CORMORANT ENGINEERING

Leaders in Hydraulic Artificial Lift

HYDRAULIC ARTIFICIAL LIFT SYSTEMS

Lifespan Lift Systems

Hydraulic Reciprocating
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Cormorant is dedicated to the development, deployment, and service of the most cost effective artificial lift pumping systems. The needs of artificial lift have changed, as the drilling and completions have evolved. Artificial lift systems are required to reach further, produce more, and do so more efficiently.

We at Cormorant believe that hydraulic lift systems can play a major role in answering the call of industry. By eliminating the effect of deviations and horizontal completions, reducing rig time, and providing a more reliable operating platform, Cormorant is committed to providing the best value to our customers.
A velocity string is a small tube that is placed into the production tubing to increase the flow velocity to the critical velocity needed to lift liquids from the well.

Utilizing the physics of the venture effect, jet pumps can be utilized to lift large volumes of fluid with minimal impact from depth or deviation.

Hydraulic reciprocating technology that creates a positive displacement pump. Providing maximum drawdown and improved efficiency.
Wells over time change, this change will often require different technologies to achieve optimal production. Traditionally the facilitation of different technologies will demand the change in completion. This is costly in capital, deferred production, resources and dependence upon outside services. This problem becomes more acute in unconventional wells, where traditional A/L solutions have a higher service interval. This cost can be reduced or even eliminated with Cormorant Lifespan Lift System.
Rodless Rod Pump

The retriever pumping system technology is a positive displacement pump that is driven by a dual acting cylinder. Same moving down hole parts as a rod pump, minus the mechanical rod connection to the surface. Rather than convey energy through a rod and controlling the reciprocating action from the surface, we provide a pressurized fluid flow (recycled produced fluid) to the down hole pump, which directs it inside the pump to reproduce the reciprocating action of a beam unit. This allows it to deploy in high dogleg severities and horizontal/deviated wells, without the damage to rod or tubing.

The benefits over traditional rod pump are also that the down hole pump is retrievable via hydraulics or wire line. The pump can be serviced without any additional rig time and or any other services if desired. The other benefits is that we have increased gas handling capabilities as well as solids.
Retriever hydraulic pump is Cormorants solution to long term pumping in unconventional and deviated well bores

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**Extend Stroke - Basic Pump Concept**
- Rod Volume being produced
- Engine Valve in Home position
- Traveling valve open
- Standing valve closed

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**Valve Shift Forward at End of Extend Stroke**
- Piston Travels to Fully Extended Position
- Engine Valve in Home position
- Signal Rod Connects Power Fluid to Engine Valve Shift Area
- Shift Area 2x Engine Valve Bias Area
- Engine Valve Shifts Forward
- Power Piston Begins Retract Stroke

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Produced Water Discharge Fluid at Hydrostatic Head
Power Fluid at Hydrostatic pressure plus system pressure
Spent Power Fluid at Hydrostatic Head
Produced Water intake at BHP
TYPE 1: High GLR

Type one completion is applicable to high Gas Liquid Ratio (GLR) wells. Utilizing a concentric production tubing string, the produced fluids and power fluids are kept inside the production tubing and gas is free to move up the casing.

Application:
High GLR
<200 bbl/d
4 1/4" Casing or larger
TYPE 2: Completion

Type two completion is applicable to low GLR wells. Utilizing a packered completion, the produced fluid and power fluid utilize the concentric completion of production tubing and casing. All production is then produced through the pump.

Application:
Low GLR

<350 bbl/d
Simple and effective surface equipment provide the valuable uptime that is demanded by economics. A system is only as effective as its weakest link. Cormorant has developed a reliable surface package by utilizing simple equipment in a well engineered manor. By derating surface pumps we can increase the service life while maintaining a high efficiency and effective HPU.

Specs:

Type 1:
- 20-50 HP
- 4000 PSI MAX
- 2000-3000 PSI (Typical Operating)
- Variable Speed
- Electric drive/NG drive

Type 2:
- 30-100 HP
- 4000 PSI MAX
- 2000-3000 PSI (Typical Operating)
- Variable Speed
- Electric drive/NG drive

Additional Features: SCADA Integration, Safety switches, Remote Capable
By recycling the produced fluid and utilizing as a power fluid, we reduce the cost and complexity of the surface equipment. The surface equipment can incorporate the operators chemical program and effectively treat the entire completion, at a reduced cost.
SPECS:

COMPLETION SIZES:

TYPE 1:

2-3/8 PRODUCTION TUBING
- 1-3/4” X .120 COILED TUBING INSERT STRING
- 20 - 30 HP SURFACE EQUIPMENT
- ≥ 4-1/2” CASING

2-7/8 PRODUCTION TUBING
- 2” X .120 COILED TUBING INSERT STRING
- 2.0625” FLUSH JOINTED PIPE INSERT STRING (FJT)
- 20- 40 HP SURFACE EQUIPMENT
- ≥ 4-1/2” CASING

TYPE 2:

2-3/8 PRODUCTION TUBING
- 25- 50 HP SURFACE EQUIPMENT
- ≥ 4-1/2” CASING

2-7/8 PRODUCTION TUBING
- 35- 70 HP SURFACE EQUIPMENT
- ≥ 4-1/2” CASING
CORMORANT ENGINEERING LIFESPAN LIFT SYSTEM

VELOCITY STRING OPERATION

- Injected Power Fluid
- Gas Flow > Critical Rate
- Insert String Landing Assembly
- Produced Fluid
- Production Tubing
- Seating Assembly
- Gas Anchor
- Pumped Liquids
- Produced Gas
- Gas Flow
- Insert String Landing Assembly
- Cormorant Retriever
- Retrievable Pump
- Seating Assembly
- Dip Tube
- Wireline Retrievable Standing Valve
- Lubricator

Produced Fluids
Produced Gas

CORMORANT ENGINEERING LIFESPAN LIFT SYSTEM

JET PUMP OPERATION

- Injected Power Fluid
- Gas Flow
- Insert String Landing Assembly
- Produced Fluid
- Production Tubing
- Wireline Retrievable Standing Valve
- Lubricator

Produced Fluids
Produced Gas
Natural Gas Production Vs. Pumped Water Rate
Fayetteville Shale, Arkansas @ 89° off Vertical

Natural Gas Production Vs. Pump Installation
Fruitland Coal, New Mexico
CORMORANT ENGINEERING

Dedicated to development, deployment, and service of the most cost effective artificial lift pumping systems.

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