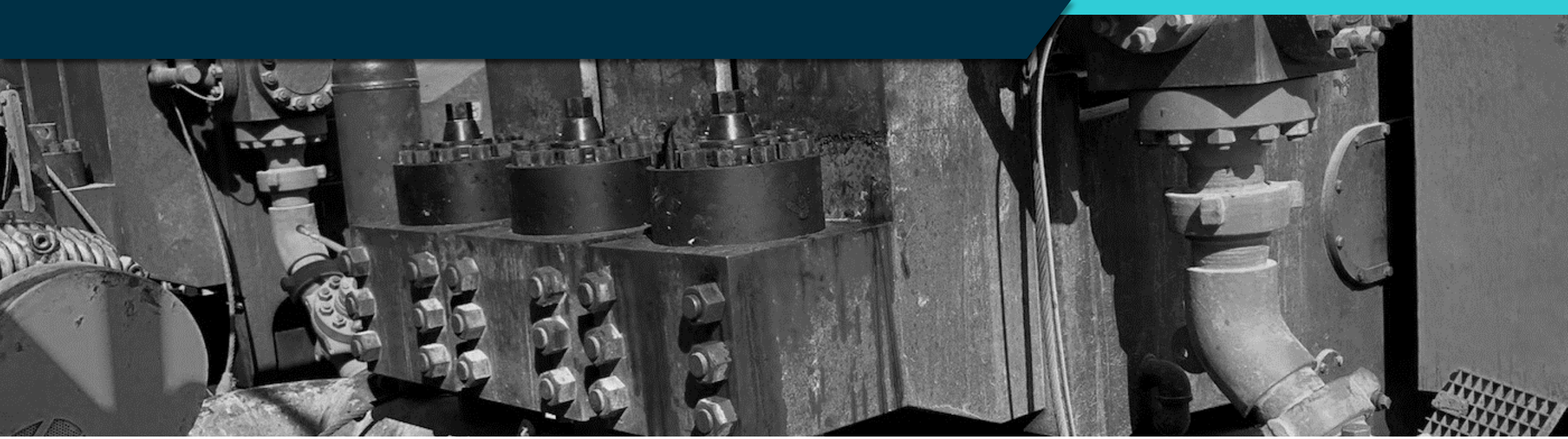


FET™

P-QUIP SYSTEMS

GENERAL OVERVIEW







P-Quip - OVERVIEW

P-Quip Overview

History

- P-Quip has been offering aftermarket/alternative systems for Liner Retention Valve Cover and Rod systems for over 25 years, we also offer Strainer systems, Washpipes and some specialized operational tools.

What it replaces

- OEM – Hammer up and standard clamp style systems

What it does

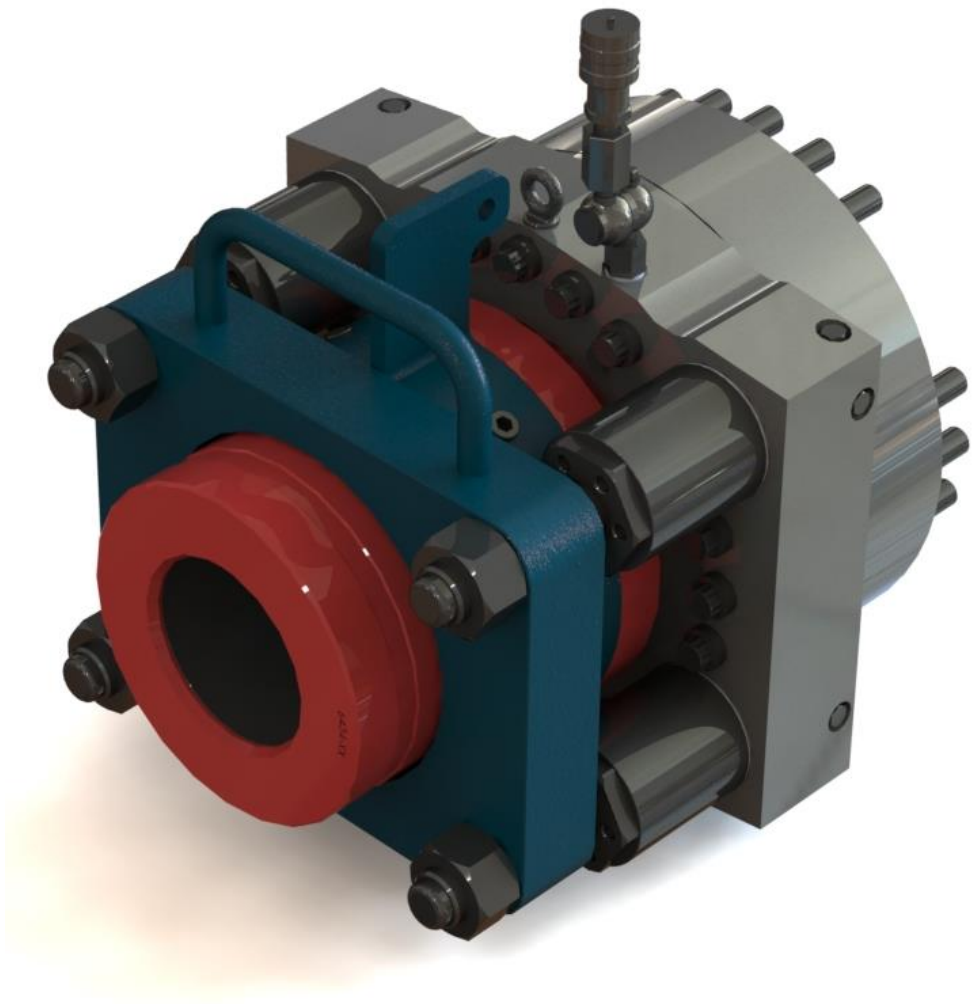
- Rod system replaces OEM 1 or 2 piece Rod using clamps making Piston/Swab change out quick and safe.
- Retention systems all have basic same functionality… they compress a seal in order to retain pressure within the fluid end module with the additional benefits of being very quick and safe to use compared to OEM hammer up or clamp style systems.



SYSTEM OVERVIEW

P-QUIP LRS

- Designed for the future with 10k operating pressures in mind, yet still being a fully backwards compatible plug n play system using the proven technology that has made it No.1 in the field for over 25 years.



Easy to Operate

- Automatic clamping means no more under- or overtightening
- Direct replacement for OEM equipment (plug and play)
- Versions available for most pumps 1,000 HP to 3,000 HP

Efficient

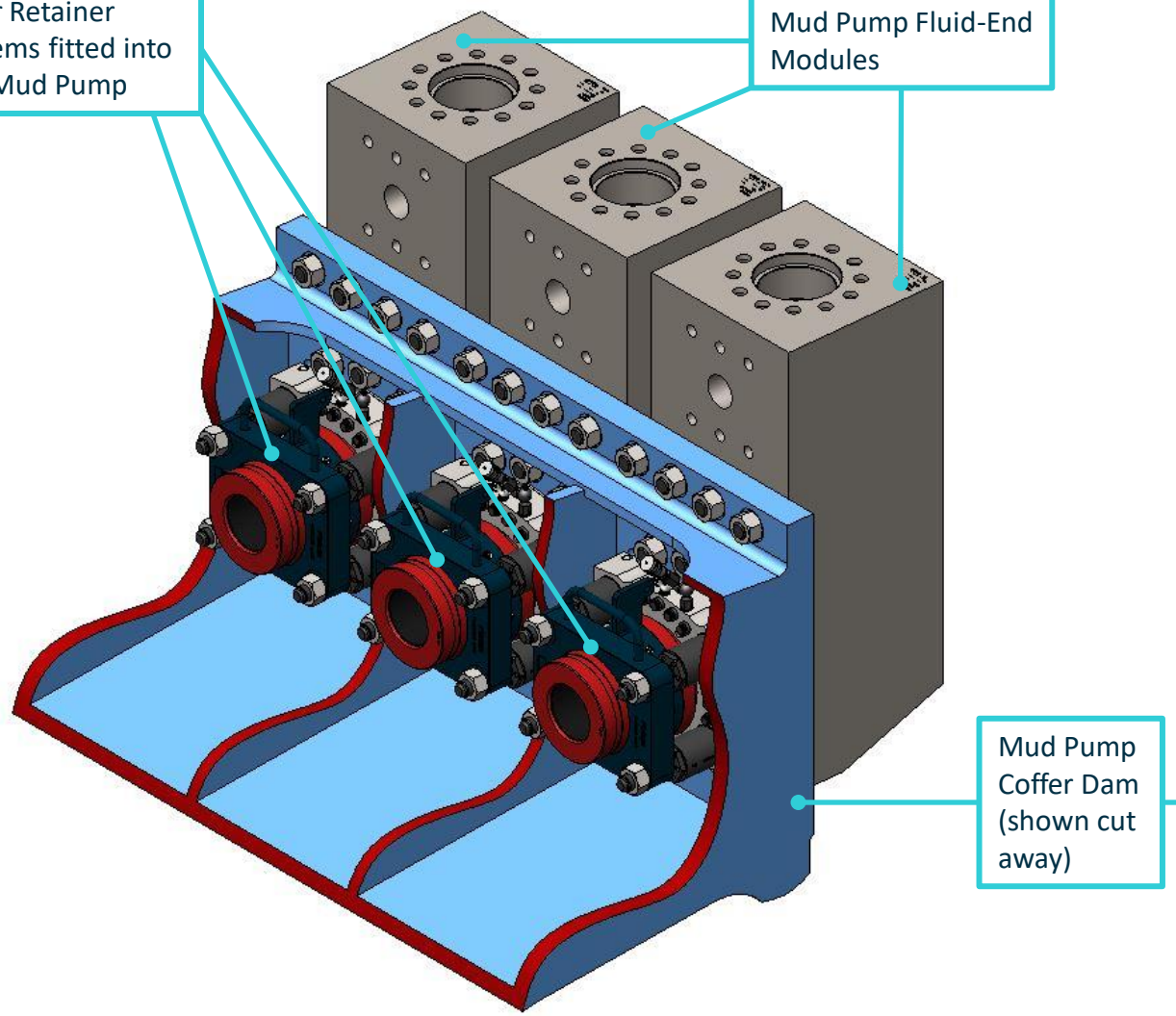
- Decreased downtime, up to 90% faster liner change out times
- 50% Lower lifecycle cost over 10 years versus competition
- Scope 3 GHG Footprint reduced by 5x over life of Rig
- Proven life of up to 20 years

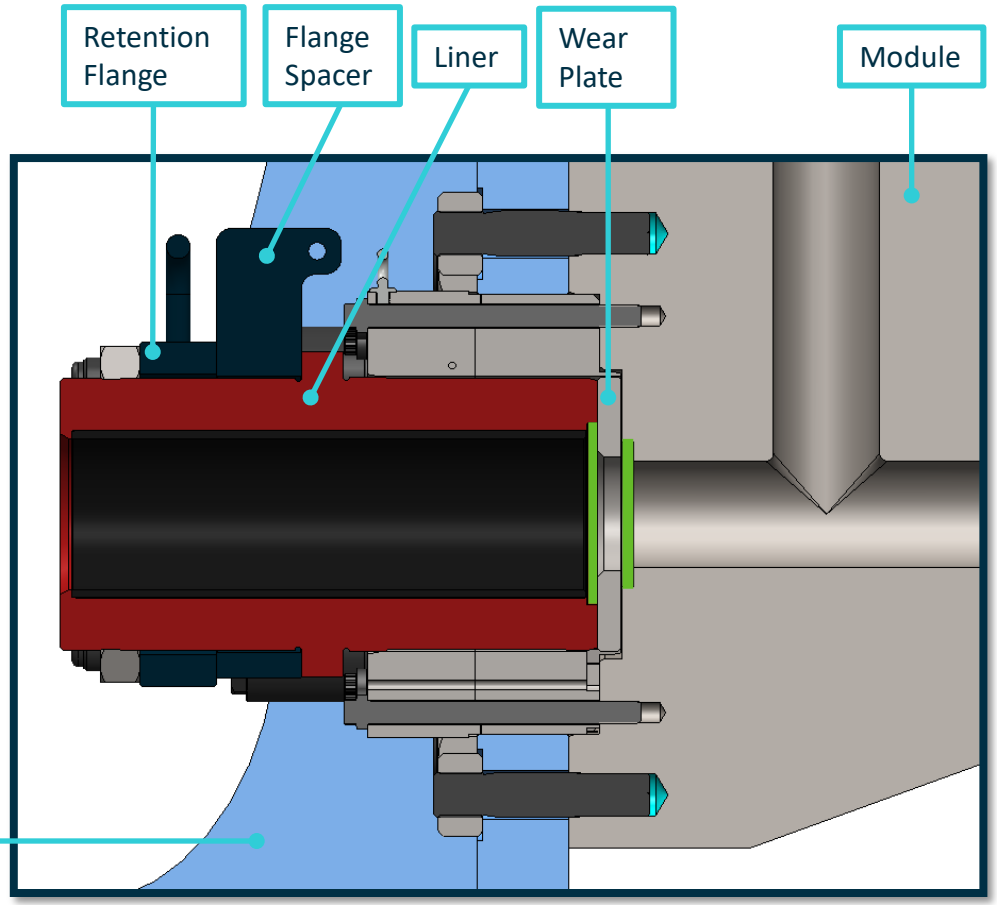
Safe

- Inherently safe, no hammers or cheater bars required to install or operate
- Easy operation with a conventional air- or hand-operated hydraulic pump
- Built in Liner lifting devise making change out quick and safe and removing need for manual handling.

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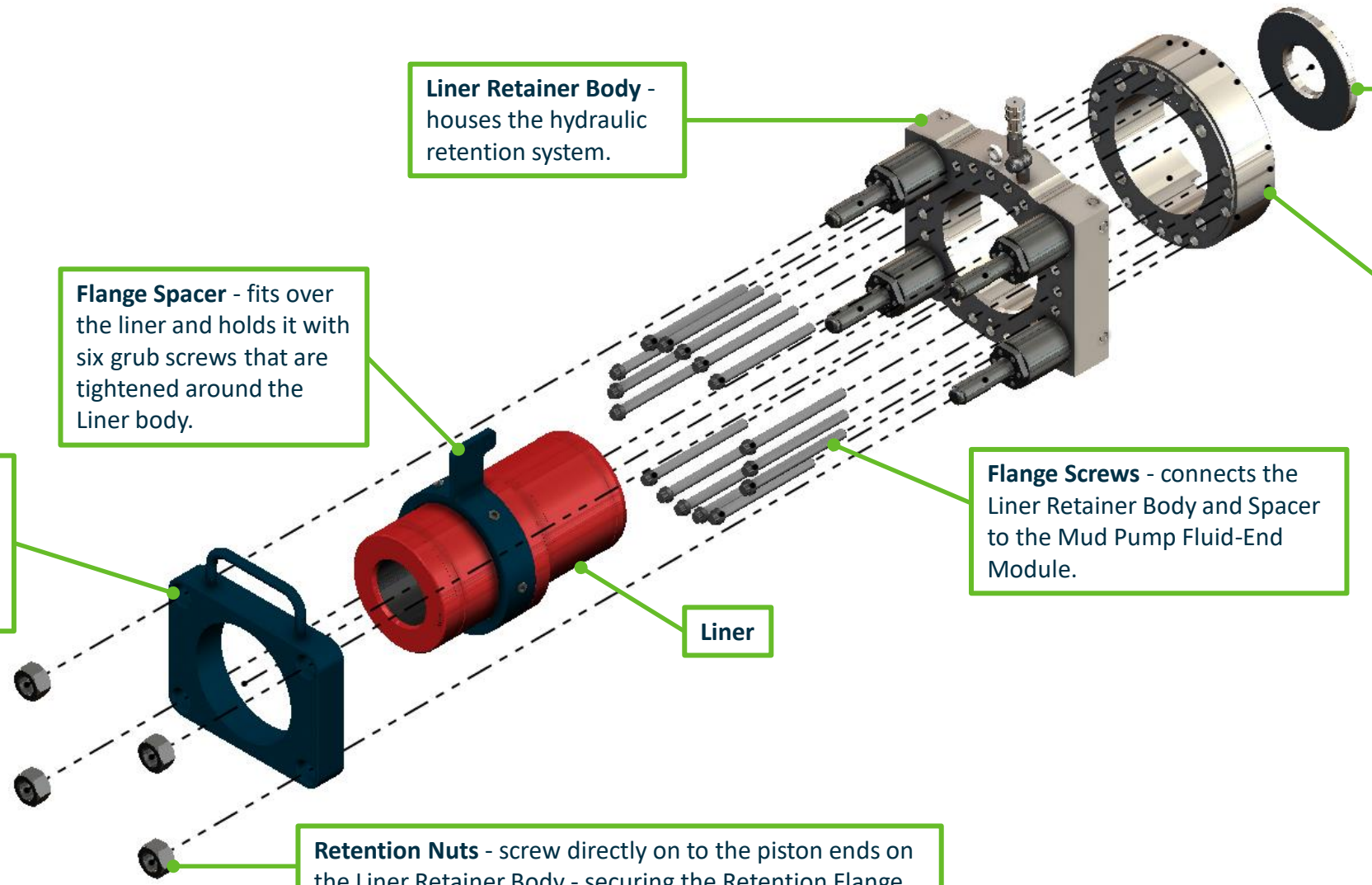
SYSTEM INSTALLED ON MUD PUMP





The Liner is fully retained by the spring force from the retention pistons - maintaining a metal-on-metal connection between the Retention Flange, Flange Spacer, Wear Plate and Module.

EXPLODED VIEW / COMPONENT FUNCTION



Liner Retainer Body - houses the hydraulic retention system.

Wear Plate - a sacrificial part that helps reduce wear on the Liner and Mud Pump Fluid-End Module.

Flange Spacer - fits over the liner and holds it with six grub screws that are tightened around the Liner body.

Spacer - fits between the Mud Pump Fluid-End Module and the Liner Retainer Body.

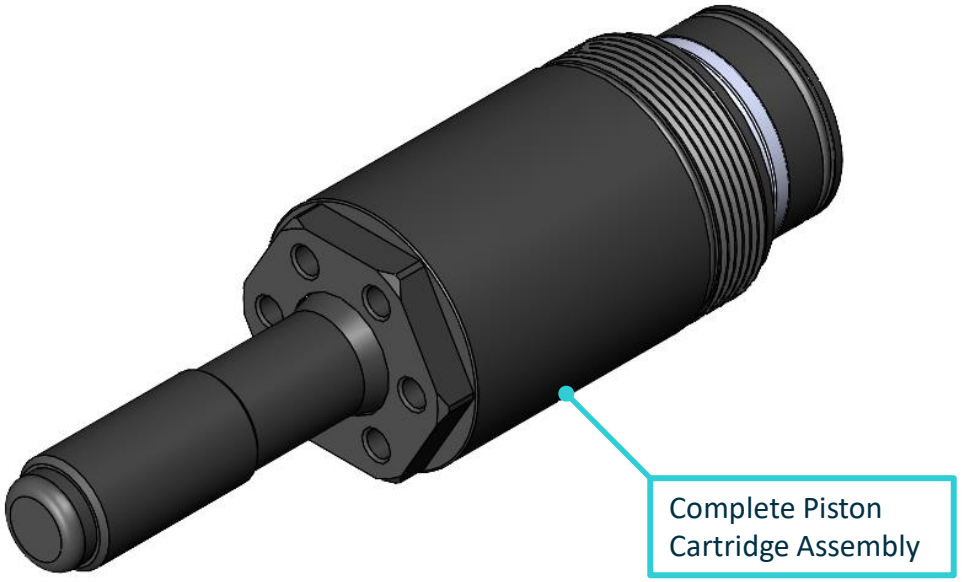
Retention Flange - retains the Liner in position under the spring force from the single-acting cylinders in the Liner Retainer Body.

Flange Screws - connects the Liner Retainer Body and Spacer to the Mud Pump Fluid-End Module.

Liner

Retention Nuts - screw directly on to the piston ends on the Liner Retainer Body - securing the Retention Flange.

RETENTION PISTON CARTRIDGE ASSEMBLY

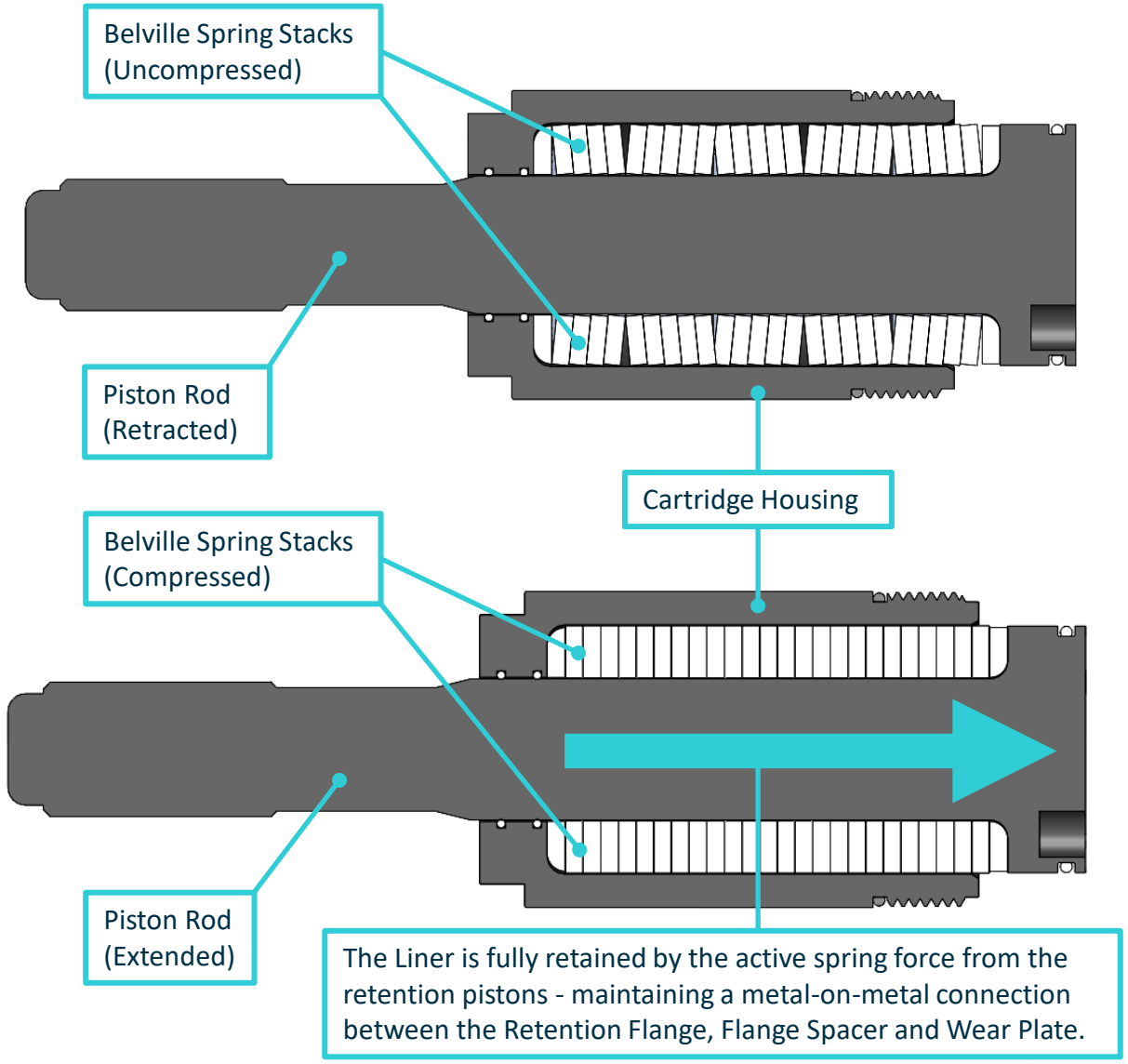


Equivalent Spring Force per Piston:

58,300 lbf (~29 tons)

Total Retention Force Available Across All 4 Pistons:

233,200 lbf (~116 tons) 1.5 x max uplift



SYSTEM OVERVIEW



Efficient

- Decreased downtime, up to 66% faster Piston change out times
- 50% Lower lifecycle cost over 10 years versus competition
- Scope 3 GHG Footprint reduced by 5x over life of Rig
- Proven life of up to 20 years

Safe

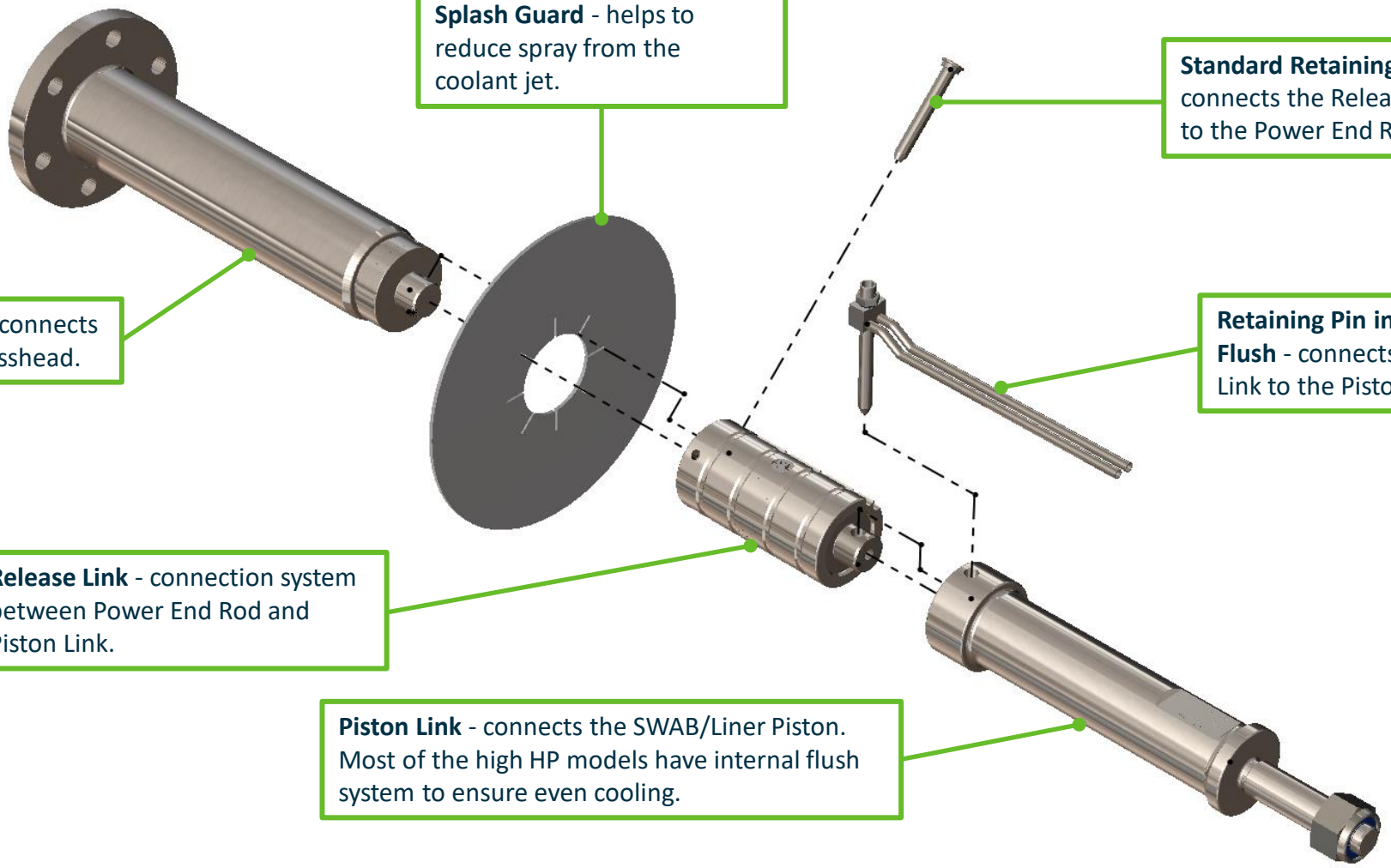
- Inherently safe, no hand injuries due to wrench slippage, sheared fittings or hammering
- Simple hydraulically actuated system that is fully passive (0 psi) during pump operations

Easy to Operate

- Consistent retention force means no more under- or overtightening of mechanical systems
- Direct replacement for OEM equipment (plug and play)
- Versions available for most pumps 1,000 HP to 3,000 HP

EXPLODED VIEW / COMPONENT FUNCTION

STAINLESS STEEL ROD CONFIGURATION



Splash Guard - helps to reduce spray from the coolant jet.

Standard Retaining Pin - connects the Release Link to the Power End Rod.

Power End Rod - connects to mud pump crosshead.

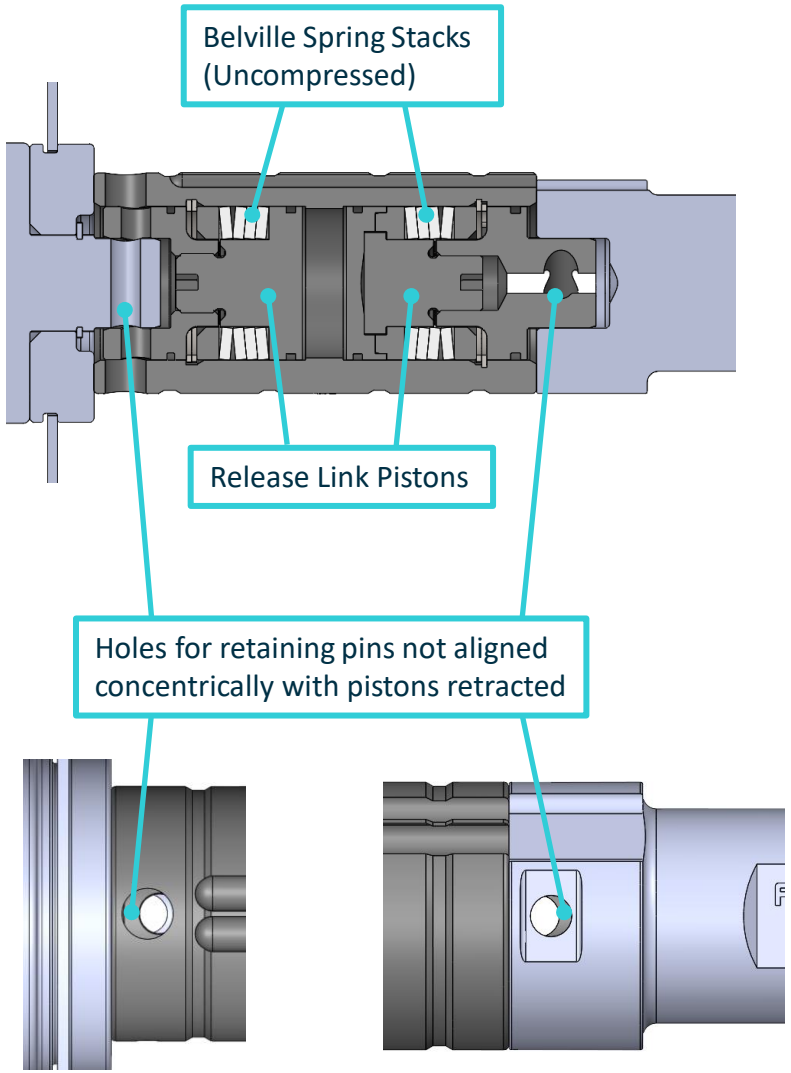
Retaining Pin including Liner Flush - connects the Release Link to the Piston Rod.

Release Link - connection system between Power End Rod and Piston Link.

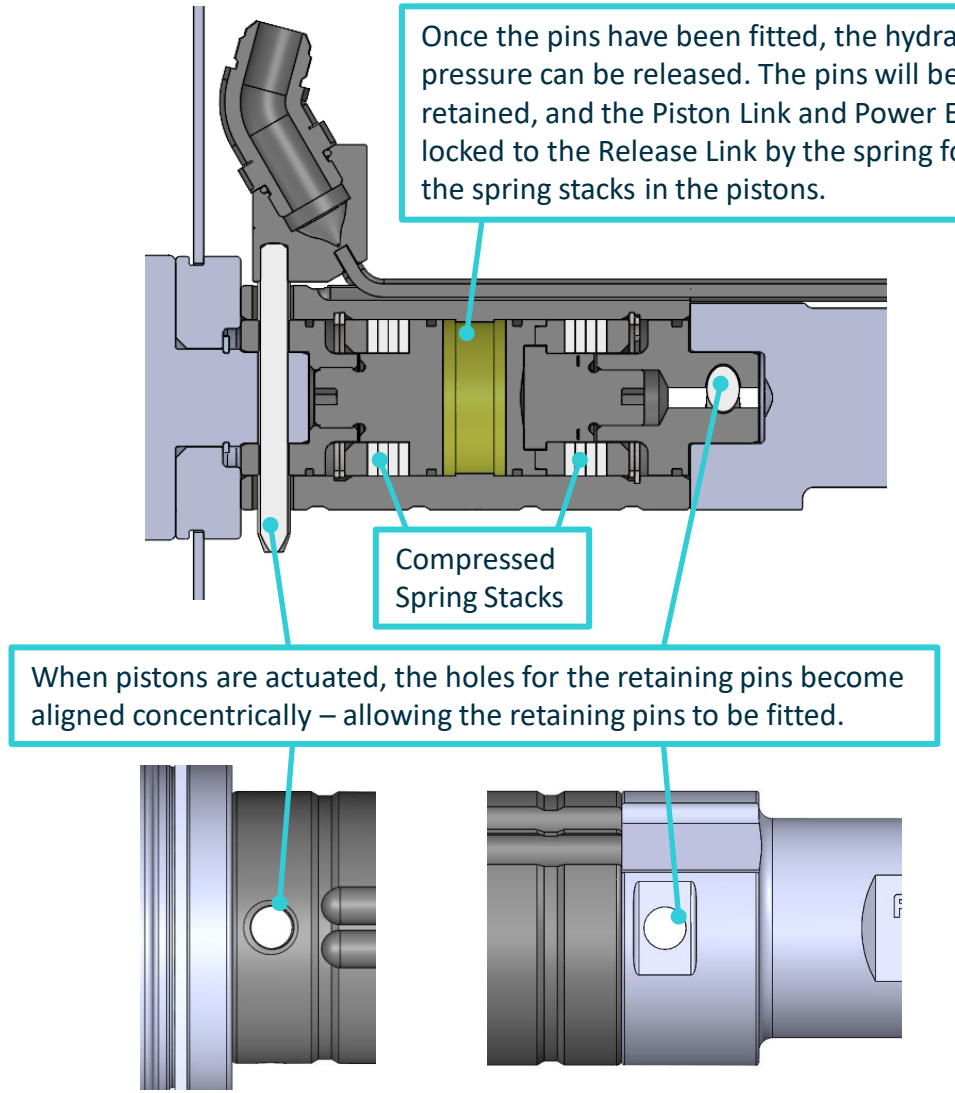
Piston Link - connects the SWAB/Liner Piston. Most of the high HP models have internal flush system to ensure even cooling.

RELEASE LINK – CROSS SECTION

NO HYDRAULIC PRESSURE



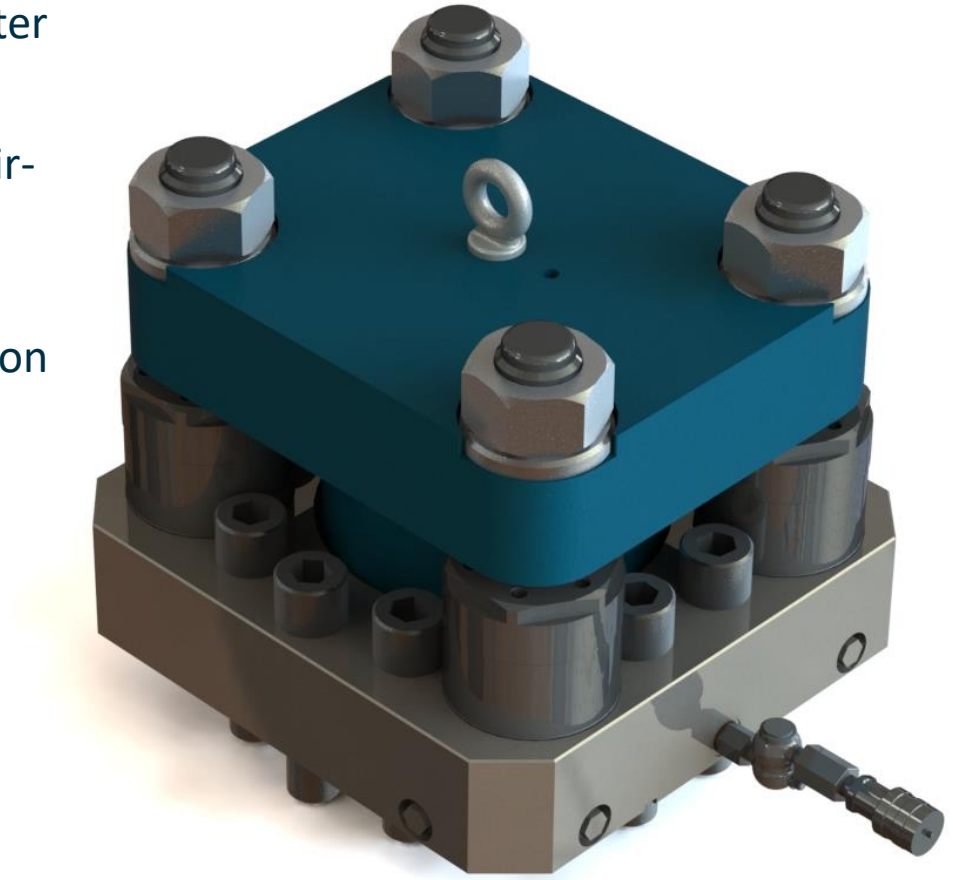
SYSTEM CHARGED – SPRINGS COMPRESSED



SYSTEM OVERVIEW

Safe

- Inherently safe, no hammers or cheater bars required to operate
- Easy operation with a conventional air- or hand-operated hydraulic pump
- Reduced HSE risks and costs, due to lost time incidents such as overexertion etc. since hammers and cheater bars are eliminated



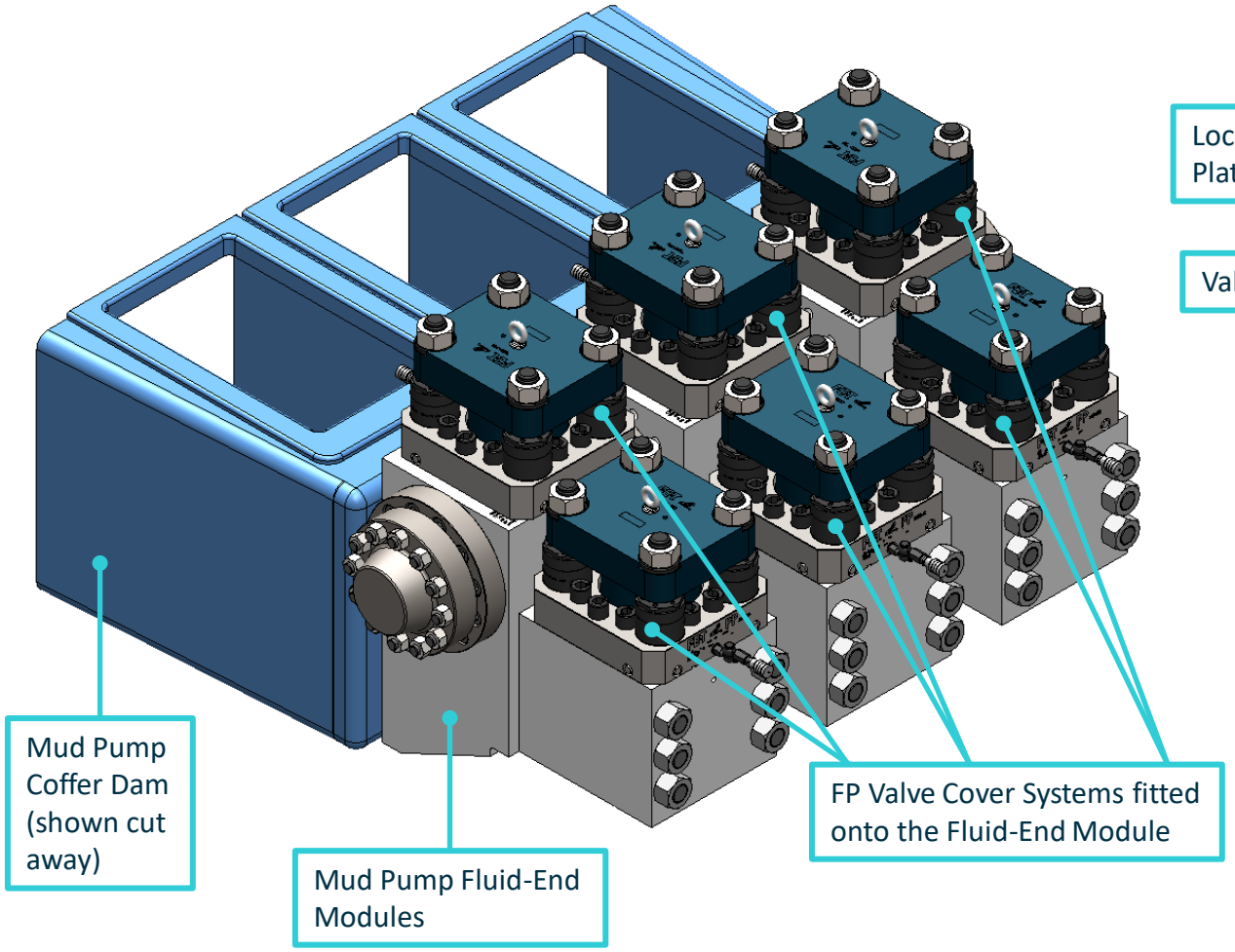
Easy to Operate

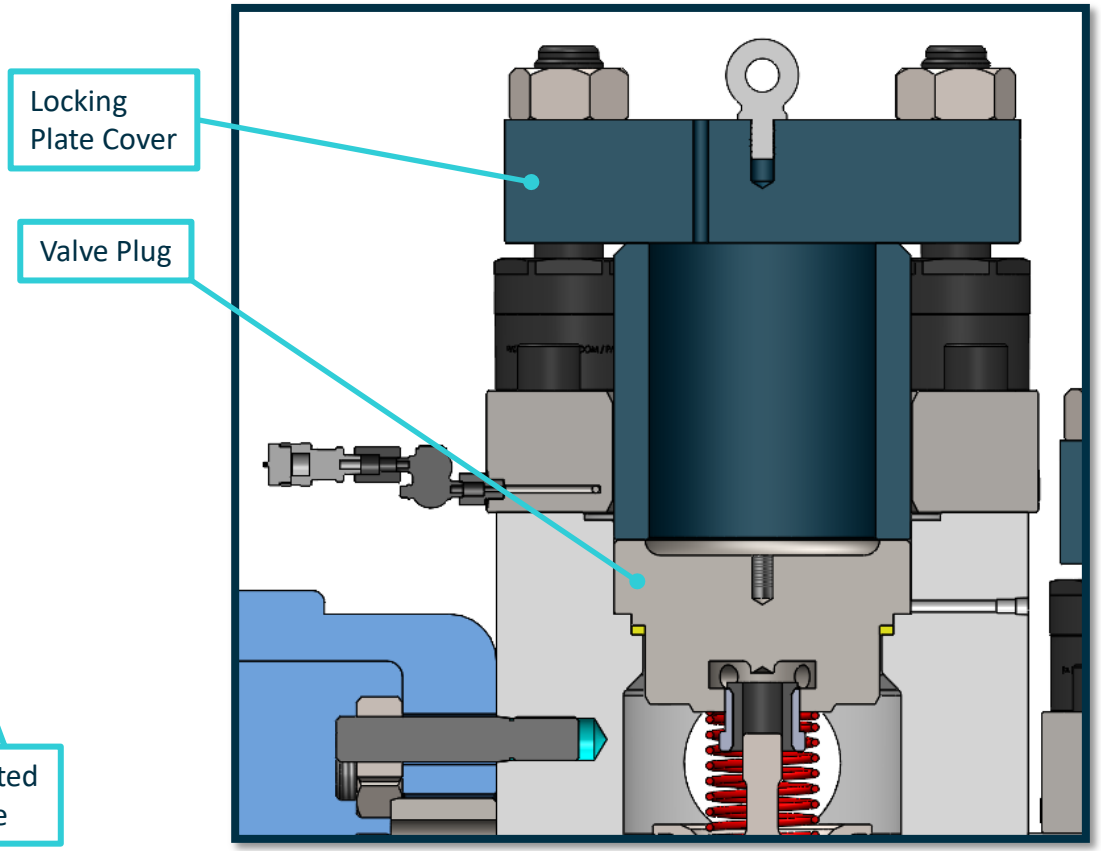
- Automatic clamping means no more under- or overtightening
- Direct replacement for OEM equipment (plug and play)
- Versions available for most pumps 1,000 HP to 2,200 HP

Efficient

- Decreased downtime with quick and easy installation and change-outs
- Improved drilling efficiency and equipment life since automatic clamping means no more under or over tightening

SYSTEM INSTALLED ON MUD PUMP





The Valve Plug is fully retained by the spring force from the retention pistons - maintaining a metal-on-metal connection between the Locking Plate Cover and Valve Plug.

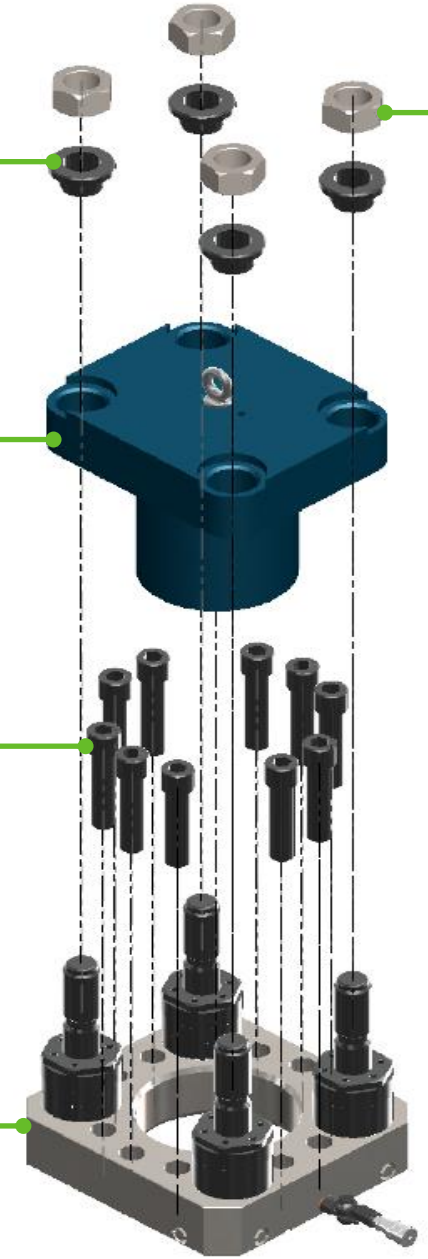
EXPLODED VIEW / COMPONENT FUNCTION

HD Bushings - provides a snug fit between the Retention Pistons, Retention Nuts and the Locking Plate Cover.

Locking Plate Cover - retains the valve plug in position under the spring force from the single-acting cylinders in the Valve Cover Body

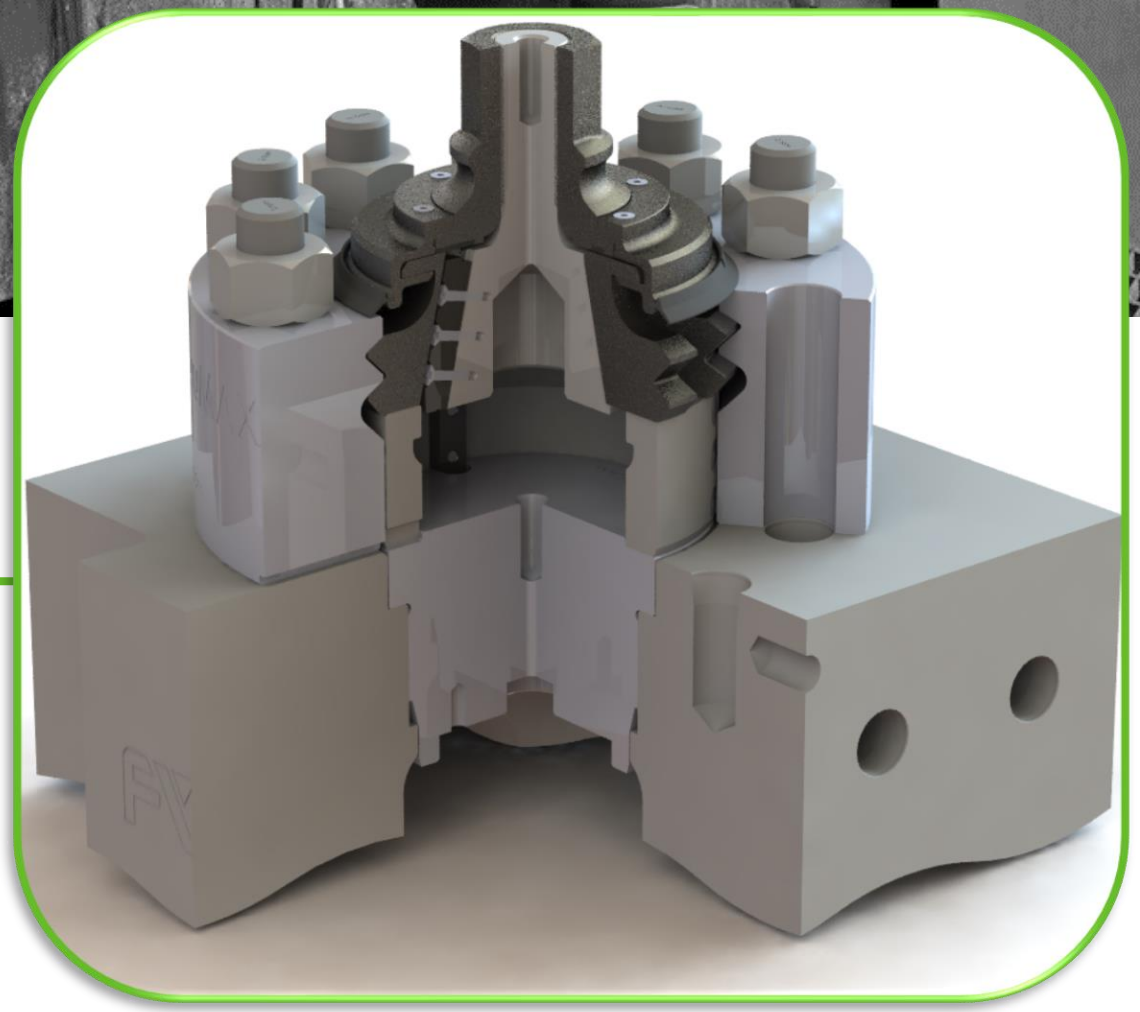
Flange Screws - connects the Valve Cover Body and Spacer to the Mud Pump Fluid-End Module.

Valve Cover Body - houses the hydraulic retention system.



Retention Nuts - screw directly on to the piston ends on the Valve Cover Body - securing the Retention Flange.





P-QUIP ML SERIES VALVE COVER

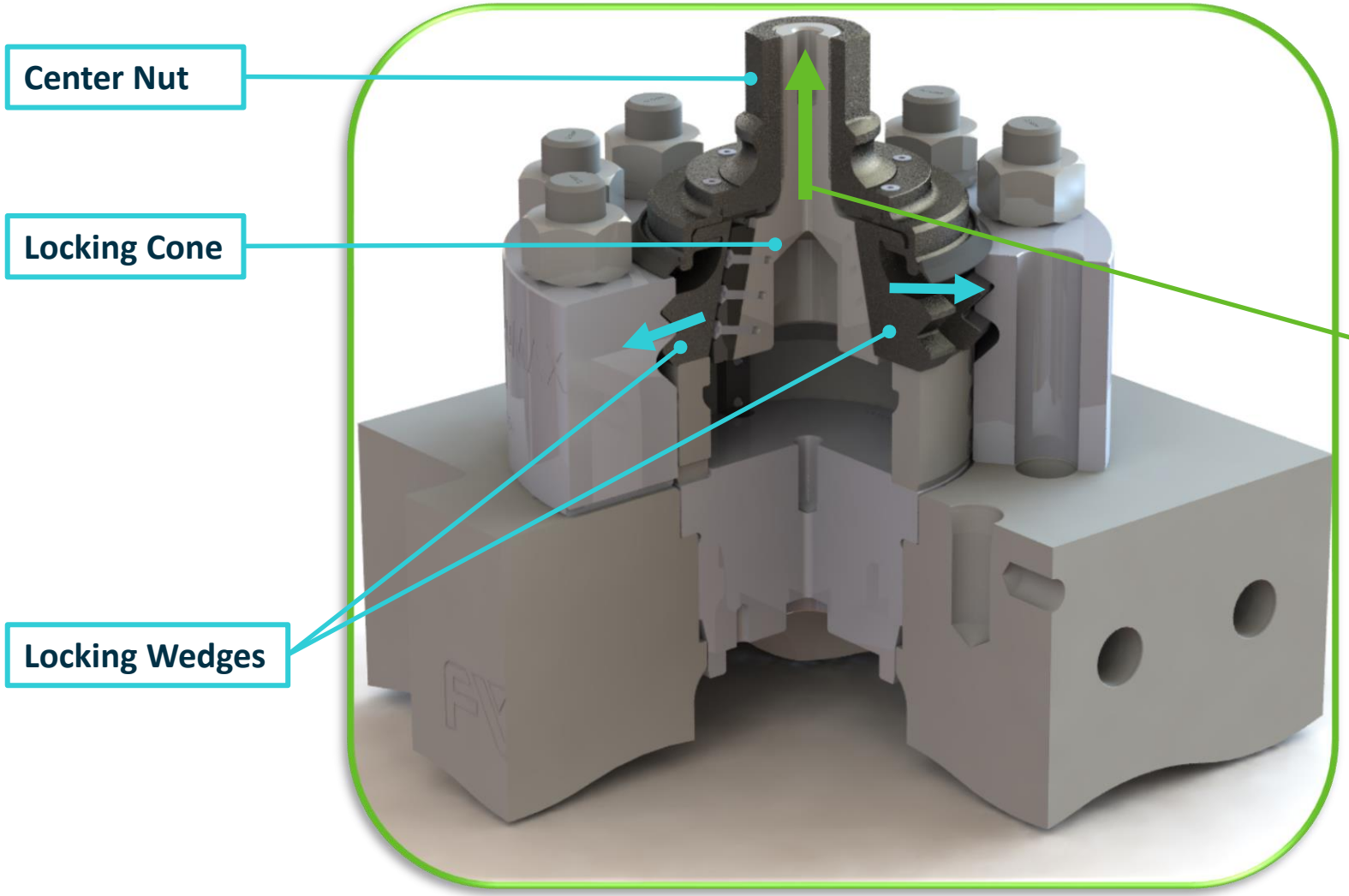


P-QUIP (ML) Valve Covers

- Access valves & seats < 90 seconds, reducing downtime and increasing efficiency
- Reduces LTI's & OSHA incidents
- One-Piece locking system for consistent retention
- Prevents leakage and excessive plug breathing
- Robust assembly eliminates binding or locking during use
- Retraction & expansion controlled by guides for smooth operation
- Available for API-6 & API-7 configurations
- Mechanical lock retention technology developed to improve retention performance on critical rig equipment.

P-QUIP ML VALVE COVER CROSS-SECTION

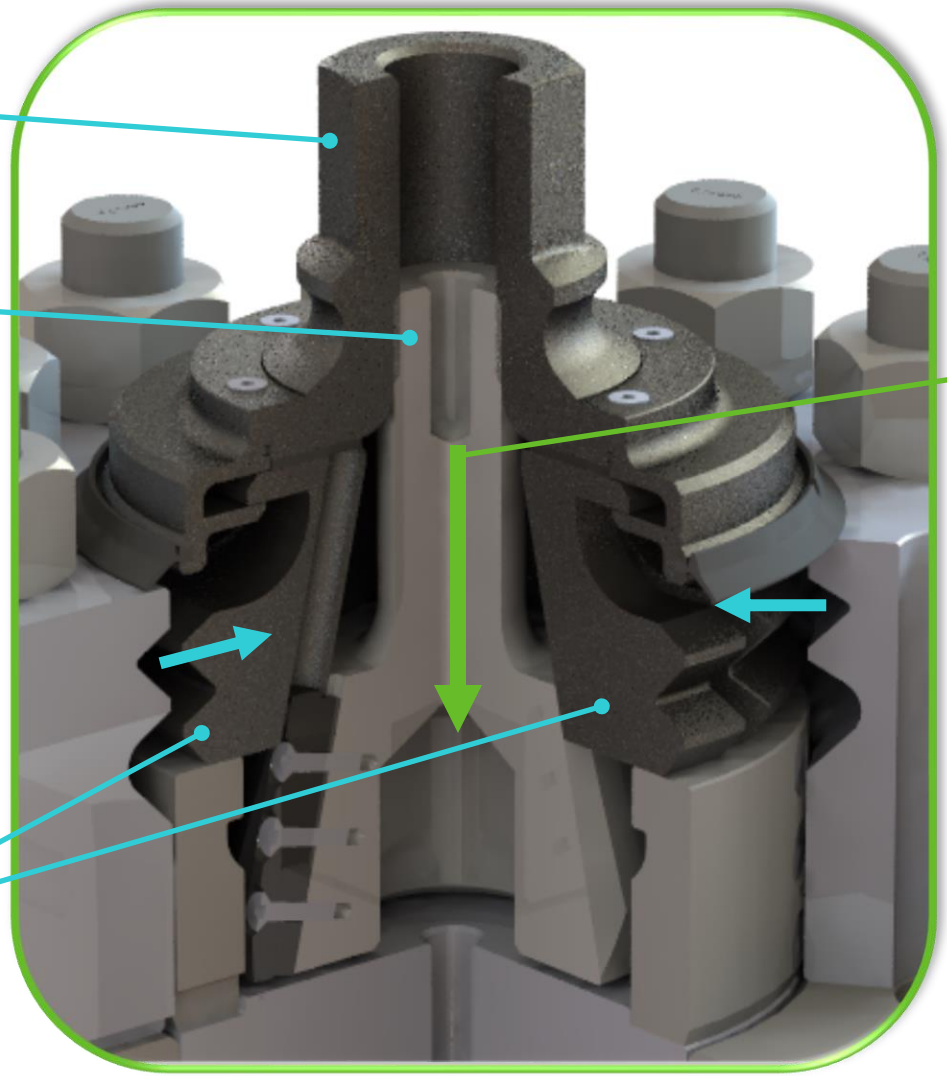
LOCKING WEDGES ENGAGED



- The **Locking Cone** is raised by using an impact wrench to tighten the **Center Nut**.
- This pushes the **Lock Wedges** into the corresponding grooves in the **Cover Flange**.
- The **Valve Cover** will be fully engaged when the **Centre Nut** is fully torqued to the required figure – locking the wedges in place.
- No hydraulic pumps are needed to install and operate the ML Valve Cover.

P-QUIP ML VALVE COVER CROSS-SECTION

LOCKING WEDGES DISENGAGED

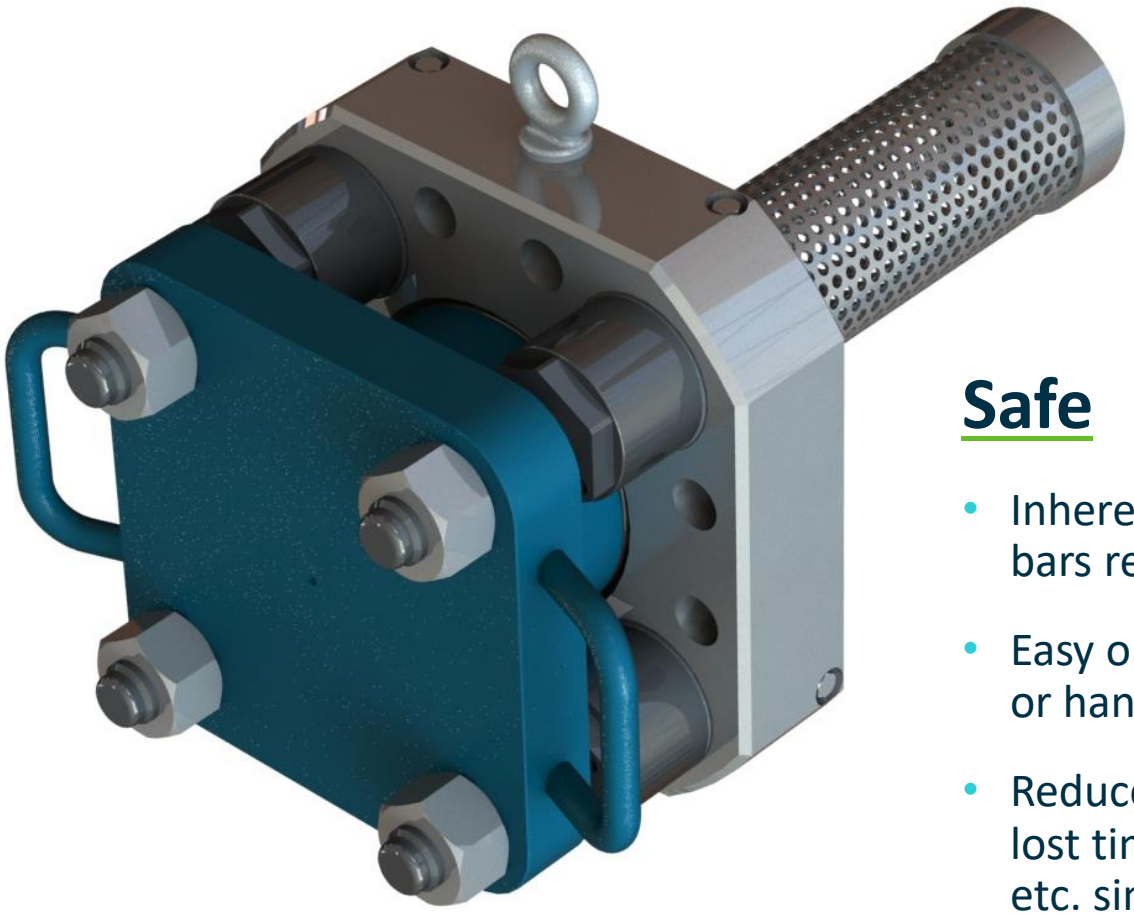


- The **Locking Cone** is lowered by using an impact wrench to loosen the **Center Nut**.
- This releases the **Lock Wedges** from the corresponding grooves in the **Cover Flange**.
- The central locking assembly and plug can now be lifted from the module with the T-handle provided with the valve cover.

SYSTEM OVERVIEW

Efficient

- Decreased downtime with five-minute clean out or strainer change
- Improved drilling efficiency and equipment life since automatic clamping means no more under or over tightening and prevents cover from loosening during operation
- Rugged stainless steel strainer tubes extend product lifecycle – reducing lifecycle costs



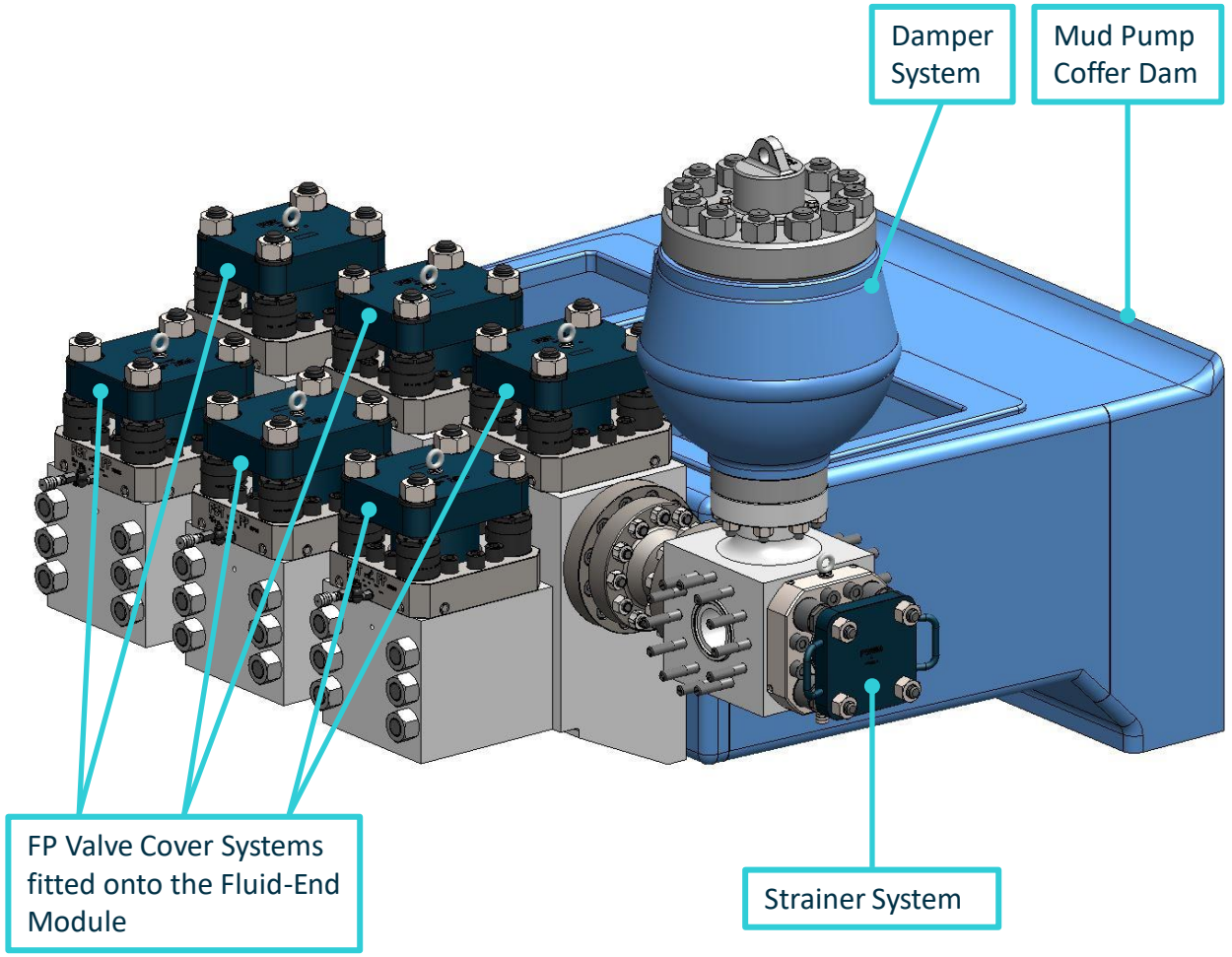
Easy to Operate

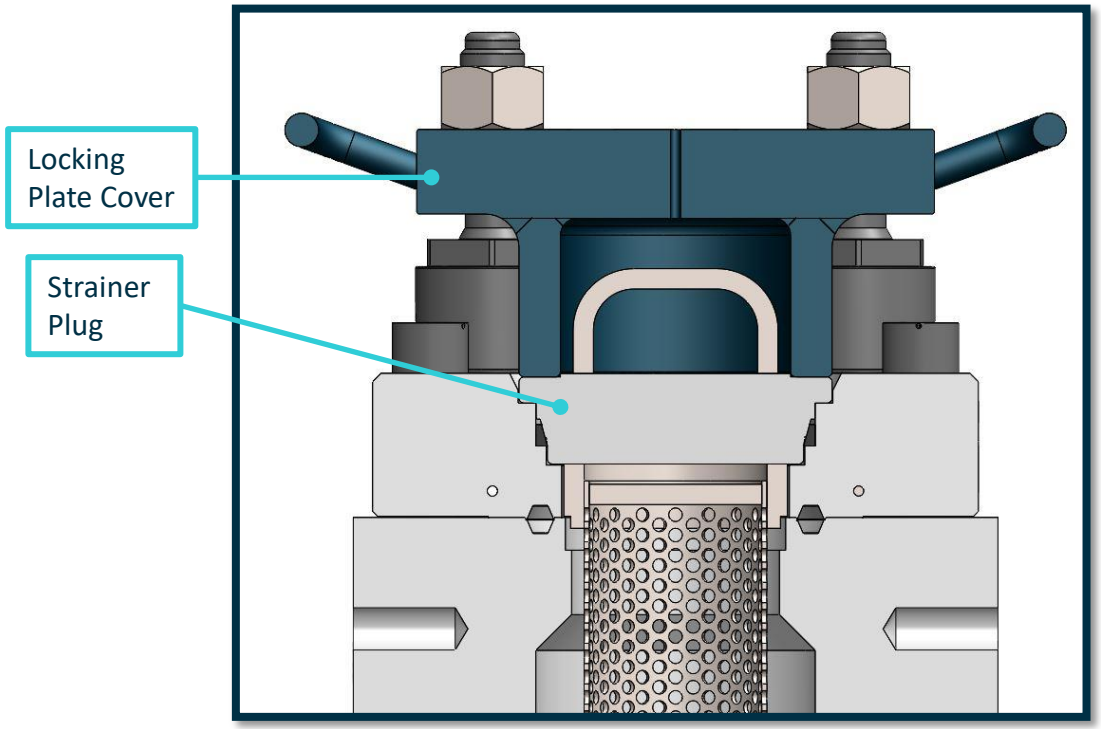
- Automatic clamping means no more under- or overtightening
- Direct replacement for OEM equipment (plug and play)
- Versions available for most pumps 1,000 HP to 2,200 HP

Safe

- Inherently safe, no hammers or cheater bars required to operate
- Easy operation with a conventional air- or hand-operated hydraulic pump
- Reduced HSE risks and costs, due to lost time incidents such as overexertion etc. since hammers and cheater bars are eliminated

SYSTEM INSTALLED ON MUD PUMP





The Strainer Plug is fully retained by the spring force from the retention pistons - maintaining a metal-on-metal connection between the Locking Plate Cover and Strainer Plug.

SYSTEM OVERVIEW

Safe

- Inherently safer, no hammers needed to tighten/loosen nuts
- Easy operation with built-in air cylinder that fully energizes packing
- Integrated handles allow for safer manual handling practices



Easy to Operate

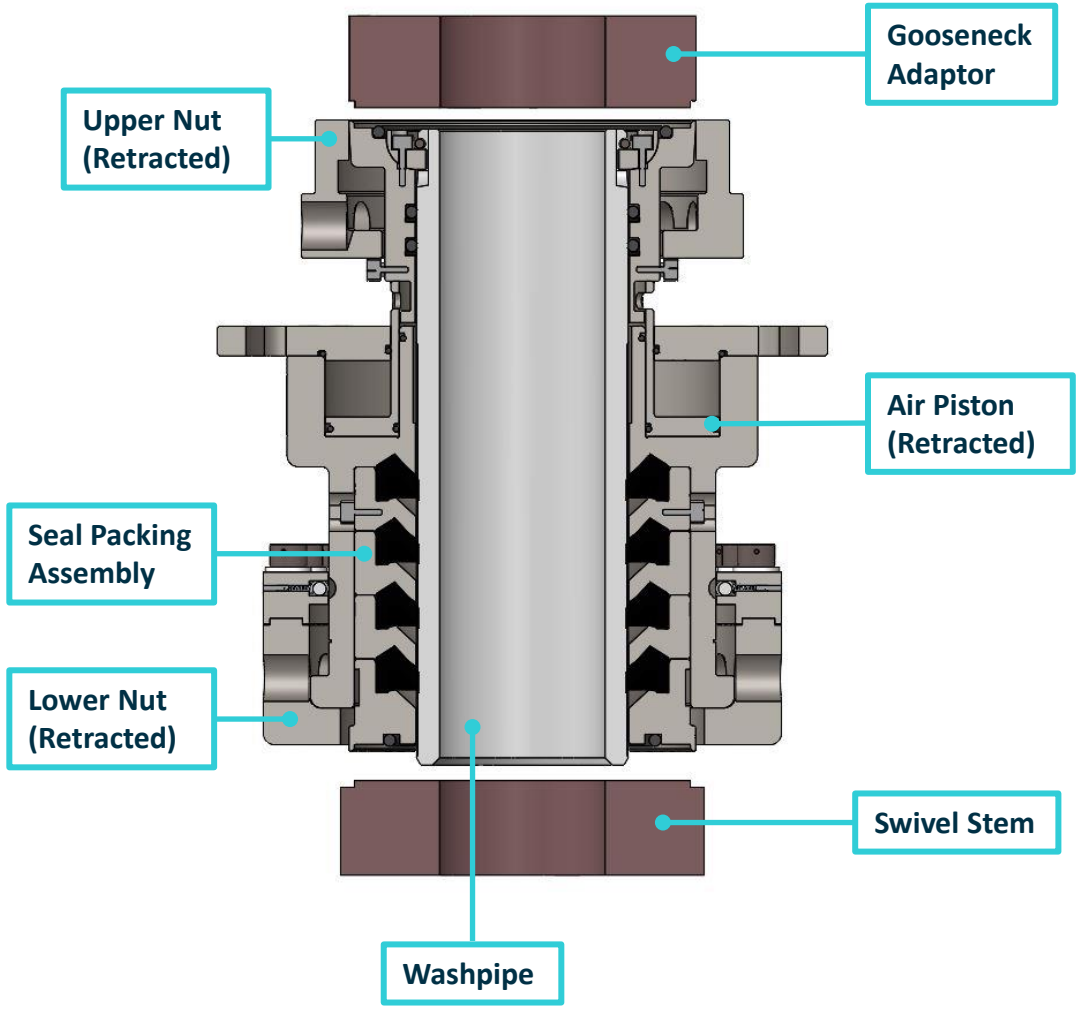
- Fully rig serviceable, clear operating instructions
- Direct replacement for OEM equipment (plug and play)

Efficient

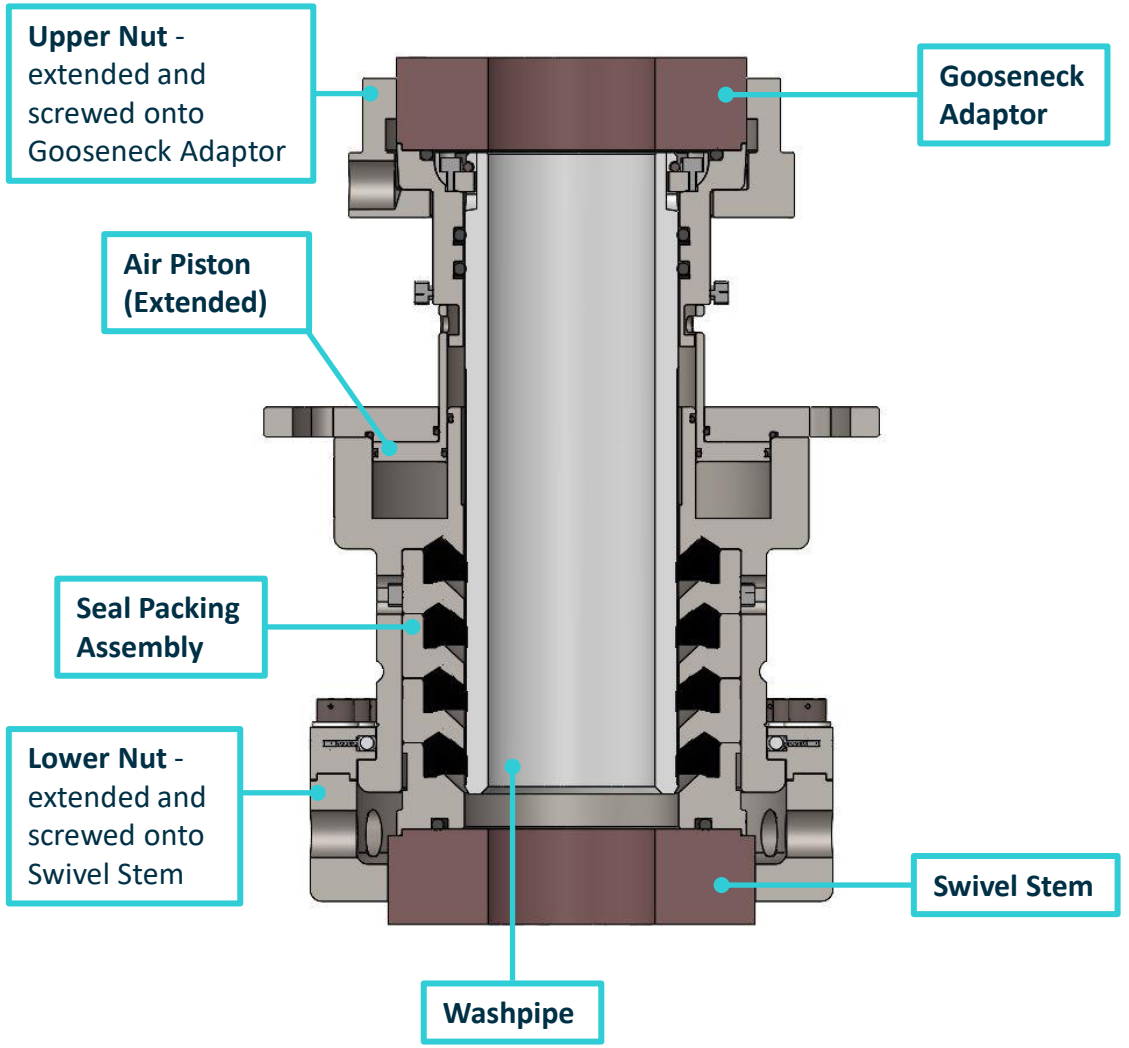
- Decreased downtime with quick and easy installation and change-outs
- Improved drilling efficiency and equipment life with hard-surface wash pipe

SYSTEM FITMENT INTO TOP DRIVE

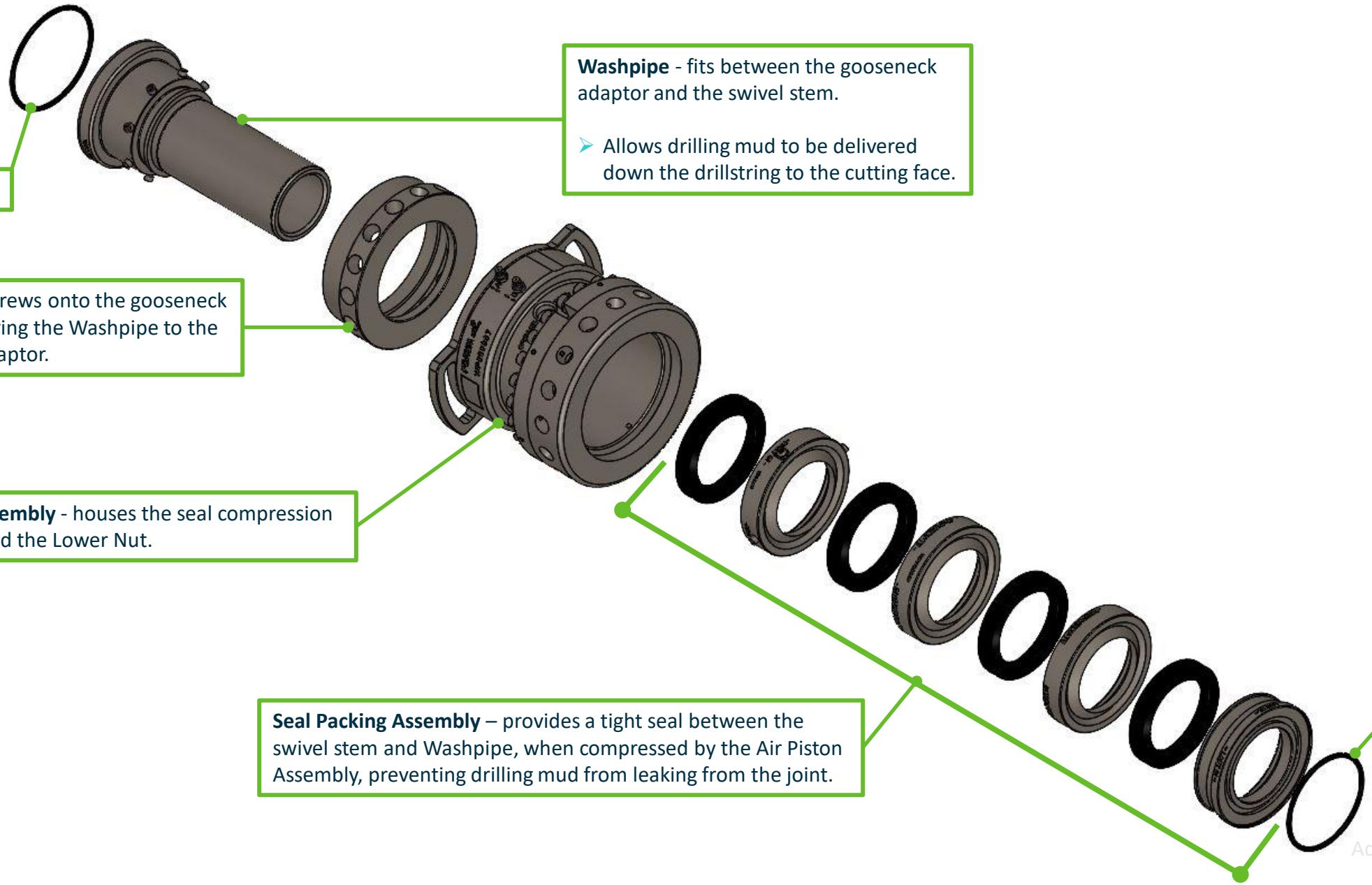
AIR PISTON RETRACTED



AIR PISTON EXTENDED



EXPLODED VIEW / COMPONENT FUNCTION



Upper O-ring

Washpipe - fits between the gooseneck adaptor and the swivel stem.

- Allows drilling mud to be delivered down the drillstring to the cutting face.

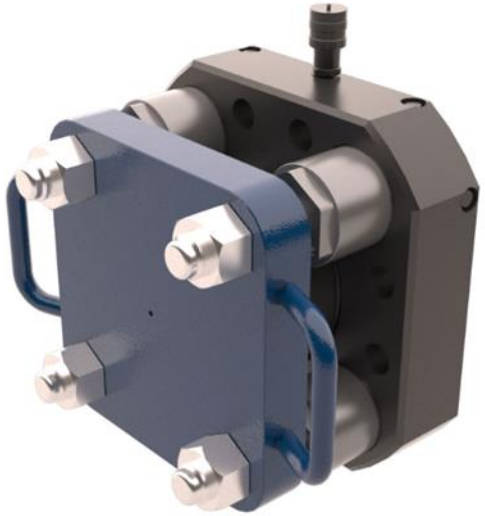
Upper Nut- screws onto the gooseneck adaptor, securing the Washpipe to the gooseneck adaptor.

Air Piston Assembly - houses the seal compression air cylinder and the Lower Nut.

Seal Packing Assembly – provides a tight seal between the swivel stem and Washpipe, when compressed by the Air Piston Assembly, preventing drilling mud from leaking from the joint.

Lower O-ring




FET™

PQUIP SYSTEM SOLUTIONS

Osprey Mud Pump Fluid Ends

Drilling consumables such as mud pump systems and their components can drastically increase your uptime while reducing costs and health/safety/environmental (HSE) risks. To support your drilling needs, Forum's patented P-Quip® mud pump system offers a single-source solution that integrates high-quality fluid end components for maximum longevity and performance

Complete Fluid End Packages using best in class technology

Banded Bore Technology Modules

- Improved life compared to other offerings.

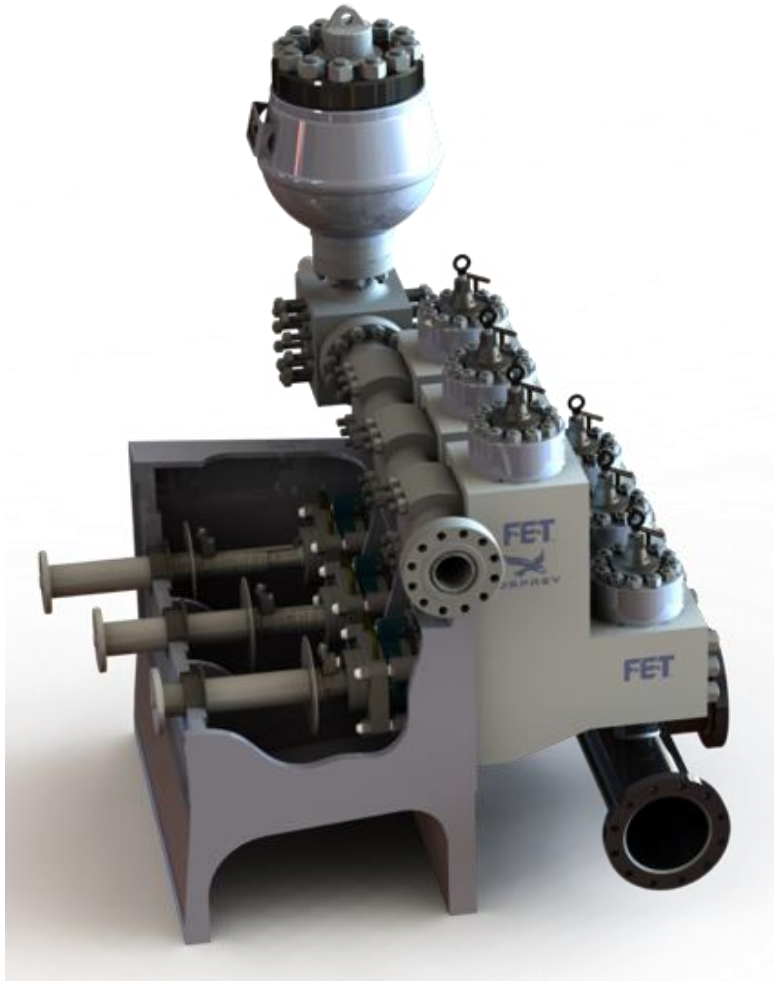
P-Quip quick change systems

- Liner Retention Systems
- Rod Systems
- P-Quip ML Valve Covers
- P-Quip wash pipe

Lower lifecycle costs

- Mitigates downtime
- Reduces safety risks on mud pump fluid ends

Designed and built in the USA and UK



P-Quip High Performance Liner Retention System

BENEFITS

- Decreased downtime, liner change < 15 minutes
- Inherently safe, no hammers or cheater bars needed for installation
- Simple installation and removal
- System last up to 10 years (Lower lifecycle costs)
- Improved efficiency, positive spring retention design to minimize liner movement

FEATURES

- Automatic clamping to eliminate under- and over-tightening
- Easy operation with conventional air- or hand-operated hydraulic pump
- Direct replacement for OEM liner retention system
- Versions available for most pumps from 1,000-2,200 horsepower





Liner Retention Sistem demo
https://www.youtube.com/watch?v=iGcwLgLBoz0

P-Quip High Performance Rod System System





BENEFITS

- Less downtime (five-minute piston changes)
- Reduced safety risks and fewer lost-time incidents
- Improved drilling efficiency and piston/liner life vs. traditional flanged rod designs

FEATURES

- Integral low-profile liner flush systems
  - ❑ Flows up to 18 gpm (50% higher than original system)
  - ❑ Compatible with 4-1/2” to 7” Liners
- No heavy clamps or connecting threads and studs
- Automatically controlled clamping force – no more broken rod ends
- Direct replacement for OEM rod system
- Versions available for most pumps from 1,000-2,200 horsepower on stainless and carbon steel options available

Showing workings of P-Quip **rod system**
https://www.youtube.com/watch?v=cMFH5-Chioc

P-Quip FP Valve Cover Sistem

BENEFITS

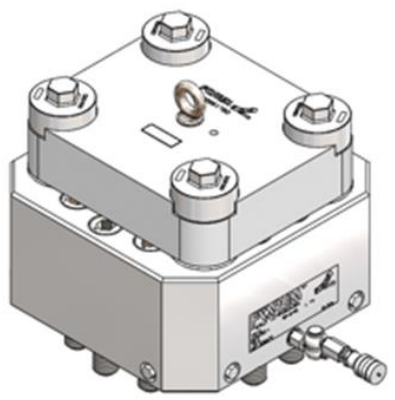
- Decreased downtime with simple installation and change-outs
- Reduced lost-time incidents, no need for hammers and cheater bars
- Improved drilling efficiency and equipment via automatic clamping
- Access valves & seats < 3 Minutes

FEATURES

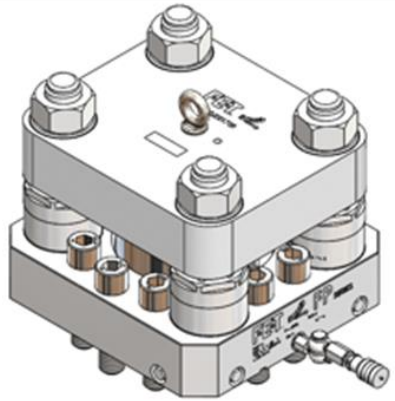
- Easy operation with conventional air- or hand-operated hydraulic pumps
- Versions available for most pumps from 1,000-2,200 horsepower
- Det Norske Veritas- and Lloyd's-certified
- Direct replacement for OEM valve cover system

GEN II Benefits

- Higher durability piston assemblies for longer life

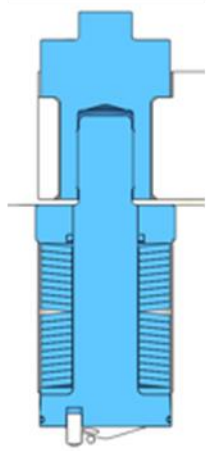


P-Quip FP Valve Cover Gen I

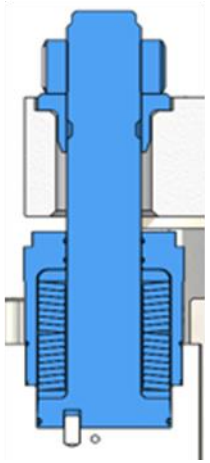


P-Quip FP Valve Cover Gen II

Legacy Configuration



Gen II Configuration



P-Quip Wash Pipe System

BENEFITS

- Decreased downtime with easy installation, change-outs completed in minutes
- Inherently safe, no hammers needed to tighten/loosen nuts
- Improved drilling efficiency and equipment life with hard-surface wash pipe

FEATURES

- Easy operation with built-in air cylinder that fully energizes packing
- Handles for safe working at height



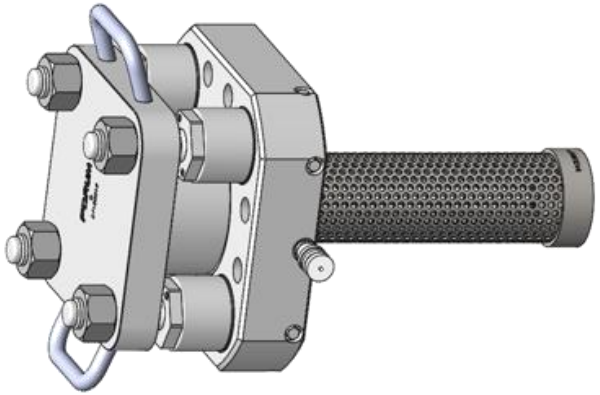
washpipe pquip system video installation
https://www.youtube.com/watch?v=BkDnqlfK8Qs

washpipe pquip system video removal
https://www.youtube.com/watch?v=GRfvo775v3k

P-Quip (FP & ML) Strainer Cover

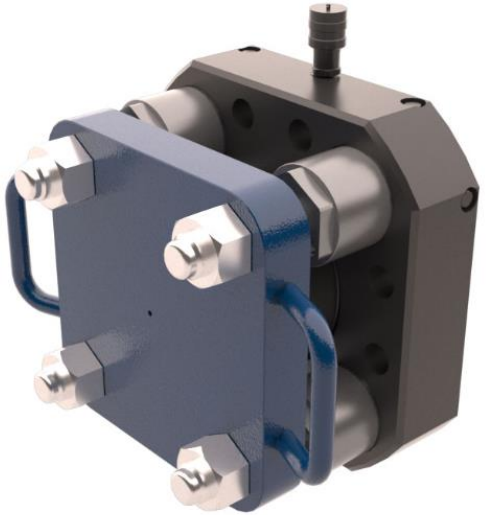
BENEFITS

- Decreased downtime and quick strainer changes/clean-outs < 3 minutes
- Inherently safer, no hammers or cheater bars needed, uses standard hex nut
- Reduced lifecycle cost
- Improved drilling efficiency/equipment, stable cover during operation



FEATURES

- Automatic clamping, no more under-or over-tightening
- Easy operation with conventional air- or hand-operated hydraulic pumps
- Direct replacement for OEM strainer system
- Rugged stainless steel strainer tubes
- Versions available for most pumps from 1,000-2,200 horsepower



Mud Pump Consumables

Liners (4” – 7” ID Available)

- Steel (Up to 800 Hours)
- Ceramic (Up to 3,000 Hours)
- Zirconia (Up to 5,000 Hours)
- Compatible with most fluid ends available today
- Proven to be dependable & reliable



Valves & Seats

- Full-Open (Roughneck Style)
- SPD 3-Web (Double Angle Insert)
- 3-web plate style (Replaceable insert)
- 4-Web
- High Temperature available



Pistons (4” – 7” ID Available)

- General Service Rubber
- Black Max Bonded Rubber
- Red Head General Service
- Blue Devil High Temperature
- Shorty General Service
- Endurohead Solid Body





Value to Customer

Lowest cost of ownership in the market

- Extended Valve & Seat life
- P-Quip systems last up to 10-years
- Less downtime

Performance

- P-Quip reduces change-out time from hours to minutes
  - Consistent retention on pump parts increases run time

Safety

- Phase out opportunities for LTI's and Recordable Incidents
  - Less requirements for heavy lifts
  - Less maintenance
  - Eliminate hammers

Click on the link below to get more information on our newest Osprey fluid end product line:
https://f-e-t.com/drilling/osprey/