ROTATING RIGHT

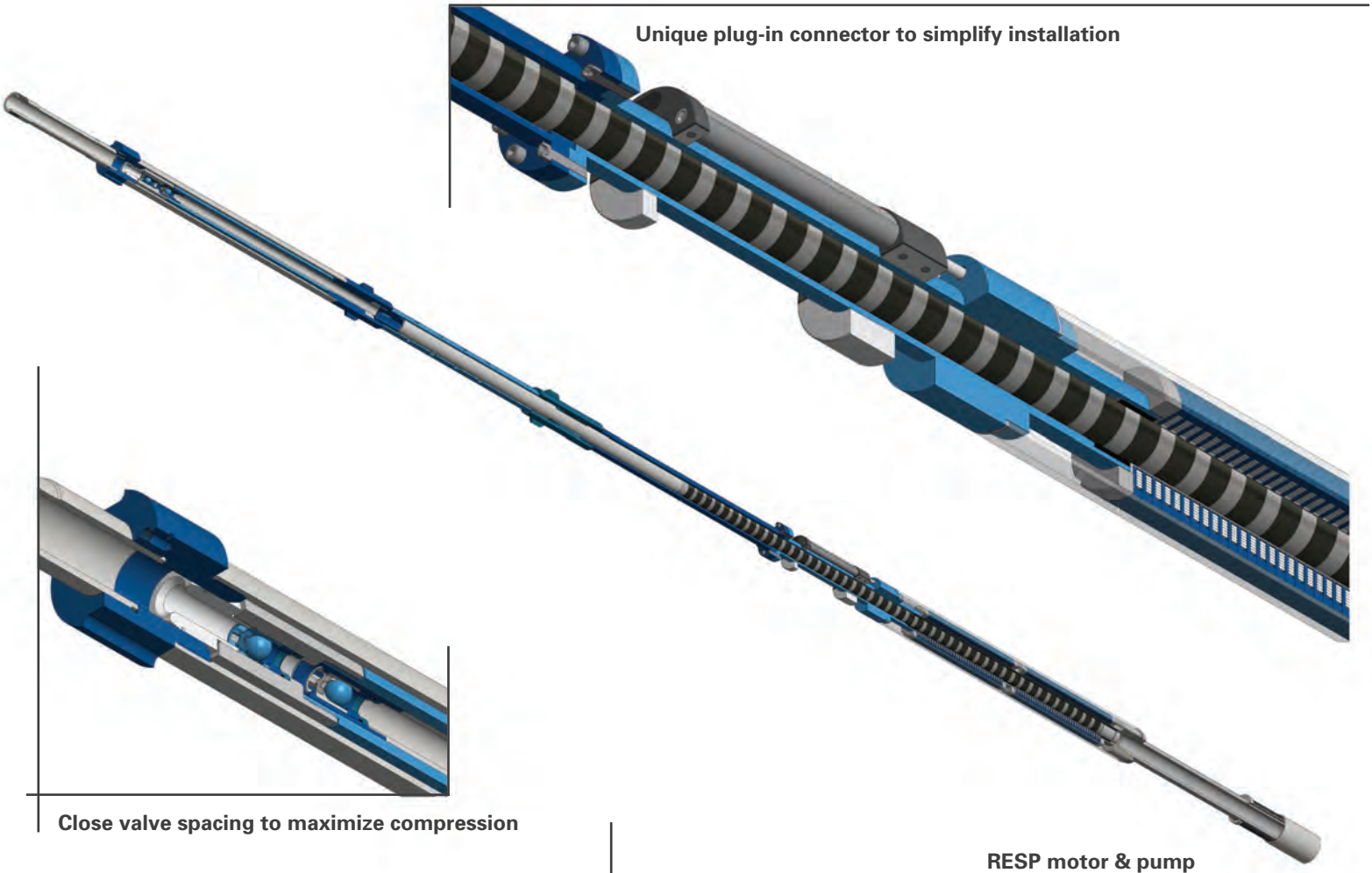
ARTIFICIAL LIFT SOLUTIONS

Rotating Right has provided artificial lift technology for a number of years. It now focuses on jet pump hydraulic lift systems, and a revolutionary Reciprocating Electric Submersible Pump (RESP) technology.

With our extensive experience and expertise, Rotating Right will analyze well data and advise on a preferred method for artificial lift. From wells with high deviation or solid content to high temperatures and corrosive environments, an optimized solution can be found.

RECIPROCATING ELECTRIC SUBMERSIBLE PUMP (RESP)

REVOLUTIONARY ARTIFICIAL LIFT TECHNOLOGY



Unique plug-in connector to simplify installation

Close valve spacing to maximize compression

RESP motor & pump

OLD TECHNOLOGY

At present beam pumping units (pumpjacks) are the most common type of artificial lift system used worldwide accounting for about 90% of all installed artificial lift on oil wells. They have several drawbacks:

- **Obtrusiveness (height)**
- **Leaking stuffing box**
- **Rod wear**
- **Tubing wear**
- **Gas locking**
- **Inefficient if not balanced**

HOW IT WORKS

A linear motor replaces both pumpjack and sucker rods to drive a reciprocating pump end to lift production to surface. The pump and linear motor are run on end of tubing with motor landed at or above perforations so that production cools motor. The power cable is directly connected to the linear motor and banded to tubing as in ESP installations. The controller energizes the motor only when travelling up or down and the motor is off between strokes which saves energy.

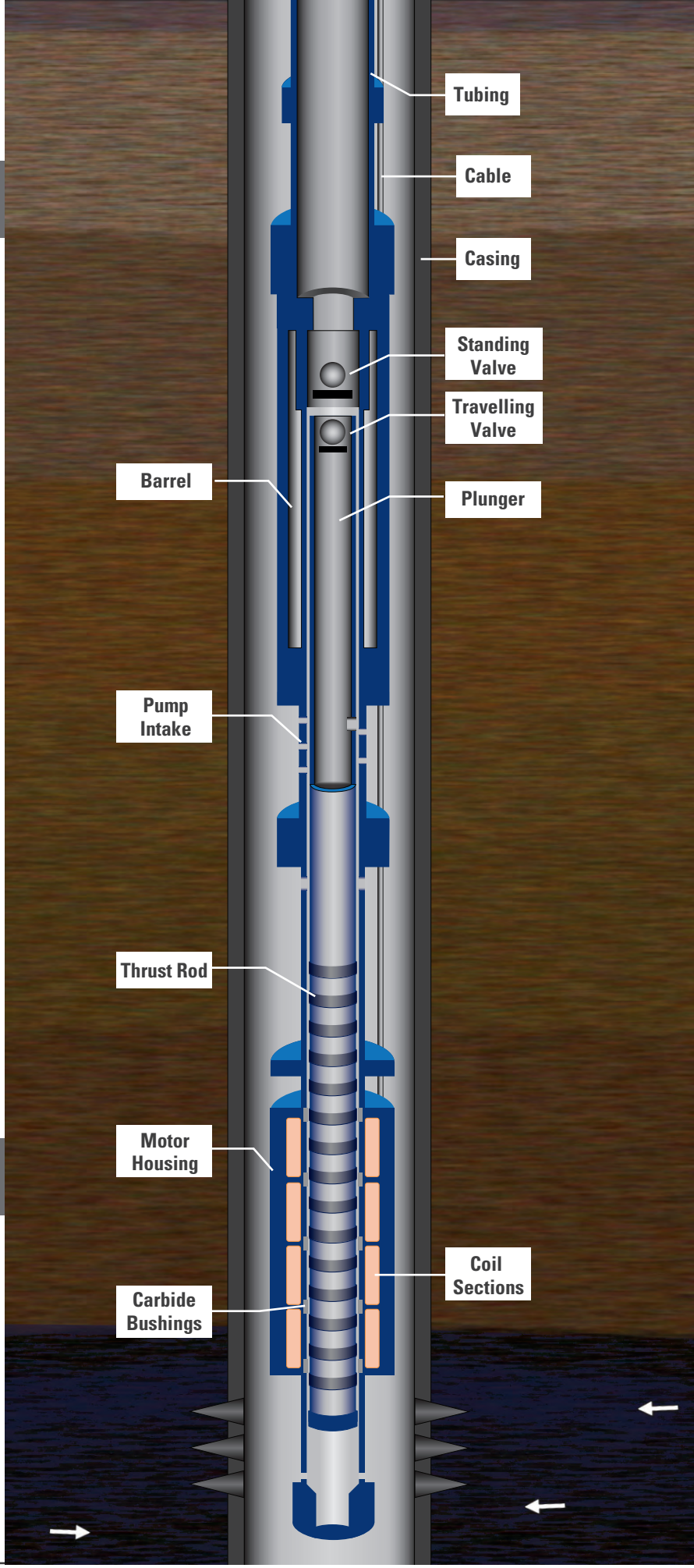
The stroke frequency is adjustable between 0-12 strokes per minute by changing the controller parameters. The entire system can be monitored and controlled with a SCADA system.

This is a revolutionary improvement over the conventional reciprocating pump technology used in the industry for over a century.

- **Installs on tubing**
- **Can be run in deviated or horizontal wells**
- **Close valve spacing**
- **Intermittent power consumption**
- **0 - 12 Strokes per minute**
- **Rates up to 1000 bbls/day**
- **Up to 6500 PSI discharge pressure**

RESP ADVANTAGES

- **Low profile**
- **No leaks at wellhead**
- **No rod wear**
- **No tubing wear**
- **Eliminates gas locking**
- **Improved efficiencies**
- **Highly variable stroke rate**
- **Easily optimized**
- **Lower power consumption**



RESP Motor and Pump Cutaway

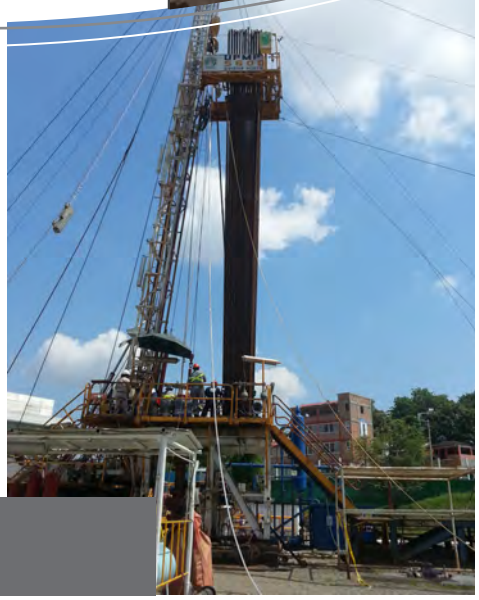
ENVIRONMENTAL IMPACT

Depending on the application, the RESP can reduce power consumption significantly. The Smooth Operator controller energizes the motor on the up and down stroke only, so no power is used between strokes. In addition, the frequency of the motor is controlled so as to maximize thrust on the upstroke and minimize thrust on the down stroke to further decreased energy consumption.

The product weighs 1 ton versus an average of 30 tons of steel used in manufacturing equipment for one beam pumping installation. Assuming there is 1.8 tons of carbon dioxide emissions per 1 ton of steel production, that is a reduction of 52 tons of carbon dioxide emissions to the atmosphere per installation.

TYPICAL RESP APPLICATIONS

- **Replace beam pumping units**
- **Gassy wells**
- **Deviated wells**
- **Gas well dewatering**



RESP SPECIFICATIONS

The RESP units are offered in several size combinations. Dimensionally there are two size offerings – 4-1/2" (114mm) and 5-1/2" (140mm) OD. The RESP pump is designed for optimal intake and close fitting valves to mitigate gas locking. The assembly includes API Specification 11AX components and are offered in a variety of standard sizes from 1.25" to 3.75". Stroke length for all pump sizes is 48 inches (1.22 m).

The RESP motors are tested in the horizontal position, to 200°C (392°F) and 30 MPa (4,350 psi). They are offered in 480 V, 660 V and 1140 V sizes, all of which are accompanied by specific controller packages that require little more than a power supply and step up transformer, where required.

The rated depths for the units are calculated using plunger size, fluid column pressure of fresh water, and nameplate voltage. The RESP is rated up to 15,000 ft TVD and displacements range from 0 to approximately 1000 bbls/day dependent on liquid and gas properties.

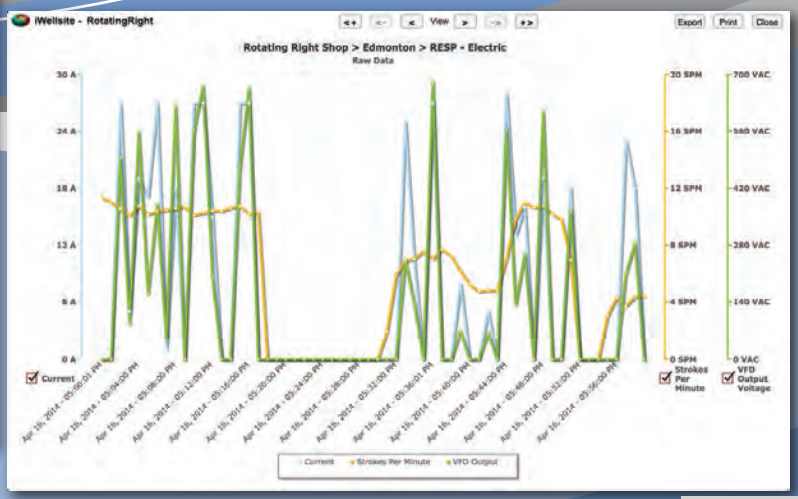
"THE SMOOTH OPERATOR"

Advanced Monitoring and Control

Intelligent control can be achieved with the Smooth Operator controller which is designed and built specifically for the RESP. It is an advanced inverter based control system using proprietary firmware and algorithms to deliver advanced control of the RESP permanent magnet linear motor. The user friendly graphical display enables operators and engineers alike to monitor the full spectrum of the systems operation in real time. The downhole pressure gauge and real time POC option allows for greater control leading to improved recovery and production optimization.

FEATURES AND BENEFITS:

- **Continuously monitors pump conditions and shuts down pump if adverse conditions are detected**
- **Touchscreen display provides HMI (Human Machine Interface) for local control, analysis and configuration**
- **Continuous logging and monitoring of all on-site equipment. Minimum 60 days historical data**
- **Optional remote monitoring and control. Exceptions/alarms may be immediately transmitted to an operator's cell phone or email**
- **Three levels of password-protected security**
- **Easily customizable User Interface Screens**
- **Graphing and trending module for quick, at-a-glance performance analysis**
- **Convenient configuration upload/download via USB**
- **Feature enhancement via automated USB firmware upload**
- **Optional Asset Management Module to track and manage your remote assets**

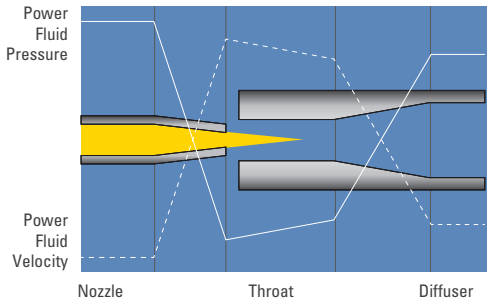


JET PUMP SYSTEMS

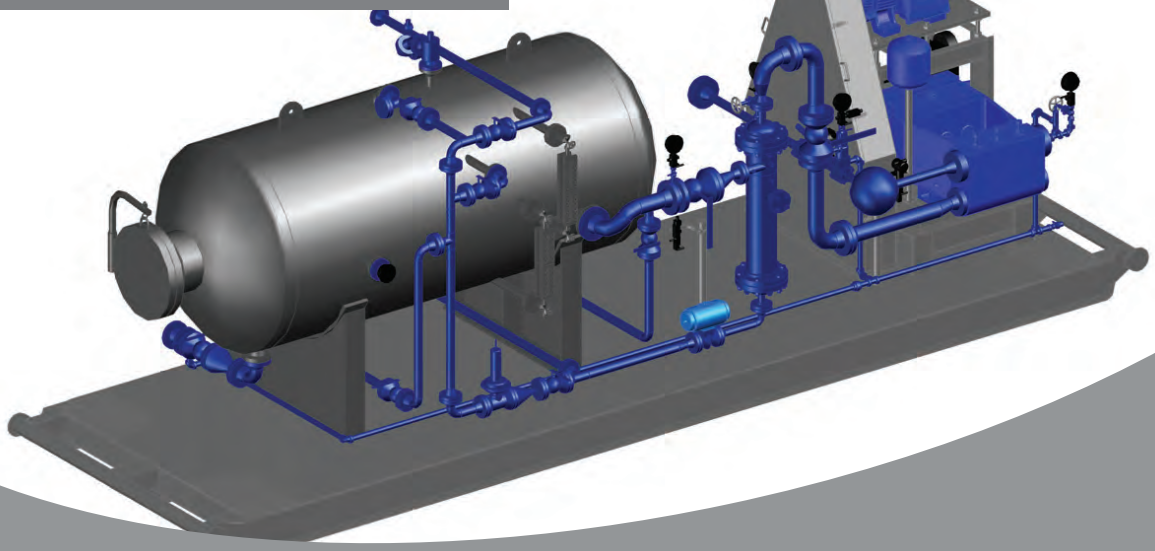
JET PUMP ADVANTAGES

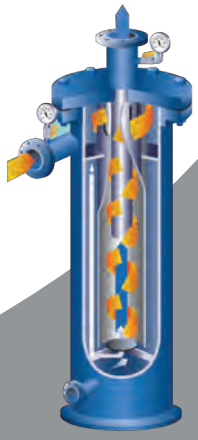
- No moving parts
- Tolerant to solids, corrosive environments and higher GOR's
- Multi-well production from single surface package
- Often either “free” or wireline retrievable
- Compact, easy to handle/ship
- Adaptable to various existing BHA’s
- High volume potential
- Field repairable
- Ideal for remote and environmentally sensitive locations

Jet Pump - Venturi Principle



JET PUMP SURFACE UNITS





Desander

With jet pump systems, the produced oil or water is recycled to use as the power fluid. In order to condition, clean and pressurize the power fluid, well designed and manufactured surface equipment is required.

Rotating Right provides a full range of surface equipment packages. The primary items on a surface package consist of a prime mover, a power fluid pump, a reservoir vessel, and the required controls. These are mounted on a heavy duty oilfield quality skid, and assembled with the necessary pressure piping, control valves and other associated equipment.

The typical horsepower required ranges from 30 to 300 HP, and up to 625 HP with higher volume wells. The prime mover can be electric motor, natural gas or diesel engine. The power fluid is usually pressurized in the range of 2,000 to 5,000 PSI.

The reservoir vessel is an integral part of the conditioning of the power fluid. It is used for surge capacity and to assist in separating the gas, oil and water. The vessel is typically designed in the 150 to 300 ANSI range and built to the current ASME code.

Power fluid conditioning can include chemical injection to prevent corrosion or paraffin build up, and heat treatment to reduce crude oil viscosity. In addition, a hydrocyclone desander can be fitted for solids removal.

TYPICAL JET PUMP APPLICATIONS

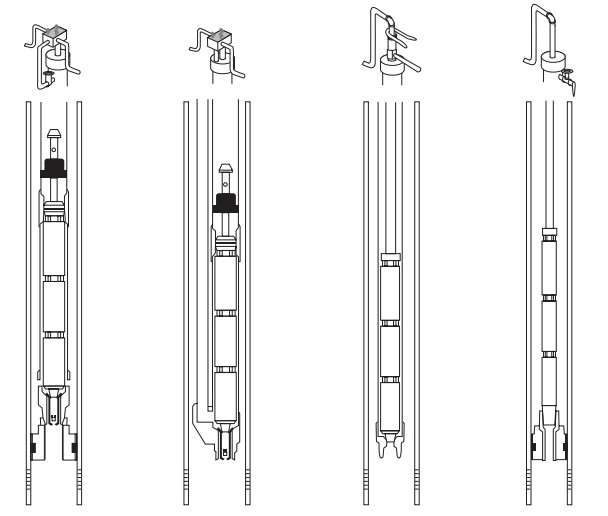
- Permanent production
- Well productivity evaluation
- Well clean-ups and unloading
- Drill stem testing
- Gas well dewatering

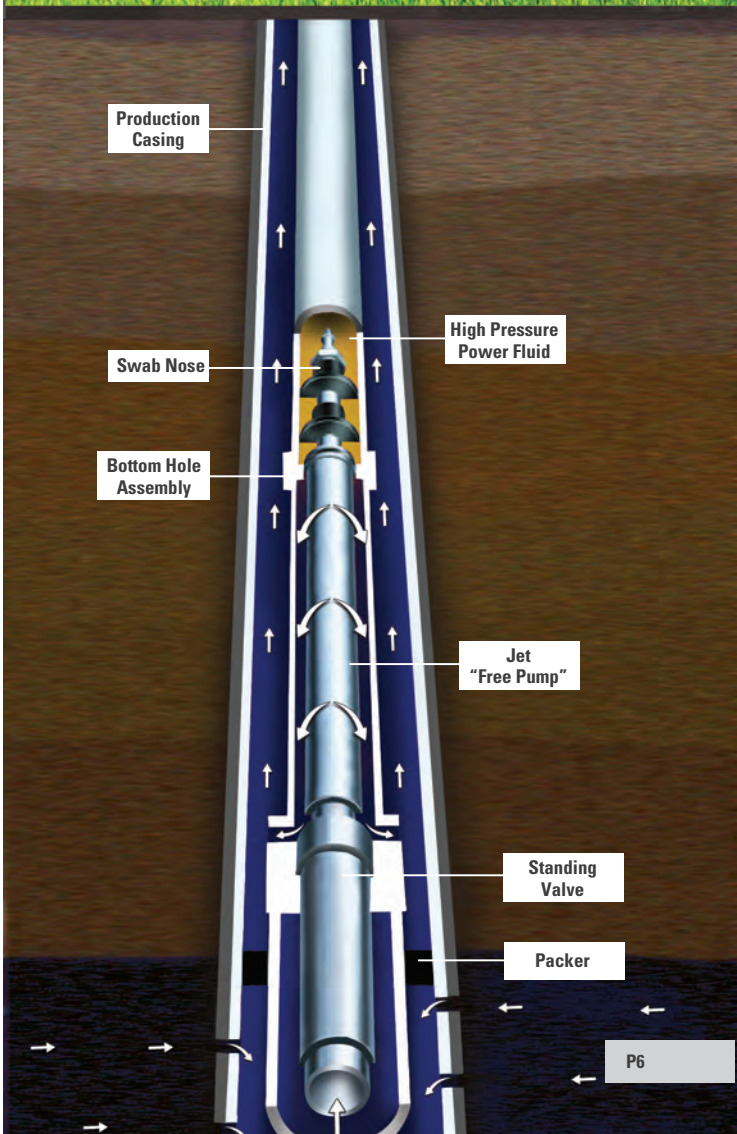
SUBSURFACE JET PUMPS

The subsurface jet pump is what transfers energy and momentum when mixing the power fluid with the well fluid. Rotating Right provides subsurface jet pump equipment in a broad range of sizes and designs. The “free pump” design is more common since they can be pumped to surface for replacement or redress by circulation alone.

Jet pump are comprised of nozzle, throat and diffuser, which come in a variety of sizes and configurations. They can be used to produce wells from as little as 50 B/D to over 15,000 B/D. One of the inherent benefits of jet pumping is the lack of downhole moving parts. This coupled with high quality corrosion and abrasion resistant metallurgy, allows jet pumps to remain operational downhole for exceptionally long periods.

Basic Configurations



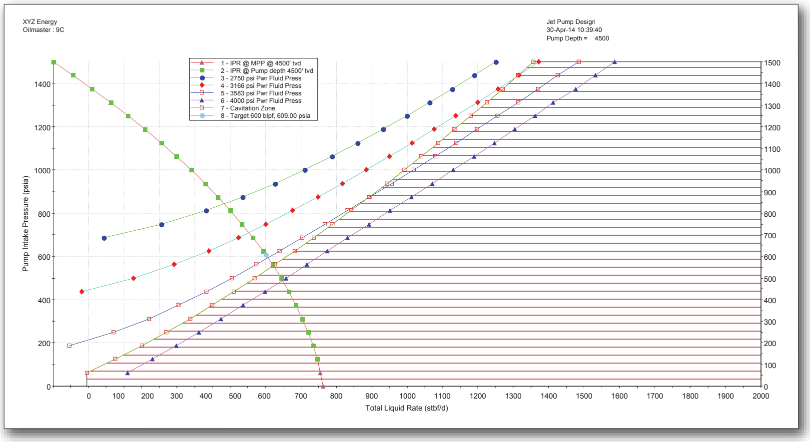


HYDRAULIC DESIGN

There are many important parameters that have an effect on the function of a jet pump system. Depths, fluid properties, production rates, gas volumes, static and dynamic pressures and tubular sizes all play an important role in calculating the optimal configuration.

Rotating Right utilizes specialized evaluation software to simulate well conditions and performance with the given well data. With careful analysis the optimal jet pump characteristics will be determined and provided as part of a complete hydraulic system recommendation, complete with pump performance tables and graphs.

Jet Pump Example

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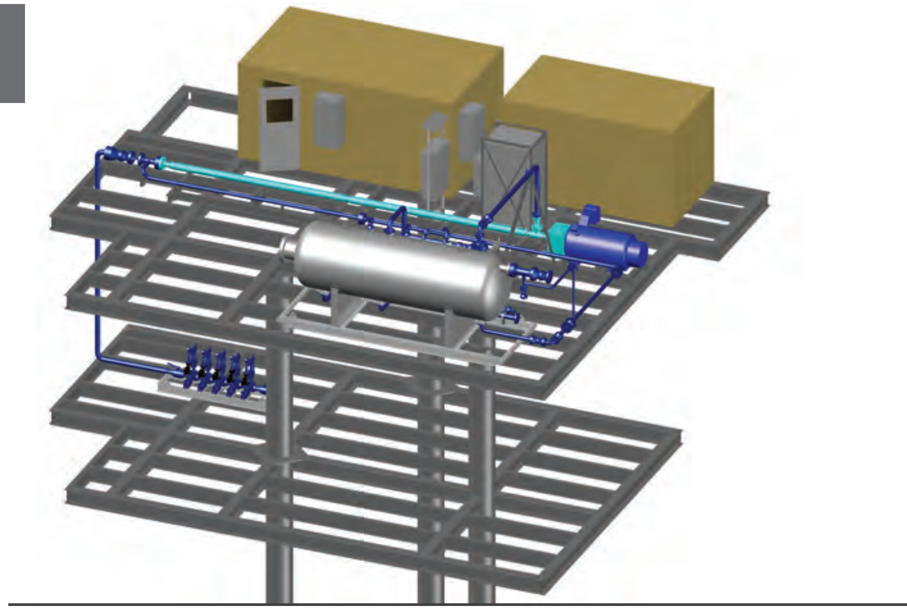
 Dataset: Jet Pump Example
 Title: XYZ Energy
----------------------------------------------------------------------------------
 1) Perforation Depth        (ft) :   4500        13) Producing GOR  (scf/STB) :   1500
 2) Pump Vertical Depth      (ft) :   4500        14) Gas Sp. Gravity (air=1.) :  0.800
 3) Pump Installation                             15) Separator Press   (psia) :   90.0
          Casing installation                     16) Well Static BHP   (psia) : 1500.0
 4) Casing (production) ID  (in) : 16.169         17) Pump Intake Press (psia) :  609.0
 5) N/A                                           18) Well Test Flow Rate(bpd) :  600.0
 6) Power Tubing ID         (in) :  2.441         19) Well Head Temp    (deg F) :  120.0
 7) Power Tubing OD         (in) :  7.302         20) Bottom Hole Temp (deg F) :  150.0
 8) Tubing Length           (ft) :   5000         21) Not Vented               : Not Vented
 9) Pipe Roughness e/d   (in/in) : 0.0018         22) Power Fluid oil/water    :  Water
10) Oil Gravity            (API) : 42.000         23) Power Fluid Spec Gravity :  1.100
11) Produced Vol Water Cut (%)   :  60.00         24) Bubble Point Press(psia) :    N/A
12) Water Specific Gravity       :  1.100         25) Well Head Press   (psia) :   90.0
==================================================================================
 Oilmaster  9C  Pump Performance Summary
     Target Production Rate : 600 BLPD @pump intake pressure : 609 psia
     Predicted Surface Power Fluid Injection Pressure =   3529 psia
     Predicted Surface Power Fluid Injection Rate     =   1452 bpf/d
     Predicted Pump Intake Pressure                   =    609 psi
     Predicted Pump Discharge Pressure                =   2027 psia
     Predicted Power Fluid Pressure at Pump depth     =   5612 psia
     Predicted Horsepower requirement                 =    105 HP
==================================================================================
                        ---------------- ---------------- ---------------- ----------------
 Match Prod Rate (blpd)       Rate=   485      Rate=   553      Rate=   607      Rate=   648
 Match Pwr Fluid Press (psia) PFP =  2750      PFP =  3166      PFP =  3583      PFP =  4000
 Match Pwr Fluid Rate (blpd)  QN  =  1299      QN  =  1384      QN  =  1462      QN  =  1535
 Match Pump Intake Pres(psia) PIP =   843      PIP =   711      PIP =   593      PIP =   490
 Pump Discharge Prs(psia)      PD =  2054      PD  =  2037      PD  =  2025      PD  =  2016
 Match Pwr Fld prs @pmp (psia) PN =  4837      PN  =  5251      PN  =  5666      PN  =  6080
                        ---------------- ---------------- ---------------- ----------------
PmpInPr  Qresvr    QCav  QSuctn  QNozzl cd QSuctn  QNozzl cd QSuctn  QNozzl cd QSuctn  QNozzl cd
  psia   STB/D   STB/D   STB/D     B/D     STB/D     B/D     STB/D     B/D     STB/D     B/D
 ------ ------- ------- ------- ------- - ------- ------- - ------- ------- - ------- ------- -
  1500       0    1358    1250    1188 0    1372    1259 0    1486    1326 0    1586    1390 0
  1438      56    1314    1190    1199 0    1315    1269 0    1425    1336 0    1532    1400 0
  1375     110    1270    1128    1210 0    1257    1280 0    1371    1346 0    1477    1409 0
  1313     162    1225    1064    1220 0    1199    1290 0    1314    1356 0    1413    1418 0
  1250     212    1180     999    1231 0    1138    1300 0    1256    1365 0    1361    1427 0
  1188     260    1134     931    1242 0    1076    1310 0    1198    1375 0    1305    1437 0
  1125     305    1088     860    1252 0    1014    1320 0    1139    1384 0    1247    1446 0
  1063     349    1040     787    1263 0     949    1330 0    1079    1394 0    1189    1455 0
  1000     390     992     710    1273 0     884    1340 0    1018    1403 0    1131    1464 0
   938     429     943     626    1283 0     818    1349 0     957    1412 0    1072    1473 0
   875     466     893     535    1293 0     748    1359 0     895    1422 0    1012    1481 0
   813     501     842     432    1304 0     677    1369 0     833    1431 0     952    1490 0
   750     534     790     306    1314 0     601    1378 0     768    1440 0     892    1499 0
   688     565     736     143    1323 4     523    1388 0     704    1449 0     832    1508 0
   625     593     682       0    1333 2     439    1397 0     640    1458 0     775    1516 0
   563     620     627       0       0 2     341    1406 0     574    1467 0     717    1525 0
   500     644     570       0       0 2     226    1416 0     506    1476 0     658    1533 0
   438     666     511       0       0 2      80    1425 4     433    1485 0     598    1542 0
   375     687     450       0       0 2       0    1434 2     355    1493 0     537    1550 0
   313     705     387       0       0 2       0       0 2     270    1502 0     474    1559 0
   250     721     320       0       0 2       0       0 2     171    1511 0     411    1567 0
   188     734     251       0       0 2       0       0 2      46    1519 4     348    1576 0
   125     746     176       0       0 2       0       0 2       0    1528 2     281    1584 0
    63     755      95       0       0 2       0       0 2       0       0 2     209    1592 0
     1     763       0       0       0 2       0       0 2       0       0 2     128    1600 0
```

EXPERIENCE

Rotating Right has decades of experience working with jet pump technology. Applications have ranged from local onshore single wells to installations on remote offshore multi-well platforms. In a recent project offshore Egypt, a multi-well package utilizing a single surface unit was installed to enable simultaneous production from 5 wells. Past experience also includes a multi-well package with single surface unit installation in Gabon, West Africa, as featured on the brochure title page.



Multi-well package, Gulf of Suez, Egypt

08.2022

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www.rotatingright.com
Phone: 780.485.2010
Fax: 780.485.1938