QR OIL PRODUCTS
WELL COMPLETIONS

SAZ
Enhancing Well Completions

Oilfield

Plunger Lift System

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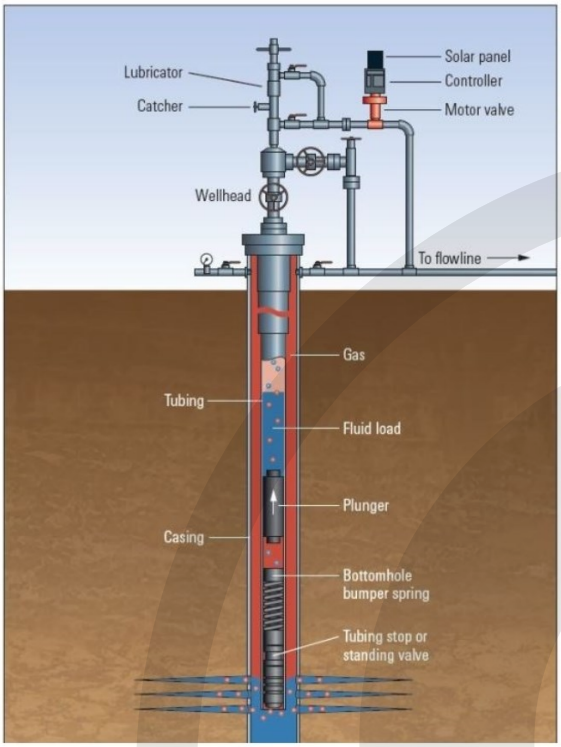
Plunger Lift System

SAZ Oilfield's Plunger Lift System is an economical Artificial Lift method used to de-liquify gas wells and remove contaminants like sand, scale, paraffin and hydrates.

SAZ Plunger Lift enhances production by unloading liquid from the well with marginal flow characteristics due to liquid fall back. During high flow rates, the plunger stays at the top of the well and as soon as liquid loading occurs due to decline in production, the motor valve is closed and the plunger travels through the production tubing to the bottom of the well and lands on a bumper spring. With the well shut-in, the pressure builds up inside the annulus and the motor valve is opened lifting the plunger along with the fluids to the top of the well.

The plunger has enough clearance to allow it to move unhindered up and down the tubing string. However, the clearance is small enough to create a seal between the fluids above and below the plunger. The plunger movement inside the tubing scrapes any initial appearance of paraffin or scale deposits on the tubing string and lifts them to the surface.



An optimized plunger lift well is achieved when the well is operating at the maximum number of cycles possible with the energy available and at the lowest average flowing bottom hole pressure.

Benefits:

- Low initial investment (CAPEX)
- Low operating, repair and maintenance cost (OPEX and R&M)
- Rig not required for installation
- Cost of system is unaffected by well depth

Applications :

- For de-watering gas wells
- Enhance oil production in high Gas Liquid Ratio (GLR) oil wells
- To prevent paraffin and hydrate build-up

Well Candidates

Bypass Plunger

- Operating near critical rate and liquid loading
- Erratic/Unstable production
- Gassy Liquid Wells (particularly HZ/Directional/Shale)
- Paraffin deposits in the production string
- Wells that are currently in some form of intervention (swabbing/intermitting/soaping/venting)

Conventional Plunger

- Liquid Loading due to unstable rates
- High Tubing/Casing Differential (Liquid Loading indicator)
- Wells that are currently in some form of intervention (swabbing/intermitting/soaping/venting)

Plunger Lift System

Plunger Types

Continuous flow / By-pass Plungers

These plungers are typically applied at or near critical velocity and require little to no shut-in, these type plungers open to allow gas passage on the downward travel and typically operate at gas velocities greater than 9 ft/s (calculated at the bottom of the tubing). These plungers are available in variety of types:-

- HSP Ball and Sleeves
- Dart Plungers
- Center Rod Plungers

Conventional Plungers

Conventional plungers are used in wells that require additional energy build-up in order to lift accumulated liquid and plunger. This build-up occurs while the well is shut in at the surface. Various types of Conventional Plungers are:-

- Bar Stock
- Padded Plungers
- Brush Plungers

Fast Fall Plungers

Fast Fall Plungers are designed to run 2-3 times as often as conventional plungers without using any external or mechanical shifting mechanisms. The reduction in close time allows for more cycles per day and optimal fluid removal. These plungers are available in two type:-

- Raptor Fast Fall
- Fast Fall Bar Stock
- TREX Fast Fall

Surface Equipment

Lubricators

- 8 Rd EUE Lubricators
- Bowen Lubricators
- Flange Bottom Lubricators

Lubricator Catchers

- Manual Catcher
- Auto-Catcher
- Catcher Adaptors

Anvil and Rod Product Lines

- Anvil Blind
- Anvil Bypass
- Anvil Rods

Downhole Tools

- Heavy Duty Bumper Springs
- Standard Bumper Springs
- Hold Downs and Collets
- Tubing and Collar Stops
- Multi-stage Tools
- Pack-off tools
- Standing Valves

Plunger Lift Electronics

- Controller
- Arrival Sensor

Accessories

- Plunger Picker Tool
- Plunger Magnets

Plungers

By-Pass (Continuous Flow) Plungers

- By-pass or Continuous Flow Plungers are designed to fall through the flow of the well
- The “By-pass” area of the plunger allow it to fall against flow
- Utilize a valve seat mechanism to open and close by-pass area
- Can make several more cycles per day which yields more fluid removal per day (smaller liquid loads per cycle)
- Great for wells flowing at or near critical flow, wells that recover quickly and gas injection wells
- MUST BE ALLOWED to fall through the flow of the well, not recommended to run from bottom (excessive shut in time)
- Some can be used as “Quick Drop” Plungers but MUST make sure you have fluid to fall through and MUST make sure the plunger does not fall too fast.

By-pass Plungers–Cycle Frequency with By-pass Plungers

- By-pass Plunger cycles should be longer than conventional cycles (top-bottom-top of well)
- Pressure build-up is not necessary but rather flow of the well is important (flowing at or near Critical Flow Rate)

HSP Ball and Sleeve Plungers

- Utilize a two piece ball and seat type mechanism
- Ball weight and sleeve length matched with production volumes
- Able to fall against higher rates (rates of over 1 MCFD)
- Effective on very high rate wells
- Handle sand better than dart style plungers
- MUST be allowed to fall against flow, extremely fast fall speeds and high impacts (over 2500ft/min)
- Proper ball and sleeve pairing is vital

Features

- Choked sleeves to help reduce fall velocity and impact
- Various lengths (6”, 8”, 9”, 10”, 12”,18” (2 7/8)
- Medium to Heavy weight balls available for high flow are wells
- Available in 1-1/2”, 2-1/16”, 2-3/8”, 2-7/8”

Plungers

Dart Plungers

Applications

- Free-flowing, Gas Lift, and Wells in early stages of Liquid Loading
- Moderate to High Rate Production Volumes (Up to 200 bbld)
- Light Paraffin and Solid Production
- Controlled fall speeds and reliable clutch in wet and gassy wells

Features

- Needs very little shut in time (less than 5 seconds) to fall
- Does not need Shut-in to fall (clutch keeps by-pass area open)
- Can fall against rates up to 1200 MCFD and over 200 bbld
- Angled Slots help promote rotation for even wear distribution

Padded Dart Plungers

Applications

- Free-flowing, Gas Lift, and Wells in early-mid stages of Liquid Loading
- High Line pressure wells
- Lower to Moderate Rate Production Volumes (Up to 80 bbld /600 MCFD)
- Recommend clean wells (little to no paraffin, salt, sand)
- Controlled fall speeds and reliable clutch in wet and gassy wells

Features

- Needs very little shut in time (less than 5 seconds) to fall
- Does not need Shut-in to fall
- Can fall against rates up to 800 MCFD and over 60 bbld
- Machined pads help create a seal to utilize lift gas
- Can be used as a quick drop

Plungers

Center Rod Plungers

Applications

- Free-flowing, Gas Lift, and Wells in early-mid stages of Liquid Loading
- Lower to Moderate Rate Production Volumes (Up to 80 bbld / 800 MCFD)
- No separate rod required, best option on odd lubricators where conversion is not available

Features

- Needs very little shut in time (less than 5 seconds) to fall
- Does not need Sut-in to fall against flow
- Machined pads help create a seal to utilize lift gas
- Can be used as a quick drop
- Available in 2-3/8" (Padded Only) and 2-7/8"
- No by-pass area, solid body mandrel
- Wells flowing near and below critical flow
- Lift larger liquid loads per cycle vs. bypass plungers (less cycles per day)

Conventional Plungers

Rotary Sand Plungers

Applications

- Economical Solid and Hollow Body Plunger
- Wells with solids, hydrates, and paraffin production
- Rifles promote aggressive rotation for even wear distribution

Features

- Available in various lengths for different applications
- 4140, 17-4 SS, Hardened Black Diamond Coating Available
- Solid or hollow body
- Available in 1-1/2" to 3-1/2" pipe sizes

Plungers

Scale Buster Plungers

Features

- Solid Body design constructed from 4140 heat treated Steel
- Grooves facing up and down for effective paraffin and scale cutting
- Effective against salt, sand, and other solids when conventional plunger is needed
- Available for 2-3/8” and 2-7/8” Tubing Size
- Available in 12” and 18” length

Pad Plungers–Machined Pads

Applications

- 4140 Precision machined pads and body
- The design incorporates interlocking devices beneath the pad and along the top and bottom of the each pad to keep flow from passing under or around the pads
- Inconel pad springs are the most durable in the industry
- Wear indicators on each pad (top and bottom)

Features

- Available in single and dual pad designs
- Body OD of 1.890” to help utilize lift gas
- 4140 heat treated steel precision machined pads
- Available for 2-1/16, 2-3/8, 2-7/8” Tubing strings

Pad Plungers–Forged Pads

Applications

- Same applications as machined pad plungers
- Forged (cast) pads from 17-4 SS
- All SS version available (built to order)
- More economical than machined pads

Features

- Available in single and dual pad designs
- Body OD of 1.890” to help utilize lift gas
- 17-4 SS casted pads
- Available for 2-3/8” Tubing strings

Plungers

Brush Plungers

Features

- Used as a cleanout plunger to help brush Tubing and clear solids
- Can be used in marginal wells
- Has the best seal compared to any plunger but with less life expectancy (usually 1-2 months max)
- High Temp Nylon Brush with 4140 HT body
- Available for 1-1/2–3-1/2” Tubing sizes

Decelerator Plungers

Features

- Used as a test plungers in wells that have bottom hole nipples
- 1.890” NO-GO bumper stop at the bottom of the plunger
- Can be used in marginal wells (regular inspections recommended)
- Pad body and Bar Stock body available
- Available forc2-3/8” and 2-7/8” tubing sizes

Fast Fall Plungers

Applications

- Used as a gap or bridge plunger between by-pass and conventional plunger cycles
- Falls significantly faster than conventional but not as fast as by-pass plunger
- NOT able to fall against flow of well (needs shut in time)
- Great for “Tight” gas wells or wells that recover quickly

Plungers

Raptor Fast Fall Plungers

Applications

- Wells in the beginning stages of liquid loading
- Conventional plunger applications in wells that recover quickly
- High gas / high liquid / to low gas / low liquid wells

Features

- 3/8” bypass port to fall quickly to bottom
- First plunger of its kind to utilize a check valve that seals on the up-stroke
- Offset 5/16” extra strength coiled pin with 12,000lb shear strength to retain ball and seat
- No rod or conversion anvil needed in conventional plunger lift lubricator
- Up to 725ft/min fall rate in gas and 100ft/min fall rate in fluid

Fast Fall Bar Stock Plungers

Applications

- Falls faster than a conventional bar-stock plunger
- NOT able to fall against flow of well (needs shut in time)
- Great for “Tight” gas wells or wells that recover quickly

Surface Equipment

8 Rd EUE Lubricators

Applications

- Low pressure application (3,000 psi & 5,000 psi)
- Sweet Gas and Low CO2 Applications
- Easy to install on the tree

Features

- 1026 Steel
- Extra heavy wall thickness
- 3K and 5K versions available
- Flange base and outlets Available
- Solid Cap with no Threads or Welds
- Screened Outlets to prevent ball down flow line
- Tested to 6000 & 7500 psi

High Pressure Bowen Lubricators

Applications

- Higher Pressure Applications
- High Impact Velocity Applications
- Sour and Cold Service

Features

- Fully Machined Body
- Welded Versions are also available
- 4130 Q&T Steel
- All Caps have handles and ½" NPT port
- Meets or Exceeds API 6A, PLS 3 & NACE MR0175 Standards
- 5K and 10K flange options
- 5K version fail tested to 14,900 psi

Surface Equipment

Lubricator Selection Guide				
Body Type	Welded Ports & Thread-o-lets	Welded Ports & Thread-o-lets	Fully Machined Body	Fully Machined Body *Welded Flange Ports*
MAWP	3,000 psi	5,000 psi	5,000 psi	10,000 psi
Tested Psi	6,000 psi	7,500 psi	7,500 psi	14,900 psi
Temp. Rating	(-) 20 to >180° F	(-) 20 to >180°F	(-) 50 to >180°F	(-) 50 to >180°F
Service Type	Sweet/Light H2S & CO2	Sweet/Light H2S & CO2	Cold and Sour Service	Cold and Sour Service
Cap and Threads	Fully Machined, 8 RD EUE	Fully Machined, 8 RD EUE	Bowen 4-3/4" ACME	Otis 5-3/4" ACME
Base type and Threads	8 RD EUE Threads Flange, specified by order	8 RD EUE Threads Flange, specified by order	Flange, Specified by order	Flange, Specified by order
Catcher Type	Manual/Auto/ Interchangeable	Manual/Auto Interchangeable	Manual/Auto interchangeable	Manual/Auto interchangeable
Manual Catcher	5,000 psi	5,000 psi	5,000 psi	10,000 psi
Auto Catcher	5,000 psi	5,000 psi	5,000 psi	N/A
Material	1026 Steel designed with extra wall thickness and 4 pass welds for longevity. Minimal Sour Service <0.05 psi Partial Pressure	1026 Steel designed with extra wall thickness and 4 pass welds for longevity. Minimal Sour Service <0.05 psi Partial Pressure	4140 & 4130w, 90,000-120,000 tensile strength. No tubular welds on uni-body Meets or exceeds API 6A NACE compliant for sour applications	4140 & 4130w, 90,000 -120,000 tensile strength. No tubular welds on uni-body Meets or exceeds API 6A NACE compliant for sour applications

Auto Catcher

Applications

- By-pass Plungers running with After-flow
- Lower fluid volumes (helps prevent "Free-Cycles" and dry trips)
- Easy to install and maintain
- Interchangeable between 8Rd and Bowen Lubricators (Epic)

Features

- SS Material to prevent corrosion and rust
- Uses Kim Ray Inc. Top Works and stuff-n-box for high quality and
- reliability U.S.A. products!
- Tested and Rated for up to 5,000 psi
- Adaptors available for most major MFG Plunger Lubricators

Surface Equipment

Anvil and Rod Product Line:

Anvil are used in the lubricator to stabilize the shock spring. The shock spring is fitted over the rod and the base section fits inside a groove at the top of the lubricator body. The lubricator cap is then fitted over top and screwed down.

Anvils

- Anvil for Most Major MFG plungers
- IPS
- PCS FB (RED AND BLUE LUBRICATORS)
- FLOW CO
- WELL MASTER
- WEATHERFORD
- DEFOPT
- PRIORITY
- 8 Rd. Lubricators and Bowen Lubricator Solid and By-pass Conversions Available

Rods

- Straight Rods at various lengths (24, 27, 35”) and thickness
- Tear Drop Rods for Ball and Sleeves
- Long and Short Rods
- Fat Boy Rods
- Tear Drop Groove

Downhole Assembly Tools

Heavy Duty Bumper Springs

Features

- Used with fast falling plungers and by-pass plungers
- Large ports for maximum flow and least amount of downhole re-striction
- Heavy duty extended spring for maximum durability
- 17-4 SS head with 17-7 SS Spring and NACE Body construction
- Titanium head available for ball and sleeves
- Inconel spring available for H2S and CO2

Applications

- Interchangeable with 3 cup hold downs, collet latch downs, collar

Standard Bumper Springs

Features

- Economical BHBS used with conventional plungers to slower falling by - pass plungers
- Constructed from Stainless Steel and NACE material
- Interchangeable with 3 cup hold downs, collet latch downs, collar stops, and TBG stops

Hold Downs and Collets

2 and 3 Cup Hold Downs

- Used to seat BHBS in seat nipple and profile nipples
- Interchangeable with different style of seating cups
- Largest flow through area on the market
- Built in NO-GO on top of tool
- Available in 1-1/2”–2-7/8”

Heavy Duty Collet Latch Downs

- Wells with no seat nipple, set above deviations, or with debris or ob-struction in TBG
- Used with fish-neck stops
- Strong deep fingers to allow maximum hold

Downhole Assembly Tools

Tubing Stops

Applications

- Wells without or highly deviated seat nipple
- Gas Lift wells or wells with TBG perforations
- Setting in TBG string without upsets or a need for a more secure and / or positive barrier than a collar stop
- Higher rate wells (fluid and gas) for a better hold
- Fish neck or threaded available
- Available in 1-1/2”–2-7/8” TBG

Collar Stops

Applications

- Wells without or highly deviated seat nipple
- Gas Lift wells or wells with TBG perforations
- Setting in TBG string in-between two joints in a collar
- Moderate rate wells (fluid and gas) for a Features
- Built in NO-GO on Threaded Version
- Fish neck and Threaded Versions available
- NACE Material for corrosion resistance
- Inconel springs for maximum durability
- 2-3/8–2-7/8 TBG available

Multi Stage Tool

Applications

- Marginal Wells that struggle to run a conventional plunger
- High fluid producing wells with low gas volumes (Low GLR)
- Wells that need extended shut in time to lift conventional plunger
- Entirely mechanical; no power or fuel requirement
- Lower installation costs than gas lift and pump jacks
- Works with existing plunger lift equipment
- Available in 2-3/8 and 2-7/8 TBG

Downhole Assembly Tools

Pack-Off Tools

Applications

- Used to isolate fluid above any given point in the TBG string
- Can be used with collar stops, TBG stops and other stop tools
- Used to operate a Pressure Relief Standing Valve or Standing Valve in TBG string

Features

- 100% redressable in the field
- Easy to set and remove
- 4140 and NACE body constructed
- 2-1/16", 2-3/8, 2-7/8 TBG available

Auto Dump (Pressure Relief Standing Valves)

Applications

- Lower fluid volume wells with conventional plungers
- Used to ensure fluid is retained in the TBG during shut in
- Pressure relief spring will retain a positive seal until the amount of pressure differential across the valve is met
- Testing TBG and or batch treating below TBG
- Used a "Reset" button in loaded up wells

Features

- Inconel X750 pressure relief spring
- Durable seat and ball for extended life
- Redressable and low maintenance

Plunger Lift Electronics

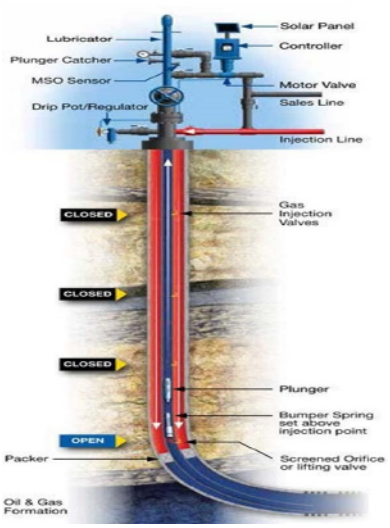
Controller System

- Designed with the operator in mind
- Stand Alone or Modbus capable
- Low power and maintenance
- Plunger Lift SCADA Page coming soon!
- One model for all applications
- Timer
- Auto Adjust-Time
- Pressure Modes (transducers needed, sold separately)
- Load Factor–Open
- Pressure Open–TBG, CSG, Line
- CSG Upturn–After Flow
- Hi-Lo Controller
- Custom Applications available upon request!

Arrival Sensor

- 3D Arrival Sensor
- Detects in 3 Axis, X, Y, and Z
- Class 1 Division 2 Certified
- Works with all major MFG controllers and SCADA
- 5 volt–28 volt systems
- Screw Cap with o-ring to deter moisture
- Test LED light in every unit
- Test switch to enable
- Sensitivity Adjustment in every unit
- Explosion Proof Container Available

Gas Assisted Plunger Lift



- Gas Assisted Plunger Lift (GAPL) is a hybrid method of gas lift that utilizes a plunger to increase efficiency of lift gas
- Can help eliminate common GL inefficiencies
  - Over Injection
  - Liquid Slippage
  - Paraffin Formation (cooling effect)
- Plunger provides a mechanical interface between gas & liquid
- Bypass plungers will not cause valve transfer issues and are appropriate tool for GAPL
- May delay or eliminate the need to pull TBG and redesign Gas Lift System as well conditions change

GAPL Benefits

- Interface provides full sweep of liquids in production string, where slippage typically still occurs
- Maximizes fluid recovery (oil)
- Paraffin control. Solidifies in upper end of production string where velocities are highest.
- Cooling effect occurs from injection point around GL valves, interrupting operation and hindering production. Plunger alleviates issue.
- Solids control (Scale and Iron Sulfates). Keeping tubing clear.
- Lower BHFP, lower drawdown will yield net production gains/uplift
- As this happens, have the ability to lower injection rates or eliminate injection completely. Release compression, etc.

GAPL Candidate Selection

- Wells that produce up to 350-500Bblsliquids per day, depending on tubing size (2 3/8” 350BblsMax & 2 7/8” 500BblsMax)
- GLR equivalent to 350-500Bbls/750Mcf/d-1MMcf/d Gross Gas
  - Depends on fluid cut (50%+ Oil = lighter weight = larger pool of well candidates)
  - Have seen success with lower GLR
  - Line Pressure has to be considered
- GL Designs with GAPL as long-term vision, can be more effective. Set SN just above bottom valve or screened orifice. A packer-less application can allow you to inject around EOT and right-size compression through the life of the well.
- Stand-alone Bypass PL (no Gas Lift assistance) can operate with up to 400 Bls/1MMcf/d, depending on tubing size, line pressure in field

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