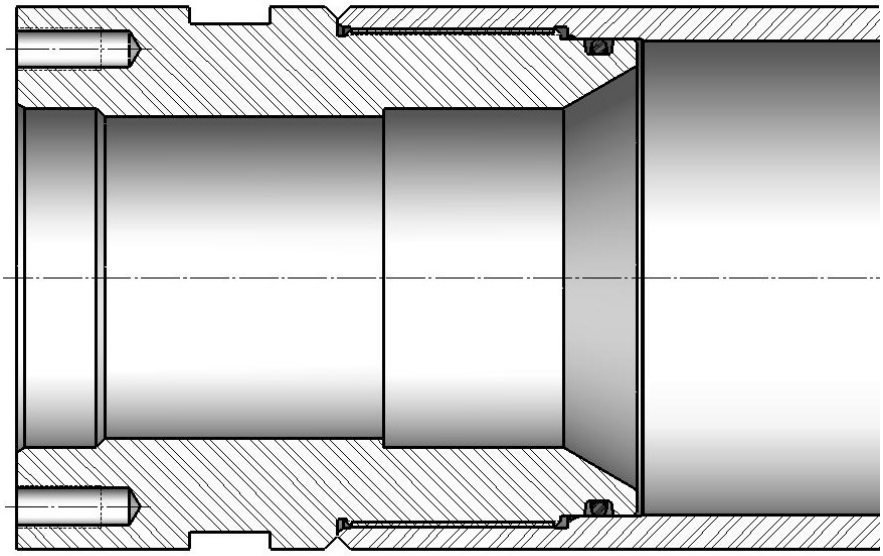
PUMP, STD FLOATER RADIAL FLOW



Standard Housing Design

Standard Design / 50,000 lb limit





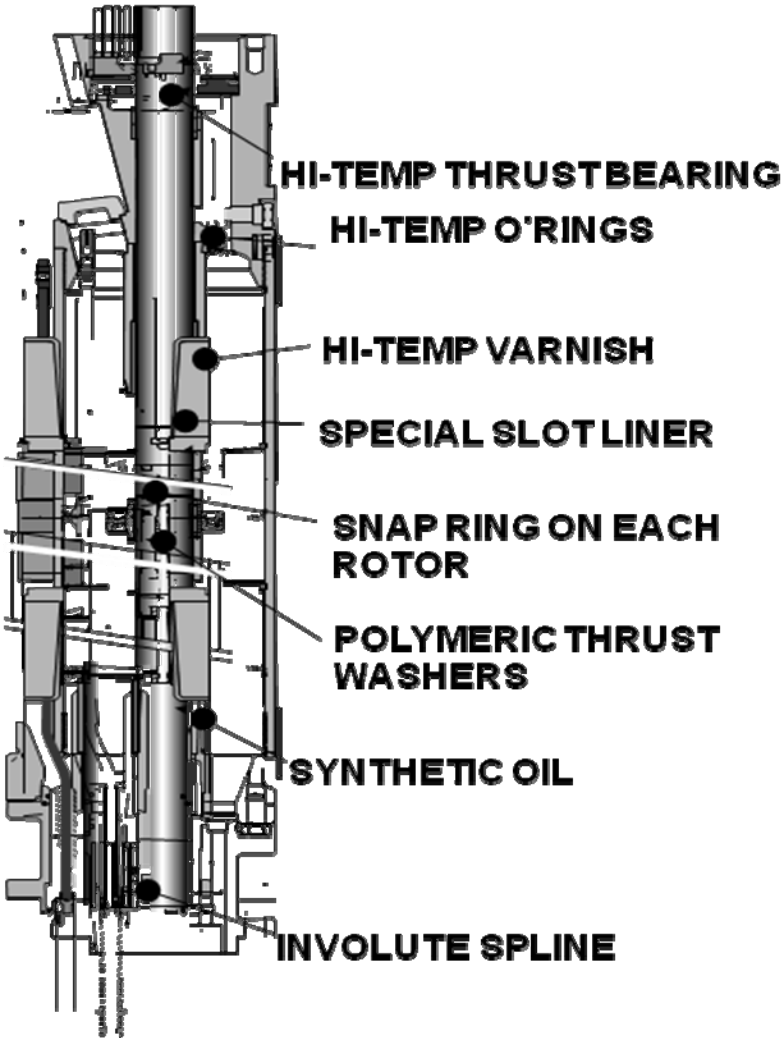
High Pressure Design / 10,000 lb limit

Features

- **Repositioned o-ring to isolate the housing's threads from high pressure**
- **90 durometer Aflas o-rings to resist extrusion at high pressure**
- **17-4PH Stainless Steel head and base**
- **Buttress threads**
- **Lock welded joints**
- **8,000psi operating (10,000psi max) @ 350°F**

Multi Abrasion Gas Separator (MAGS)

High Temperature Motor



Smart Guard Sensor Data

Int_Pres	Int_Temp	Mtr_Temp	Vibratn	Leak
188.03	172.97	203.16	0.33	1.94
188.03	172.97	202.77	0.33	1.9
188.03	172.97	202.77	0.33	1.94
188.03	172.97	202.77	0.33	1.94
188.03	172.97	203.16	0.33	1.97

Summary

Due to multi rod pump failures an ESP was installed as an alternative. The application was only successful as a result of the utilization of new technology in the ESP industry.

The sensor data sheet indicates an acceptable motor operating temperature was achieved during this installation.

A total run time of 740 days was achieved.

The well was recently converted to an injector.

This application and others alike have proven that ESPs are a viable alternative to rod pumps in low volume applications.