Rotating Right Inc. 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.
RECIPIROCATING ELECTRIC SUBMERSIBLE PUMP (RESP)

REVOLUTIONARY ARTIFICIAL LIFT TECHNOLOGY

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
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 0.0 - 20.0 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 - 20 Strokes per minute
- Rates up to 1500 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
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 300°C (572°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 1,500 bbls/day dependent on liquid and gas properties.
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 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 SURFACE UNITS

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 4,000 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.
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 pumps 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.

TYPICAL JET PUMP APPLICATIONS

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

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.

Jet Pump Example

Multi-well package, Gulf of Suez, Egypt