

# Drilling Solutions

## Mission Products





# Mission

Our Mission group offers technical expertise for pumping systems, fluid end expendables, pressure control systems, flowline equipment, wellheads and continuous technology development of fluid management systems.

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# Centrifugal Pumps

The NOV centrifugal pump line has proven to be the best centrifugal design for handling abrasive mud. This pump line offers a broad selection of innovative features for a variety of routine, demanding, abrasive, and corrosive applications. These pumps are designed for a wide range of flow rates, from a few gallons per minute to thousands of gallons per minute. Unitization services and options compliment the centrifugal pump line.



**2500 Supreme**



**Magnum Direct Connect**

## Centrifugal Pump Offerings

- Magnum™
- 2500 Supreme™
- Sandmaster™
- Magnum Xp™
- Magnum Vortex
- Shear pumps
- Close coupled centrifugal pumps
- 1180 Type “S”
- 1780 Type “W”
- Versatile drive and mounting options

Centrifugal pumps are available in a variety of engineered options:

- Horizontal Electric
- Vertical Electric
- Close Coupled Electric
- Horizontal Diesel
- Overhead Belt
- Side Belt
- Hydraulic Driven Pumping Units



**Magnum**



**Magnum Belt-Driven**



**Vertical Close Coupled Magnum**

# Fluid End Expendables

Mission manufactures field-proven fluid end expendables for all pump manufacturers. All fluid end expendables are manufactured from high quality materials to provide extended run times and longer service life.



**Rod Clamp Assembly**

**Crosshead Extension Rods (Pony Rods)**

**Gland Bushings and Junk Rings**

**Piston Rod Clamps**

**Seats**

**Springs**

**Valve Inserts**

**Gaskets**

- Cylinder Head
- High Temperature Polyurethane
- Liner
- OEM
- Polyurethane
- Valve Cover
- Wear Plate

**Liners**

- Ceramic
- Chrome Iron Sleeved
- Hardened Steel

**Packing**

- Rod (Duplex)
- Pony Rod

**Pistons**

- Blue Lightning™
- Flexlip
- Green Duo™
- Supreme
- Slip Seal Bullitt™
- White Lightning™



**Liner, Cylinder and Valve Cover Gaskets**

**Piston Rods**

- Blak-JAK™ HydrA-LIGN Rod System
- Self-Aligning
- OEM

**Pullers/Tools**

- Bushing X-tractor™
- Liner Bushing Puller (P Series Pumps)
- Liner Pullers
- Piston Rod Nut Wrenches
- Seat Pullers
- Wear Plate Pullers

**Valves**

- Bonded
- Crossarm Style
- Full Open
- Roughneck and Roughneck HP

**Modules**

- Mission "L" Style Module-5,000 and 7,500 psi
- Monoblock
- OEM Style



**Supreme Valves and Seats**



**Roughneck Bonded Valve and Seat**



**White Lightning Roughneck Bonded Valve**

## Roughneck™ Bonded Drilling Valves

The Roughneck bonded drilling valve design is the model for extreme pressure drilling. It improves maintenance conditions in valve-over-valve fluid ends and the uniform loading of the fluid end taper increases fluid end life. The Roughneck has a heat treated forged alloy steel valve body and valve seat for extended service life, ideal for higher horsepower pumps and pressures to 7,500 psi. Roughneck bonded valves are also available in White Lightning which is good to 230° F.



**Ceramic Liner**

### Ceramic Liner

Ceramic liners offer longer run times, lower operating costs and reduced risk exposure when compared to operating with chrome iron liners. The ceramic sleeve material is manufactured from alumina oxide, known for its wear resistance, and has proven run times in all types of operating conditions. The outer hull material for large bore liners is manufactured from alloy steel to increase yield strength and aid in fatigue resistance. Ceramic liners are corrosion resistant and have a smoother surface finish for reduced friction and heat. Combining these features, the extensive history of NOV in ceramics and proprietary pump technology, results in a liner unmatched by any other in the industry. NOV ceramic liners are field proven as the longest running liner (up to 16,000 hrs.) ever manufactured.

- NOV also manufactures Zirconia sleeved liners to accommodate particular customers requests.



**Supreme Liner**

### Supreme Liner

The Supreme liner is manufactured using only the highest-grade materials. The outer section, or shell, is manufactured from high strength carbon alloy steel. The shell is heat-treated to provide optimum mechanical properties providing the end user with longer liner and piston life. The inner section of the liner, or the liner sleeve, is manufactured from a proprietary high chrome iron alloy that has excellent abrasion, erosion, and corrosion resistance.



**Bushing X-tractor**

### Bushing X-tractor™

The current method for removing the liner bushing on a 9P100, 10P130, 12P160 or 14P220 can take three mechanics up to 8 hours to remove one bushing. The Bushing X-tractor uses a hydraulically actuated cylinder to remove the liner bushing which provides a consistent straight pull resulting in bushing removal in minutes instead of hours. This significantly reduces maintenance downtime, requires fewer mechanics and provides a much safer work environment.



**Self-Aligning Rod with Dual Cooling Tubes**

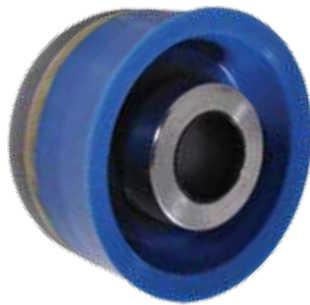
### Self-Aligning Rod with Dual Cooling Tubes

The self-aligning rod resolves misalignment issues between the crosshead and fluid end of the mud pump. In addition, it reduces piston side loading for increased piston run times. The self-aligning rod increases liner life on all types of liners and reduces downtime due to less frequent piston and liner replacement. The dual cooling tubes on the self-aligning rod provide more uniform coolant delivery, increasing piston run times.

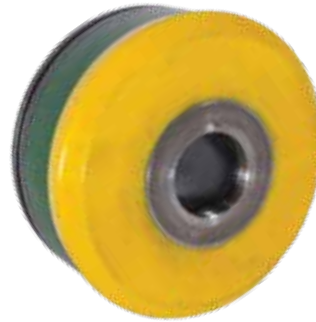
# Fluid End Expendables



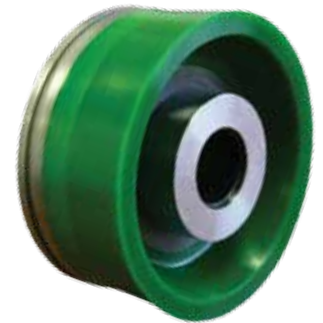
White Lightning Bonded Piston



Blue Lightning Piston



Slip Seal Bullitt Piston



Green Duo Piston

## White Lightning™ Bonded Piston

The White Lightning bonded piston is manufactured from a highly engineered elastomeric compound that provides high resistance to water, oil, and synthetic based drilling fluids. The compound provides superior resistance to tear, abrasion, and extrusion and is capable of operating in fluid temperatures up to 230°F (110°C).

## Blue Lightning™ Piston

Designed for operating in all drilling environments, the Blue Lightning piston is a super premium bonded polyurethane piston. It is manufactured from an engineered elastomeric compound that delivers excellent resistance to tear, abrasion and extrusion while maintaining high mechanical properties. The Blue Lightning piston is capable of operating in fluid temperatures up to 200°F (93°C).

## Slip Seal Bullitt™ Piston

Built to deliver an economical solution for harsh drilling environments, the Slip Seal Bullitt piston is a multi-durometer, solid bonded urethane piston. The design of the piston promises ease of assembly when loading into the liner due to the smooth engagement of the piston into the liner bore. It offers increased resistance to synthetic and oil based drilling fluids and is capable of operating in fluid temperatures of up to 225°F (107°C).

## Green Duo Piston

The Green Duo piston is a bonded dual durometer piston that is highly resistant to abrasion and tear. The bonded construction resists extrusion under pressure and restricts movement to reduce the build-up of heat. Green Duo pistons are recommended for systems with oil or synthetic based mud. It is also recommended for water based muds when weights are 11 lb/gal or over. As in all urethane pistons, the backflush requirement is recommended at 14 gal/min or greater for each piston.

## Piston Applications

Excellent	
Very Good	

Good	
Poor/Not Recommended	

Features	Blue Lightning	Bonded White Lightning	Green Duo	Slip Seal Bullitt
Abrasion Resistance				
Tear Resistance				
Resistance Oil				
Chemical Resistance				
Resistance to Synthetic Oil				
Temperature Resistance				
Extrusion Resistance				
Use in Oil Base Muds				
Use in Synthetic Base Muds				
Use in Water Based Mud >#10				
Use in Water Based Mud <#10				

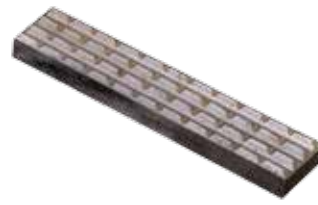
Features	Blue Lightning	Bonded White Lightning	Green Duo	Slip Seal Bullitt
Use in Water Based Mud >#11				
Use in Water Based Mud <#11				
Use in Clear Water				
Use in Salt Water				
Use in Low Solids				
Use in Moderate Solids				
Use in High Solids				
Linear Wear Characteristics				
Use in Ceramic Liners				
Maximum Temperature (Flow Line) (°F)	200	230	180	225



## Custom Dies and Inserts

NOV dies and inserts are accurately machined to tolerances using state of the art CNC machinery. All dies and inserts are then heat treated to specific standards to provide the best resistance to wear even in the harshest environments. Consistent quality and proper fit are guaranteed by extensive testing and gauging programs utilized by NOV. Various tooth patterns are available for specific applications.

- Most extensive range of dies and inserts in the marketplace today
- Consistent quality, proper fit, and improved product life by design
- Shaped steel, precision tooling and fixtures, and CNC equipment
- Several stocking distributors with large inventory for short delivery times
- Valuable experience gained in many decades of die and insert specialization



**Pyramid Tooth Tong Die**



**Die Cavins™ Type C**



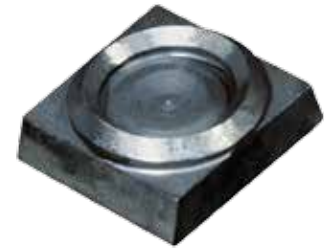
**Diamond Tooth Tong Die**



**Reducing Large**



**Reducing Medium**



**Standard Small**

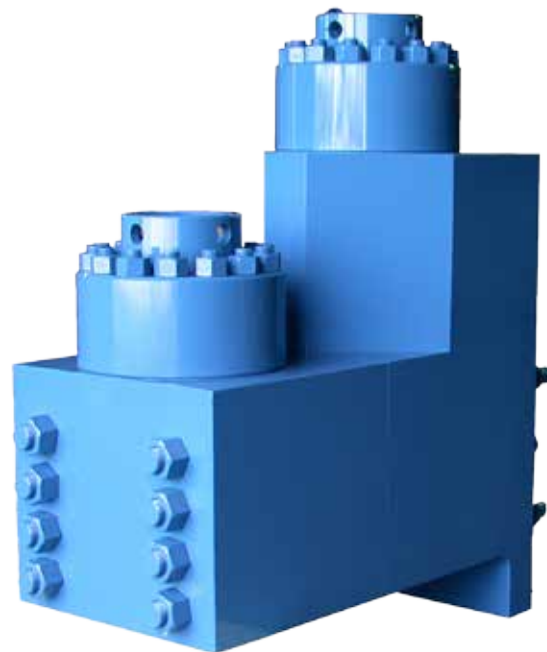
## Fluid End Modules

NOV Products manufactures fluid end modules and jewelry to exacting standards to ensure product reliability and performance. Mission produces fluid ends for all legacy NOV mud pump brands including Continental Emsco, Ideco, National, Oilwell, and Skytop Brewster as well as all other popular pump models.

### Mission L 7500 Module

Designed as an upgrade solution for existing mud pumps, the NOV L 7500 modules are equipped with 5,000 psi fluid ends. They can also be specified as original equipment for certain new NOV mud pumps and as original equipment on new pumps from other manufacturers. These modules create added value by increasing the operating range of existing mud pumps and by reducing maintenance and pump downtime. Added features can include the Blak-JAK liner retention system, Torque Pro valve cover retention system, Blak-JAK HydrA-LIGN rod system, NOV ceramic liners, and Roughneck valves and seats.

The Mission L 7500 modules are available for specific National, Oilwell, Continental Emsco and Ideco brand pumps as well as other manufacturers' popular mud pump models.



14P220 7500 psi Mission "L"

# Blak-JAK™ Equipment

Blak-JAK equipment is safer, faster and eliminates the use of hammers and creates value through shorter change-out times when compared to OEM equipment.



**Blak-JAK HydrA-LIGN Rod System**

## Blak-JAK HydrA-LIGN Rod System

The Blak-JAK HydrA-Lign rod assembly is designed to reduce operational risk exposure and improve risk environments during change-outs of high use fluid expendable parts. Additional value to operators and contractors is realized through design features that allow self-aligning capabilities between the pump liner and piston. Run times of expendables will be positively affected and pump downtime reduced. The Blak-JAK HydrA-Lign rod can be used on all popular makes and models.

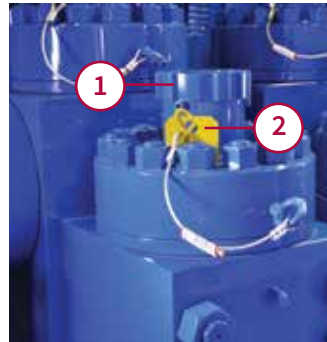


**Blak-JAK Liner Retention System mounted in a pump**

- Only 1 person required for liner change-out
- 33% lighter than OEM

## Blak-JAK Liner Retention System

Providing a simple, compact design with easy installation, the Blak-JAK liner retention system reduces weight for easier operation. There is only one Hydra-CEL (hydraulic, tension device) to maintain rather than individual hydraulic assemblies. The redesigned Lok-CEL (tensioned, mechanical device) body and locking nut assemblies are designed in conjunction with NOV fluid end technology. These mechanical designs are simple, rugged, and effective. Blak-JAK equipment is available for specific National, Oilwell, Continental Emsco, Lewco\*, Hong Hua\*, Bomco\*, \*Gardner Denver and other manufacturer pumps.

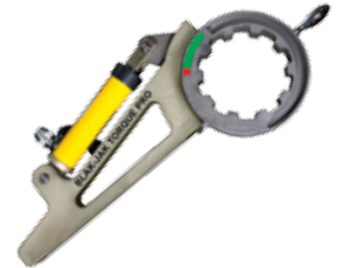


**Hammerless Valve Cover Retention System Installed**

1. Valve Cap Lug Adapter
2. Stop Locator

## Blak-JAK Torque Pro Hammerless Valve Cover Retention System

The NOV Mission Blak-JAK Torque Pro valve cover retention system utilizes a hydraulic wrench to tighten and loosen the valve cap retainer and then requires only a quarter turn to remove the retainer. This quick and easy valve access allows for faster hammers. This system works with OEM valve covers as well as Mission "L" style plugs. No modification to the fluid end is required.



**Blak-JAK Torque Pro Wrench**

## Blak-JAK Torque Pro Lite

Improving safety by eliminating the need for hammers, the Blak-JAK Torque Pro Lite utilizes a hydraulic wrench to tighten and loosen the valve cap retainer. It uses hydraulic over mechanical retention and no hydraulics stay on the pump while the pump is in operation. This system is designed for OEM valve over valve one piece fluid ends as well as "L" shaped fluid ends that do not utilize a threaded ring for the valve cover. No modification to the fluid end is required.

\* Lewco is a trademark of Joy Global Longview Operations LLC.  
 \* Hong Hua is a trademark of Honghua Group Ltd.  
 \* Bomco is a trademark of Baoji Oilfield Machinery Co., Ltd.  
 \* Gardner Denver is a trademark of Gardner Denver, Inc.



**Original 5000 psi Blak-JAK Washpipe Cartridge System**



**Blak-JAK 7500 Washpipe Cartridge with Blak-JAK Pressure Indicator Light Mounted**



**Pressure Indicator Light**

## Blak-JAK Washpipe Cartridge System

Designed for speed and efficiency, the Blak-JAK Washpipe Cartridge System is a self-contained unit designed to be repacked on the rig floor, not at the swivel. Once the assembly has been repacked, the single cartridge can be installed quickly in the swivel just by tightening the nuts to the gooseneck.

A spanner bar is utilized to tighten the nuts, eliminating the use of hammers.

- Quick change cartridge system
- 25% lighter than competing designs for ease of maneuverability
- Cartridge assembly and disassembly is simple and quick
- Utilizes standard packing and washpipe with optional high temperature resistant packing available
- Available for 5000 psi and now 7500 psi working pressure

## Blak-JAK Pressure Indicator\* Light

The Blak-JAK Pressure Indicator light ensures optimum life of washpipe packing, while at the same time providing a 12-36 hour warning before packing failure. Packing rings in the lower rotating housing of a washpipe cartridge fail sequentially. Once the third packing ring begins to leak and the fourth packing ring energizes, the light will begin to strobe; this indicates that the washpipe packing needs to be replaced at the soonest opportunity. The early warning provided by the Blak-JAK Pressure Indicator light can consistently prevent mud leakage and unnecessary downtime. The Blak-JAK Pressure Indicator light adds value through the following:

- Reduced risk exposure for rig floor personnel
- Compatibility to virtually all conventional top drives
- Field proven reliability at pressures up to 7500 psi

\* Patent Pending

# Drilling Chokes



**MPX-40D Drilling Choke**

## MPX-40D Drilling Chokes

The MPX-40D drilling choke is an adjustable drilling choke available with interchangeable linear orifice sizes and tungsten carbide flow control components. Its pressure balanced plug reduces operating force and stem loads. Its non-threaded seat requires fewer parts, less downtime and it offers ease of maintenance. The bolted bonnet design increases safety and uses a metal bonnet seal. The MPX-40D drilling choke is a direct bolt-in replacement for current CSO drilling chokes.

- Large body reservoir, minimal erosion
- API-6A annex F PR2 qualified
- Material Class EE-NL
- Temperature Class P/X (-20°F/350°F) (-29°C/180°C)
- End Connection Sizes 3-1/8", 3-1/16" and 4-1/16"
- Pressure Ratings 5K, 10K and 15K
- API-16C flow test qualified
- ANSI class V shut-off capability
- Manual or automated designs
- Internal plug and cage design for increased well control
- Forged integral flange bodies



**HXE-G3 Worm Gear and HXE-G3 Piston Choke**

## T3™ HXE-G3 Drilling Chokes

HXE-G3 designs in any inlet/outlet configurations are available in either worm gear or double acting piston operated designs. Both standard with replaceable nose, reversible gate and seat. Standard choices of positioning; Pneumatic, Digital Position Sensor or Digital Position Sensor with 4-20mA output.

Two body designs available:

- 2" Max body design with reduced mass lowers cost of trim and will accept 1", 1 1/2", and 2" orifice trim.
- While the 3" Max design will give you full range trim accepting trim sizes 1", 1 1/2", 2 and 3" orifice trim.
- The outlet spool is a unique "Wear Sub" design. It can be built to give up to 18 inches of downstream wear protection with a standard of 12 inches. Many chokes of this nature cannot compete.
- The body is manufactured with external bonnet nut threads allowing bonnet removal without disconnecting hydraulic lines from choke.
- Both the Gate and Seat are reversible giving each piece double the usage thus reducing even more cost.
- The Gate and Seat are designed to direct high velocity wear away from the positive sealing surface, this feature extends the life of the choke trim.
- Non-threaded seat
- API-6A/16C PR2 Qualified
- Material Class EE-NL
- Temperature Class L/X



**HXE-Auto-Choke**

### HXE Auto Chokes

The Model HXE Auto-Choke and Control System combines the field-proven reliability and wear-resistance of the Model HXE choke with a continuous duty-cycle Siemens electric servo motor, yielding extremely precise pressure control and quick response times. The choke itself is run by a remote console that allows manual or automated control of the choke. In automatic mode, the choke will rapidly adjust trim positioning to maintain the set-point pressure that is input at the remote console. In addition to maintaining pressure within a more precise range than hydraulically actuated chokes are able to maintain, the electric servo motor allows the choke to function reliably in very cold conditions, and without the cost of running and maintaining hydraulic lines.

- Pressure rating 5K
- Orifice size 3" max but can be converted in the field to 2" or 1.5" orifice
- API 4-1/16" inlet and outlet
- Actuator Electric servo, Class I, Div. 1, with internal velocity and position feedback



**T-3 E-S Drilling Choke**

### T3™ E-S Drilling Chokes

The E-S Hydraulic Drilling choke is ideal for situations requiring precise control of flow rates. The rotary actuator control allows operation in high-pressure environments.

- Compatible with Swaco Hydraulic Drilling Choke
- Provides positive seal
- Tungsten carbide wear sleeves extend service life
- Orifice plate design provides greater control of flow rates



**Mission Electric Drilling Choke**

### Mission™ Electric Drilling Chokes

The NOV Mission line of Shaffer drilling choke systems provide fast, accurate well control through one or two chokes operating remotely from the rig floor. Fluids can be circulated from the well bore while holding any desired back pressure rating of the choke. The system includes one or two electrically operated chokes, pressure transmitters for drill pipe and annulus pressures, and a floor-mounted control panel.

- High quality and performance
- Eliminates the additional cost of a hydraulic system
- Low maintenance - no hoses, reservoirs or potential safety issues with leaks paths
- Manual override capability at the manifold
- Electronically operated - one connection
- Higher resolution and precision choke feedback
- Valve/actuator diagnostics available
- Dual-tapered choke plug
- Erosion possibilities minimized
- Additional feedback available to rigs
- Positive visual valve position indication
- Data acquisition system available if required
- Full automation and diagnostic capabilities
- Flanges are attached with 100% penetration welds and bored out
- All welds are X-ray quality
- All flow fittings are manufactured to H2S specifications
- Products maintained and serviceable worldwide

# Gate Valves



**HPT Gate Valve**

## T3™ HPT Gate Valves

Designed for the most demanding applications, NOV's T3 brand model HPT gate valve meets the industry's toughest standards, including API 6AV1 (Slurry), API 6FC (Fire Test) and DNV Type Approval. It is available in sizes ranging from 2" 5,000 psi to 7" 15,000 psi, with 20,000 psi option. Special bore sizes available on request.

- Forged steel body and bonnet
- Bidirectional Sealing
- Low operating torque
- API 6A PSL 2, 3 or 3G
- PR2 rated
- Supplied with full material certification
- API 6A material classes: DD and EE
- Good for methane, methanol, paraffin solvents, completion fluids, acids containing 13.5% HCL, Heavy BRINE and Salt Water
- All seals meet NORSOK M-710 Rev.2 compliance

## Shaffer™ HB Subsea Gate Valves

The Shaffer HB subsea gate valves are through-conduit gate valves designed for subsea BOP stacks and systems. The hydraulic operated API 6A gate valve actuators are double acting with spring assist fail open or close and are designed for use with hydraulic failsafe systems.

- Floating seats
- Downstream sealing
- Bidirectional Sealing
- Metal-to-metal body and seat, seat-to-gate, bonnet to body
- Valve Body Styles: Dual, Angle and Single
- Supplied with full material certification
- Available bore sizes: 3-1/16" and 4-1/16"
- Pressure Ratings: 10K and 15K
- Material Class: DD-360 and DD-NL
- Temperature Class: P up to X (-20°F up to 350°F) (-29°C up to 180°C)



**E-TYPE Gate Valve**

## ANSON E-Type Gate Valves

Anson brand E-TYPE through-conduit gate valves have been developed to satisfy the need for a high quality, high specification valve which is reliable and reasonably priced. The E-TYPE gate valve makes full use of modern materials and manufacturing techniques. The valve is robust, easy to maintain, and conforms to international design requirements and quality assurance programs.

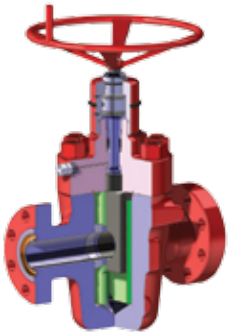
The E-TYPE gate valve is a monogramable API 6A valve available with hydraulic actuation. Valves can be supplied with spring return fail-safe, open (FSO) or closed (FSC), or double acting cylinders (DA). Both types offer a compact design, are fully weather sealed and available with extras such as position indicators, hydraulic power packs and control systems.

### Specifications

- Forged steel body and bonnet
- Bidirectional Sealing
- API 6A PSL 2, 3 or 3G
- PR2 rated
- Supplied with full material certification
- API 6A material classes: AA to HH
- Available bore sizes: 1-13/16" to 9"
- Pressure Ratings: 3K up to 20K
- Temperature Class: L up to X
- API 6AV1 Class 2 Slurry Tested



**HB Subsea Gate Valve**



2300 SFC Gate Valve

### Shaffer 2300 SFC Gate Valves

The Shaffer 2300 SFC initiated from legacy Shaffer and T3™ technologies combining the NOV Shaffer Model 2300 SurSeal gate valve with the Robbins and Myers™ T3 FC gate valve line. The Shaffer Model 2300 SFC will replace these two product offerings with one. Mission is able to offer a superior gate valve by combing our extensive experience of gate valve manufacturing processes, testing, and reliable service history.

Shaffer 2300 SFC through-conduit gate valves are robust, easy to maintain and conform to international design requirements and quality assurance programs. The valve can be monogrammed, conforming in all aspects to API 6A.

- Forged steel body and bonnet
- Bidirectional Sealing
- Low operating torque
- Shear pin protected internal works
- API 6A PSL 2, 3 or 3G
- PR1 rated
- Supplied with full material certification
- API 6A material classes: DD and EE
- Manual Operated (Non-rising stem)
- Hydraulic Operated (Double acting with MOR)
- Available bore sizes: 2", 3", 4"
- Pressure Ratings: 5K, 10K and 15K

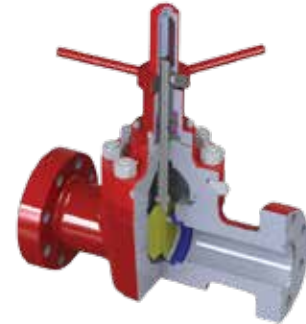


MVD-7500 Disc Type Mud Valve

### ANSON Mud Gate Valves

Anson mud valves are solid gate, rising stem, gate valves with resilient seals. They are purpose-made for mud, cement, fracturing, and water service. They are easy to operate and simple to maintain. Two ranges are available:

- MV50: The valve is suitable for a maximum working pressure of 5,000 psi
- MVD-7500: The valve is suitable for a maximum working pressure of 7,500 psi



MVD-7500 Disc Type Mud Valve

### MVD-7500 Disc Type Mud Valves

#### Specifications

##### Design

- API 6D, API 6A (where each is applicable)

##### Pressure

- Up to 7,500 psi maximum allowable working pressure

##### Temperature Rating

- -20°F (-29°C) to 250°F (121°C) (standard)
- -50°F (-46°C) to 250°F (121°C) (optional)

##### Options

- Position feedback
- Position lock
- 316 stainless steel/CRA 625 corrosion resistant API ring grooves, hub sealing areas
- Enhanced corrosion protection options (CRA 625–bonnet and seat seal areas)
- Hydraulic or electric actuation
- Butt weld, hub or flanged end connections

##### Qualification Testing

- Hydrostatic cyclic testing (high and low pressure), gas testing (high and low pressure), mud pump pulsation and flow testing (high and low pressure)

##### Third Party Approvals

- ABS, LRS, DNV, BV

# Manifolds

NOV manifold systems are designed and manufactured to customer specifications using only the highest quality materials and standards. Valve options include Anson/ T3/Shaffer API 6A gate valves, Anson mud valves, Anson/T3 check valves, and Anson plug valves. These, coupled with Anson manifold fittings, flanges, hubs, hammer unions, API blocks, and NOV welding capabilities allow NOV to control the design quality and scheduling of the most complex manifold projects.

NOV manifolds are designed and supplied fully certified in accordance with the recognized oilfield equipment standards.

NOV designs and builds the following types of manifolds:

- Choke and Kill Manifolds
- Diverter Manifolds
- Truck Mounted Manifolds
- Ground Pipe Manifolds
- Containerized Manifolds
- Standpipe Manifolds
- Gas Gathering Manifolds
- Mud Tank Manifolds
- Underbalanced Drilling Manifolds
- Managed Pressure Drilling Manifolds
- Cement Manifolds



**Choke and Kill Manifold**

## Choke and Kill Manifolds

Anson/T3/Shaffer choke and kill manifolds are designed and manufactured to customer requirements by a highly qualified multidiscipline team. Choke and kill manifolds are manufactured from Anson/ T3/Shaffer standard off the shelf products which enable NOV to exercise control over quality and scheduling to ensure prompt delivery and competitive prices. Complete control systems can be supplied with pressure requirements of up to 20,000 psi. Anson/T3/ Shaffer choke manifolds are designed and supplied fully certified in accordance with the recognized oilfield equipment standards.

- Anson/T3/Shaffer gate valves—manual and hydraulic
- Anson/T3/Shaffer positive and adjustable chokes
- T3/Shaffer Hydraulic chokes
- API studded crosses, tees, adaptors, flanges and spools
- NOV blinds, crossovers and fittings
- NOV choke control systems
- Individually pressure tested valves
- Pressure and function tested prior to dispatch

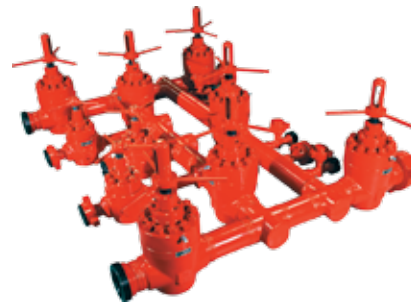


**3" Fig. 1502 10,000 psi Cement Manifold**

## Cement Manifolds

Anson high pressure cement manifolds are designed and manufactured to customer requirements. The Anson product line offers the widest range of hammer union ended equipment available from any one manufacturer. Purpose forged tees, crosses, “Y”s, laterals, plug valves, crossovers; the list is endless. This allows NOV to supply very competitively priced cement manifolds in a wide variety of sizes and configurations. Manifolds with pressure ratings up to 20,000 psi are available. Anson cement manifolds are designed and supplied fully certified in accordance with the recognized oilfield equipment standards.

- Anson plug valves
- Anson forged crosses
- Anson hammer unions
- Anson forged tees
- Anson forged long radius elbows
- Individually pressure tested fittings and valves
- Pressure tested assembly
- Full material traceability
- Design codes include API.6A, ASME VIII (Div.1 and 2) ASME B.31.



**6" NB 7,500 psi Standpipe Manifold**

## Standpipe Manifolds

NOV standpipe manifolds are designed and manufactured to customer requirements utilizing the Anson/T3 range of mud valves and forged manifold fittings. The incorporation of standard Anson/ T3 products enables NOV to control quality and scheduling to ensure prompt delivery and competitive prices. Welded, flanged, hubbed or hammer union construction is available. Pressures up to 7,500 psi using standard Anson/T3 mud valves can be accommodated. NOV standpipe manifolds are designed and supplied fully certified in accordance with the recognized oilfield equipment standards.

- Anson/T3 mud valves
- Anson forged manifold fittings
- Anson/T3/Shaffer chokes
- Anson original quality unions
- Anson hammer union forged tees and elbows
- Full material traceability
- Individually pressure tested valves and fittings
- Hydrostatically pressure tested assembly



# Reset Relief Valves

Titan™ Class reset relief valves encompass the best stand-alone, mechanically operated reset relief valves on the market today.

The Titan Class includes:

- Titan Class 3-inch “B”
- Titan Class “C” and “CH”
- Titan RX
- Titan BX



**Titan BX Automatic Reset Relief Valve**

## Titan BX Automatic Reset Relief Valve System

The Titan BX reset relief valve is the only air-operated, fully automatic reset relief valve on the market that fails open. When pump pressure exceeds set pressure, the Titan BX reset relief valve automatically opens through an electronic system. After a time delay pre-selected by the operator, the valve will automatically close using instrument air pressure, eliminating the need for manual reset. In the event that the rig loses power, air, or mud pressure, the valve will automatically open.

The unit is ISO 9001:2008, ABS and DNV type approved and can be CE/PED certified.

The Titan BX automatic reset relief valve system consists of 1-6 valves, one pilot valve box per valve, one mud cup transducer per valve, and one control panel for the entire system.



**Titan BX Mud Cup Transducer**



**Titan BX Control Panel**



**Titan Class “B” Relief Valve**



**Titan Class “C” Relief Valve**



**Titan RX Reset Relief Valve**

## Titan B, C, CH & RX Reset Relief Valves

The Titan manual reset relief valves automatically snap to a full open position when the set pressure is reached. In addition, this relief valve comes equipped with a position release button that indicates, at a glance, whether the valve is open or closed.

- Titan B: Pressure Ratings from 400 psi to 5000 psi
- Titan C: Pressure Ratings from 400 psi to 5000 psi
- Titan CH: Pressure Rating 2500 psi to 6200 psi
- Titan RX: Pressure Rating 2000 psi to 8000 psi



**Air Titan Reset Relief Valve**



## Air Titan Reset Relief Valves

The Air Titan Reset Relief Valve offers a pneumatically actuated cylinder that allows for remote control and resetting, which reduces personnel contact with high pressure equipment and improves safety. The Air Titan rapidly actuates to a full open position when the set pressure is reached, thereby protecting the mud pump from harmful pressure spikes.

The set pressure is set and changed using the inline pressure regulator on the pneumatic actuator. Set pressures range from 2,000 - 8,000 psi.

### Features

- Control Panel allows for remote resetting and changes in the set pressure
- Easy adjustment of set pressure
- Accuracy within 5% of set pressure
- Rugged inconel 718 body insert
- Eliminates mechanical calibration
- Valve opens completely in less than one second when set pressure is reached
- Minimum downtime for repairs
- Optimum seal life (field proven)
- Actuator assembly, top-loaded piston (seals can be removed while body is in line)
- Hydraulically balanced and cushioned piston

## Shear Relief Valves

Shear relief valves are economical, easy to use and require minimal maintenance. They are available in 2" or 3" threaded connections and are capable of relieving pressure at settings from 400 psi up to 5,000 psi. Mission shear relief valves are interchangeable with other Demco\* style shear relief valves.

\* Demco is a trademark of Cameron International Corporation. National Oilwell Varco, L.P. is not affiliated with Cameron International Corporation or its affiliates and Cameron International Corporation does not endorse any of the Mission™ shear relief valves.



**Shear Relief Valve**

## Float Valves



**Plunger Type Float Valve**

A complete line of float valves and repair kits are manufactured to accommodate a wide range of drilling situations and operating conditions. These drill pipe float valves provide added blowout protection at the bottom of the drill string to prevent flowback when joints are added and keep cuttings out of the drill pipe to prevent bit plugging while making connections.

The following products are available in standard service and Hi-Temp/NACE assemblies:

### **MODEL “F” - Plunger Type**

The Model “F” plunger type valve offers positive and instant shut-off. During normal drilling operations, the Model “F” offers economy and durability. The piston type stops flowback when making connections and keeps cuttings out of the drill string. (Parts are interchangeable with \*Baker style equipment.)



**Flapper Type Float Valve**

### **MODEL “G” - Flapper - Full Flow**

The Model “G” flapper style valve features an investment cast flapper. Its quick opening provides unrestricted full flow through the valve. This model is designed for highly abrasive drilling fluids. (Parts are interchangeable with \*Baker style equipment.)

### **MODEL “GA” - Flapper - Full Flow with Carbide Orifice**

The Model “GA” is identical to the “G”, except for the addition of a carbide orifice in the flapper. It allows differential pressure readings at the surface. (Parts are interchangeable with \*Baker style equipment.)

\* Baker is a trademark of Forum Energy Technologies. National Oilwell Varco, L.P. is not affiliated with Forum Energy Technologies or its affiliates and Forum Energy Technologies does not endorse any of the National Oilwell Varco, L.P. float valves.

## Solids Control Equipment



**Mud Gun**

## Mud Guns

This premium quality mud gun is considered to be one of the longest lasting on the market today. With a nozzle insert lined with engineered elastomer, the mud gun will not wear as easily as common steel inserts. Worrying less about the wear on mud guns means worrying less about the wear on mud pumps. Mud guns are an inexpensive solution to a potentially expensive problem. Other features include a collapsible handle, a 360° rotating swivel body, and the ability to be customized to any length, flanged or threaded.

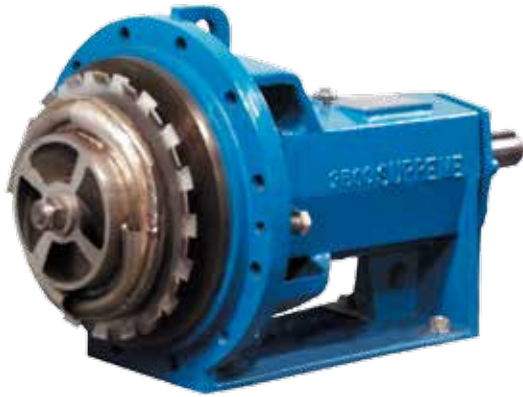


**Mud Hopper**

## Mud hoppers 4", 6"

Properly engineered hoppers ensure the highest discharge pressures, solid addition rates, and shear rates. NOV manufactures 4" and 6" hoppers with standard flow rates from 130 GPM to 830 GPM as well as the TurboShear™, primarily used for shearing hard to mix additives.

# Custom Design and Unitization



**TurboShear System**

## TurboShear System

The TurboShear System reduces the cost of mixing polymers and clays while improving mud properties. Shearing the polymers eliminates fish eyes and prevents polymer chaining (long strings), which cannot pass through the shaker screens. The TurboShear pump is available as a belt-driven or diesel-driven package including a hopper, mud gun, and transfer line orifice plate. A complete system with skid, tanks and piping is also available.

- Versatile stuffing box
- Thick, strong, concentric casing with replaceable casing wear pad
- Long-life, no-adjustment mechanical seal available for near zero leakage
- Replaceable shaft sleeve prevents shaft wear
- Labyrinth seals for maximum bearing protection come standard
- Duplex angular contact bearings eliminate shaft end play and increase bearing and seal life
- Full pipe diameter entrance for minimum turbulence and maximum efficiency



**Fire Suppression Systems**

NOV offers custom and standard fluid transfer systems. Offering versatility and a wide range of capabilities, NOV designs, tests, and certifies complex systems and packages. To complement products manufactured, 50 and 60 HZ explosion proof electric motors and motor controls are in stock. As one of the largest explosion proof motor distributors globally, NOV creates value for customers. Whether needs are simple or complex, standard or custom, NOV can respond to customer design and critical delivery requirements.

- Brake/Winch Cooling Systems
- Brine Filtration Systems
- Close Coupled Pumps
- Customized Unitizations
- Diesel Fuel Filtration Systems
- Electric, Diesel and Belt Driven Pump Packages
- Fire Suppression Systems
- Hoppers with Dust Collectors
- Mud Guns
- Oil Filtration Systems
- Potable/Sanitary Water Pressure Sets
- TurboShear Systems
- Vertical Pumps
- Washdown Systems



Potable Water Pressure Set



Top Drive Cooling Package



FF1081 Fuel Filtration System with upgraded Galvanized Base



Brine Filtration Systems

## Cooling Packages

NOV engineers and custom manufactures quality cooling packages for the most demanding applications, some of which include drawworks, top drives, winches, mud pumps, dynamic thrusters, and quarters cooling. These packages can be equipped with horizontal or vertical centrifugal pump configurations, numerous size tanks, and a variety of heat exchangers to meet virtually any footprint requirement. Land and offshore models are available.



High Pressure Washdown Systems

## High Pressure Washdown Systems

NOV manufactures high pressure washdown systems available at 10 GPM at 2,200 psi, 22 GPM at 1,200 psi or 14 GPM at 3,000 psi. Each unit can be customized with optional features to meet various needs and budgets.

### Features and Benefits

- Quality construction
- Corrosion prevention
- Personnel safety
- Installation of extra hose reels allows one unit to service multiple locations

## Diesel Fuel Filtration Systems

NOV's Model FF1080 and FF0181 Diesel Fuel Filtration Systems are each equipped with a prefilter tank, coalescer, dual gear pumps and filter gauges. Diesel Fuel Filtration Systems remove water and other contaminants more effectively than centrifuge systems and standard fuel filters.

Fuel filtration systems are available with the prefilter, coalescer-separator, transfer pumps and piping all mounted on a common base (Model FF1081); or with prefilter and coalescer-separators piped and mounted on one base and the transfer pumps mounted on a second base (Model FF1080). Both fuel filtration systems are equipped with gauges on each side of the filtration tanks to indicate when the filters need to be changed.

## Brine Filtration Systems

The Brine Filtration system is a self-contained unit that emphasizes efficient particle removal and extended filter life. The unit utilizes a three-vessel filter configuration with a manifold system to meet a wide variety of flow and filter requirements. Each particular system is dependent on the particle load and the desired flow rate of the fluid to be filtered. Filter element longevity is accomplished by filtering the larger particles in the initial stages, which is commonly 50-micron elements. With the stepped filter arrangement there is less particle load, thereby increasing filter life. Increased efficiency is realized due to the multi-staged vessel flow path as compared to conventional passage through one vessel. In addition, the vessels are stainless steel and possess a static seal between the filter element and the vessel to eliminate cross contamination.

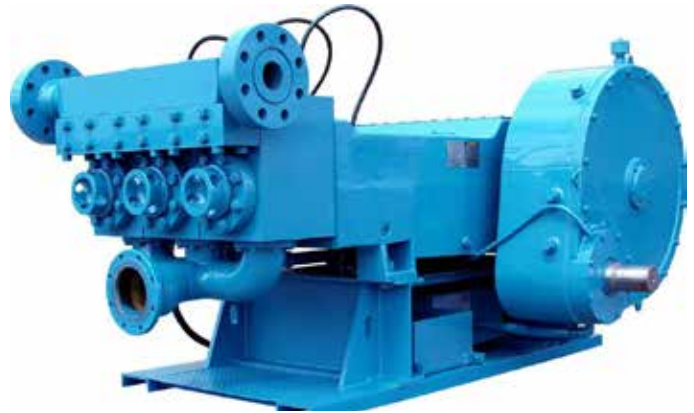
# Reciprocating Pumps



**JWS-400**

## JWS-400 Triplex Piston Pump

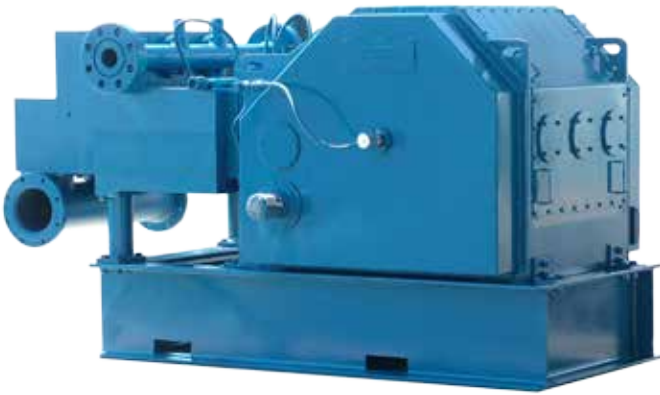
The JWS-400 5-1/2" x 7" Stroke Triplex Piston Pump is ideal for mobile rig applications. It is compact in size and including gear reducer has a dry weight of 15,000 lbs. (6,804 kg). The JWS-400 is capable of pumping volumes up to 378 gallons per minute and working pressures up to 5,000 psi.



**550T-7D**

## 550T-7D Triplex Piston Pump

The 550T-7D has a large operating envelope in a small footprint design. The 550T-7D 7" x 7" Stroke Triplex Piston Pump with the valve over valve fluid end is ideal for light weight rig applications. Including the gear reducer it has a dry weight of 18,500 lbs. (8,392 kg). The 550T-7D is capable of pumping volumes up to 612 gallons per minute and working pressures up to 5,000 psi.



**D-750LA**

## D-750LA Triplex Piston Pump

The D-750LA is a compact, lightweight machine capable of delivering big pump performance.

The D-750LA 7" x 6" Stroke Triplex Piston Pump is equipped with an "L" shaped fluid end which provides ease of access for changing valves and seats. The D-750LA has a dry weight of only 11,500 lbs. (5,216 kg), making it the lightest pump in its performance class. The D-750LA is capable of pumping volumes up to 506 gallons per minute and working pressures up to 5,000 psi.



**Custom Pump Unitization**

## Custom Pump Unitization Services

Unitized skid mounted pumps, packaged with electric motors, internal combustion engines and other accessories are available upon request.

\*Other pump models to fit specific applications are available upon request.

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