



# WELCOME

Tunisia – 16<sup>th</sup> October 2012



**NATIONAL OILWELL VARCO**

One Company . . . Unlimited Solutions

# 145 Years of History



- 1862 – Oilwell oilfield equipment business is established**
- 1878 – Oilwell Supply formed**
- 1894 – National Supply formed**
- 1930 – Oilwell Supply acquired by U.S. Steel**
- 1958 – National Supply acquired by Armco Steel**
- 1987 – National Supply (Armco) and Oilwell Supply (USX) merged in a 50-50 joint venture called National-Oilwell**
- 1989 – National-Oilwell acquires Mission Products**
- 1996 – Armco and USX sell jointly owned National-Oilwell to Company management and two investment firms**
- 1996 – National Oilwell, Inc. I.P.O., New York Stock Exchange Symbol NOI**
- 2005 – NOI and Varco merge to form **NOV****
- 2008 – NOV acquires GRP**



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# NOV Overview



## Company at a Glance

NYSE	NOV
Market Cap	\$33.6B

Member of S&P 100 Stock Index

Forbes "Fastest Growing" Co's

#3 in Barron's 500

164 Acquisitions in 10 yrs

40,000 employees in 54 countries

## Business Summary

National Oilwell Varco is a worldwide leader in the design, manufacture and sale of equipment and components used in oil and gas drilling and production, the provision of oilfield inspection and other services, and supply chain integration services to the upstream oil and gas industry.



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# NOV Vision

“My vision is for NOV to be THE equipment manufacturer of the oil industry.”

Pete Miller, CEO





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# NOV Organizational Structure

**CEO, Pres & Chairman**  
Pete Miller

**Chief Financial Officer**  
Clay Williams

**Chief Admin Officer**  
Howard Davis

**Sr. VP Technology**  
Hege Kverneland

**Sr. VP Sales & Mktg**  
Jerry Gauche

**General Counsel**  
Dwight Rettig

\$4.7B ('08)

**Petroleum Services & Supplies (PSS)**

**Downhole & Pumping**  
Jeremy Thigpen

- Drill Bits (ReedHycalog)
- Downhole Tools
- Wired Drill Pipe (IntelliServ)

**•Pumps, Exp, & Valves (Mission)**

**Services**  
Haynes Smith

- Drill Pipe (GRP)
- Pipe Inspection (Tuboscope)
- Solids Control (Brandt)

**Coiled Tubing**  
David Daniel

**Fiberglass Pipe**  
Bill Burnett

\$7.5B ('08)

**Rig Solutions**

**Rig Equip**  
Mark Reese

**CT & Wireline Equip**  
Joe McAnally

- CT Units (Hydra-Rig)
- Wireline Equip (Elmar)
- CT Equip (Texas Oil Tool)

\$1.8B ('08)

**Distribution Svcs**

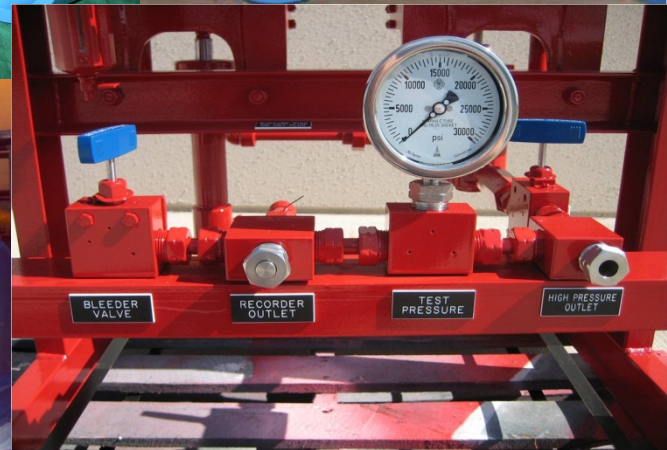
**Distribution Svcs**  
Robert Workman



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# Mission Products



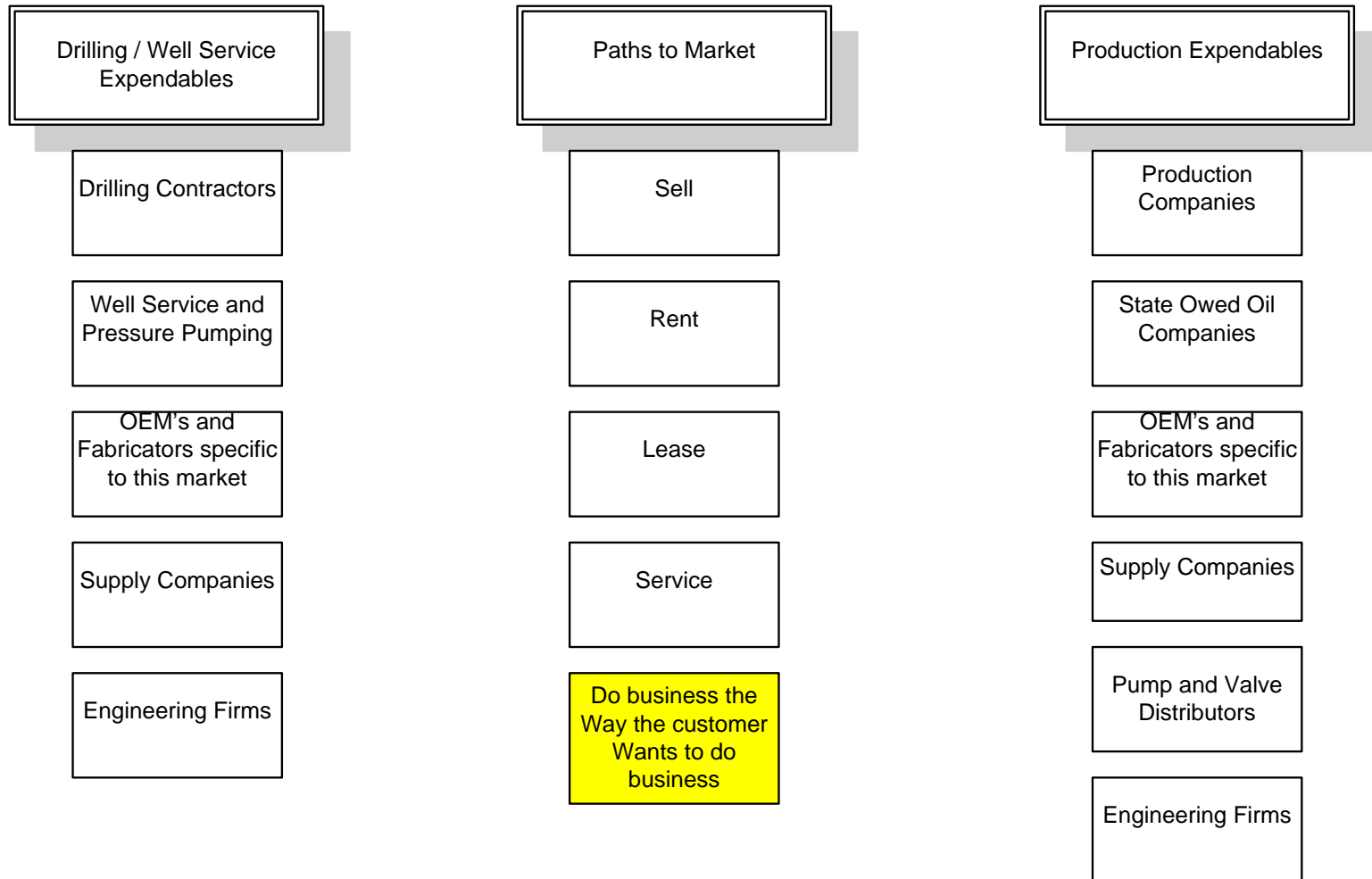




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# Market Segment Customers





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# Product Offerings

## Drilling / Well Service

- Reciprocating Pumps
- Centrifugal Pumps
- Fluid End Expendables
- Automatic Reset Relief Valves
- Reset Relief Valves
- Shear Relief Valves
- Float Valves
- Gate Valves
- Pressure Gauges
- Fluid Transfer Systems
- TurboShear Systems
- Custom Cooling Systems
- Diesel Fuel Filtration Systems
- High Pressure Washdown Systems
- Electric Drilling Chokes
- Hydraulic Drilling Chokes
- Choke valves and choke controls for drilling manifolds
- Adjustable Chokes
- API mud valves
- Choke and Kill Manifold systems
- Standpipe manifolds
- Cement Manifolds
- Reset relief valves
- Shear relief valves

## Production

- Reciprocating Pumps
- Centrifugal Pumps
- Multistage Centrifugal Surface Pumps
- Production Chokes
- Gate Valves
- Adjustable Positive Chokes
- Choke valves and actuators
- API gate valves
- Wellheads and Christmas Trees

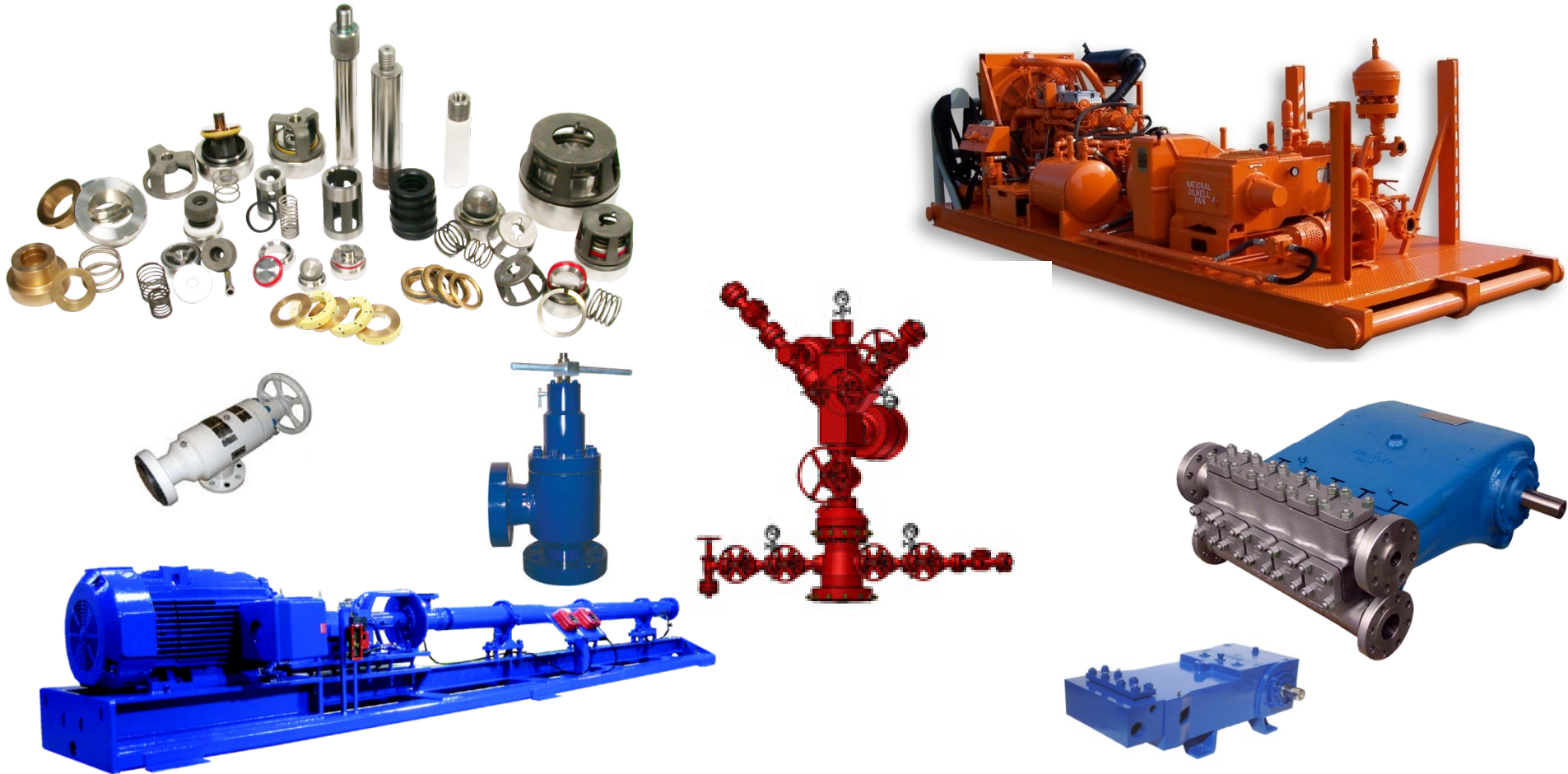




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# Mission Production Solutions



National, Oilwell, Wheatly, Gaso, Bear, Omega, Stork, Magnum MSP, Best, Anson, Sara



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## Production Solutions Product Overview

- API-674 Reciprocating Pumps
- Fluid End Expendables
- API-610<sup>(\*)</sup> Multistage Centrifugal Surface Pump
- API-6A Production Chokes & Gate Valves
- Wellhead and Christmas Tree

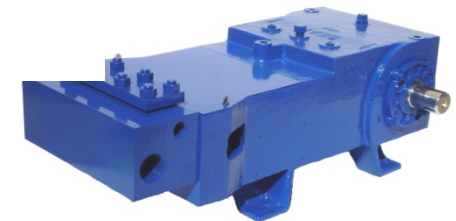
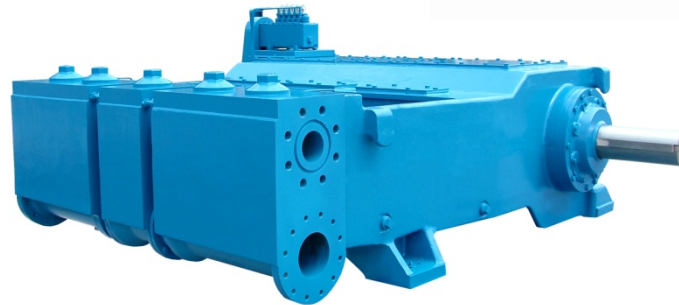
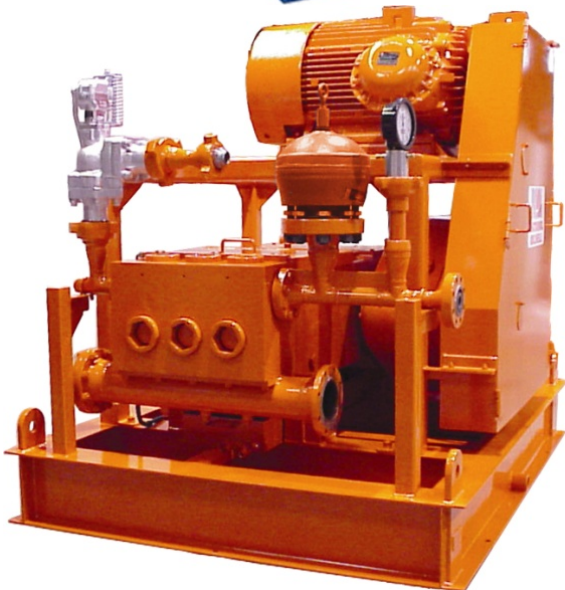
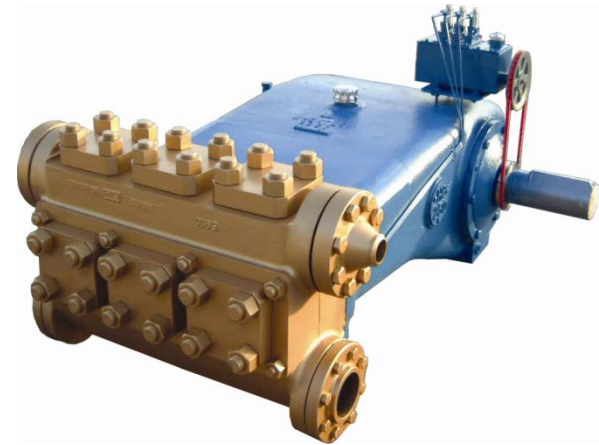
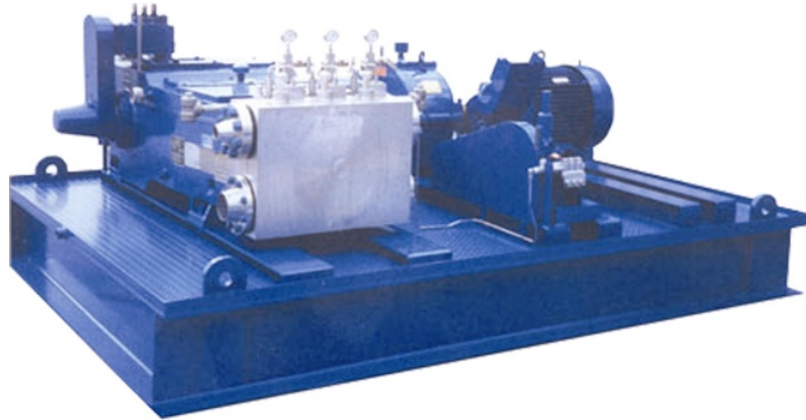
(\*general compliance)



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# API 674 Reciprocating Pumps







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Heritage Pump Lines

# Reciprocating Pump Trade Names

- **National**
- **Oilwell**
- **Wheatley**
- **Gasol**
- **Omega**
- **Bear**
- **MSW**



**BEAR**

Pump and Equipment





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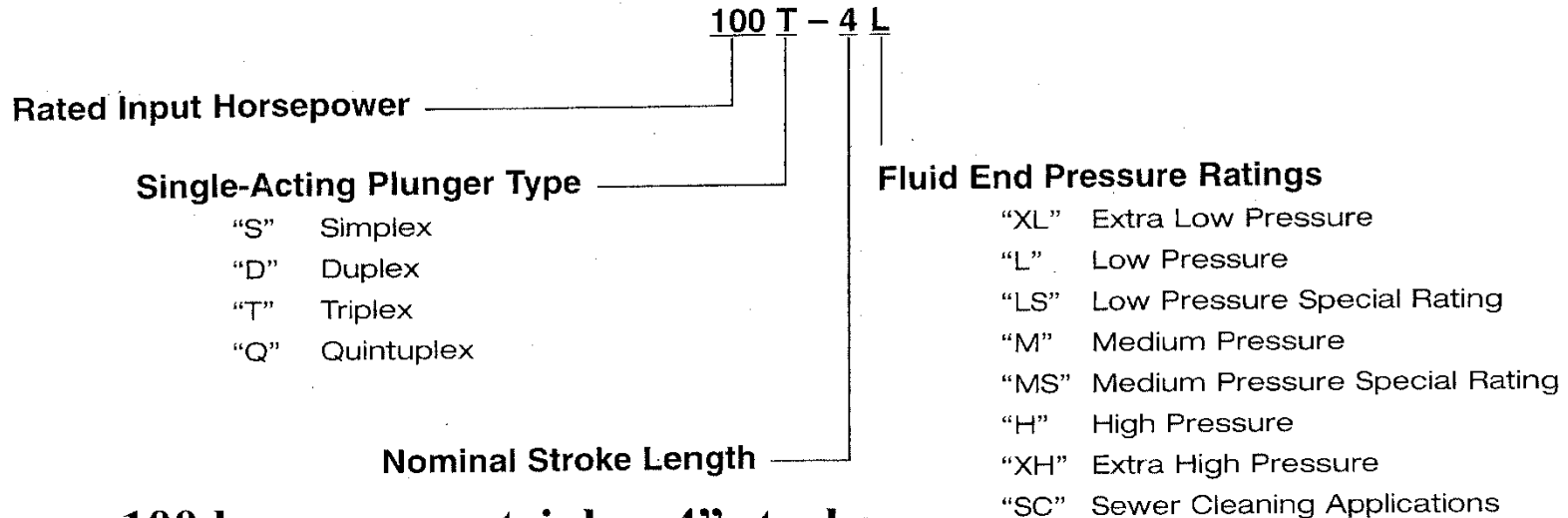
# Reciprocating Pump Common Product Applications

- Waterflood
- Salt Water Disposal
- Crude Oil Pipeline
- Glycol (TEG/MEG)
- Hydrostatic Testing
- High Pressure Water Blast
- Descaling –Steel Mills
- Boiler Feed
- Reverse Osmosis
- Hydraulic Presses
- Waste Disposal
- Slurry Pipeline Pi



# Reciprocating Pumps Nomenclature

## National-Oilwell Pump Nomenclature



**100 horsepower, triplex, 4” stroke  
L fluid end Pump**

**300Q-5M**

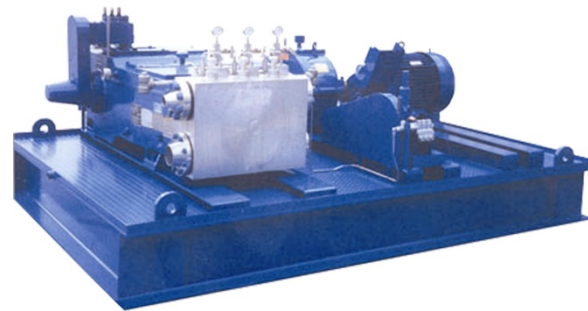
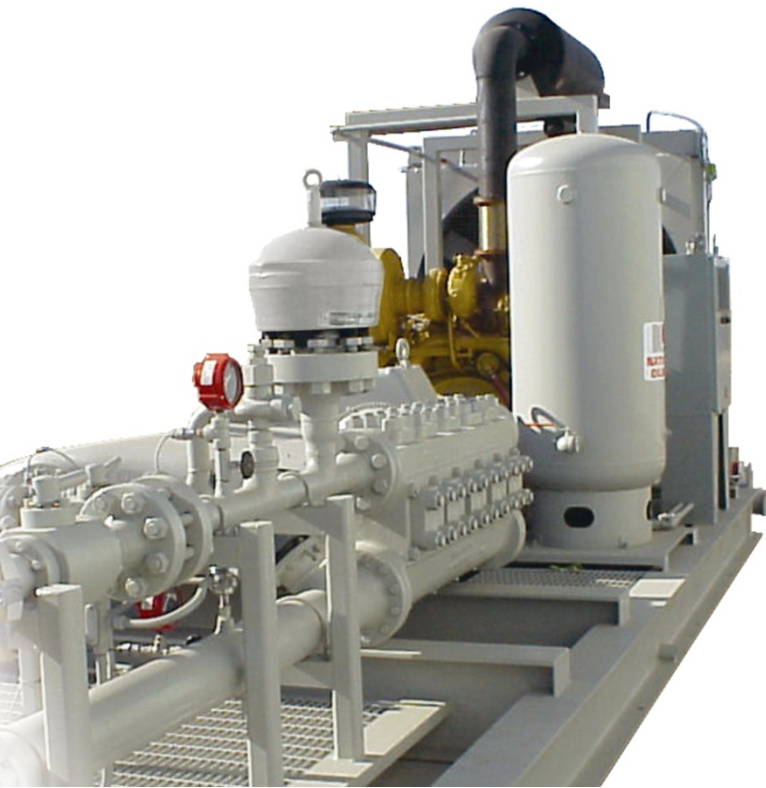
**300 horsepower, quintuplex, 5 stroke  
M fluid end Pump**



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# Reciprocating Pump Engineered Package Solutions



- Highly engineered custom multiplex unitization services
- Leading manufacturer of multiplex pumps
- Wide performance range offering



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# Reciprocating Pump Engineered Package Solutions

- Complete Packaged Units pre-assembled and tested ready for Installation at a customer's site
- Hazardous Area / Non Hazardous Area Classifications
- Drivers
  - Electric Motor
  - Variable Voltage Variable Frequency Drives (VVVF's)
  - Diesel Engine
  - Gas Engine
  - Hydraulic Motors





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# Reciprocating Pump Engineered Package Solutions

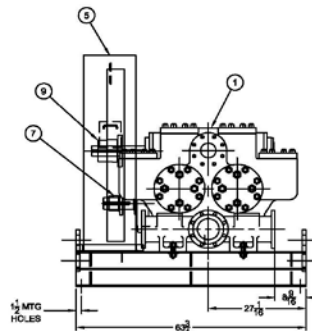
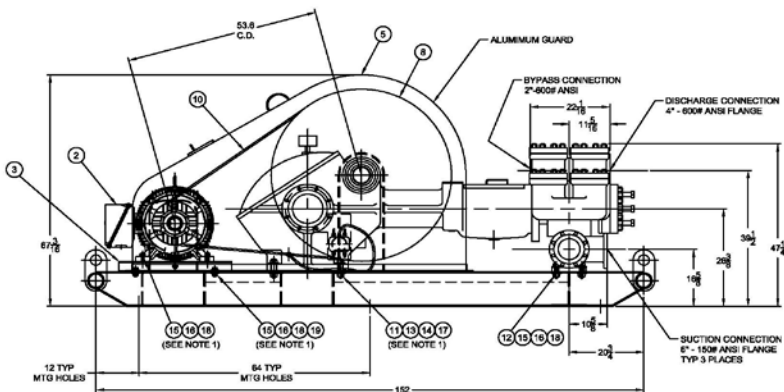
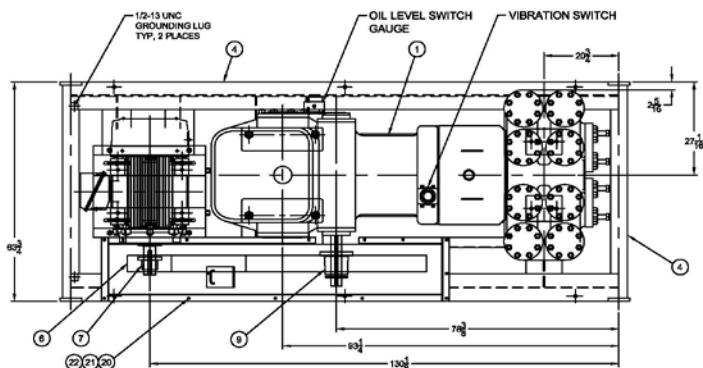
- **Transmission Systems**
  - Belt Drive
  - Gear Reducer Driven
  - Manual Transmission
  - Hydraulic Coupling
- **Control Systems**
  - PLC
  - Local / Remote Designed Systems
- **Accessories**
  - Suction and Discharge Pulsation Dampeners
    - Maintenance - free
    - Nitrogen Pre-charged Units
  - Pressure Relief Valves
  - Isolation Valves
  - Mission Centrifugal Charging Pumps



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# Pump Package Drawing & Engineering



ITEM	QTY	DESCRIPTION	PART NO.
1	1	PUMP, 1753, RHD CAST STEEL FE SLUSH TRM	6KD-06085-408
2	1	MOTOR, 150 HP, XP, 445T	S1150XP18-R
3	1	SLIDE BASE, 445T	442-00045-001
4	1	SKID, RHD, ELECTRIC MOTOR, V-DRIVE	AAD-118022-231
5	1	GUARD, V. DRIVE, ALUMINUM	AAD-118025-282
6	1	BELTWAY, SV-6 GRV 12.5" DD	419-508125-699
7	1	HUB, 1/2" W/3-3/8" BORE	420-07319-088
8	1	BELTWAY, SV-6 GV 50.0"	419-509050-699
9	1	HUB, 1/2" W/3-15/16" BORE	420-092438-075
10	8	V-BELT, SV-2120	421-52120-021
11	4	CAP SCREW, 1-1/8" x 3-1/2"	100-11813-290
12	4	CAP SCREW, 3/4" x 3-1/4"	100-034314-290
13	8	FLAT WASHER, 1-1/8"	155-118234-286
14	4	LOCK WASHER, 1-1/8"	154-118224-286
15	20	FLAT WASHER, 3/4"	155-034200-286
16	12	LOCK WASHER, 3/4"	154-034127-286
17	4	NUT, HEAVY HEX, 1-1/8"	133-118007-286
18	12	NUT, HEAVY HEX, 3/4"	133-034010-286
19	4	CAP SCREW, 3/4" x 2-1/2"	100-034212-290
20	13	CAP SCREW, 3/8" x 1"	100-038100-290
21	13	FLAT WASHER, 3/8"	155-038100-286
22	13	LOCK WASHER, 3/8"	154-038066-286

NOTES:  
1. HOLES FOR PUMP MOUNT, MOTOR MOUNT, AND SUPPORTS TO BE LOCATED AND DRILLED DURING ASSEMBLY.

ESTIMATED WEIGHT 9,880 LBS.

DATE: 01/11/01 DRAWN: [redacted] CHECKED: [redacted] APPROVED: [redacted]	DATE: 01/11/01 DESIGN: [redacted] CHECKED: [redacted] APPROVED: [redacted]	DATE: 01/11/01 DESIGN: [redacted] CHECKED: [redacted] APPROVED: [redacted]	DATE: 01/11/01 DESIGN: [redacted] CHECKED: [redacted] APPROVED: [redacted]	DATE: 01/11/01 DESIGN: [redacted] CHECKED: [redacted] APPROVED: [redacted]
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NO REPAIRS PERMITTED  
MACHINING TOLERANCES:  
BREAK SHARP CORNERS R3.0  
TOLERANCES:  
DIMENSIONAL ±.005  
DIMENSIONAL .000 ±.008  
DIMENSIONAL .000 ±.008  
ANGLES ±.05  
HOLE POSITION ±.010  
HOLE SIZE ±.0005

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PUMP UNIT, V-DRIVE  
445T ELECTRIC MOTOR  
V-BELT DRIVE  
MODEL 1753

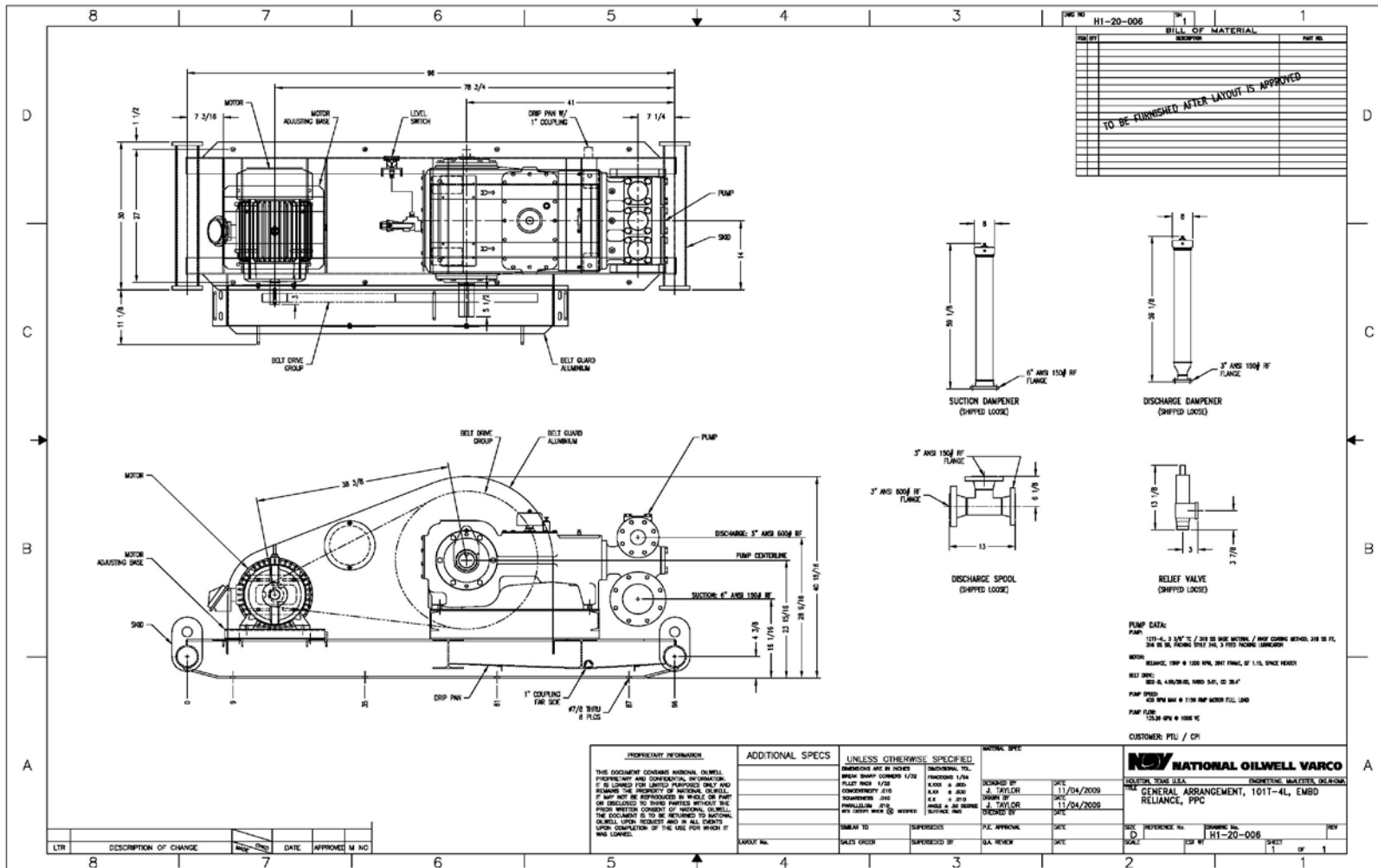
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# Pump Package Drawing & Engineering



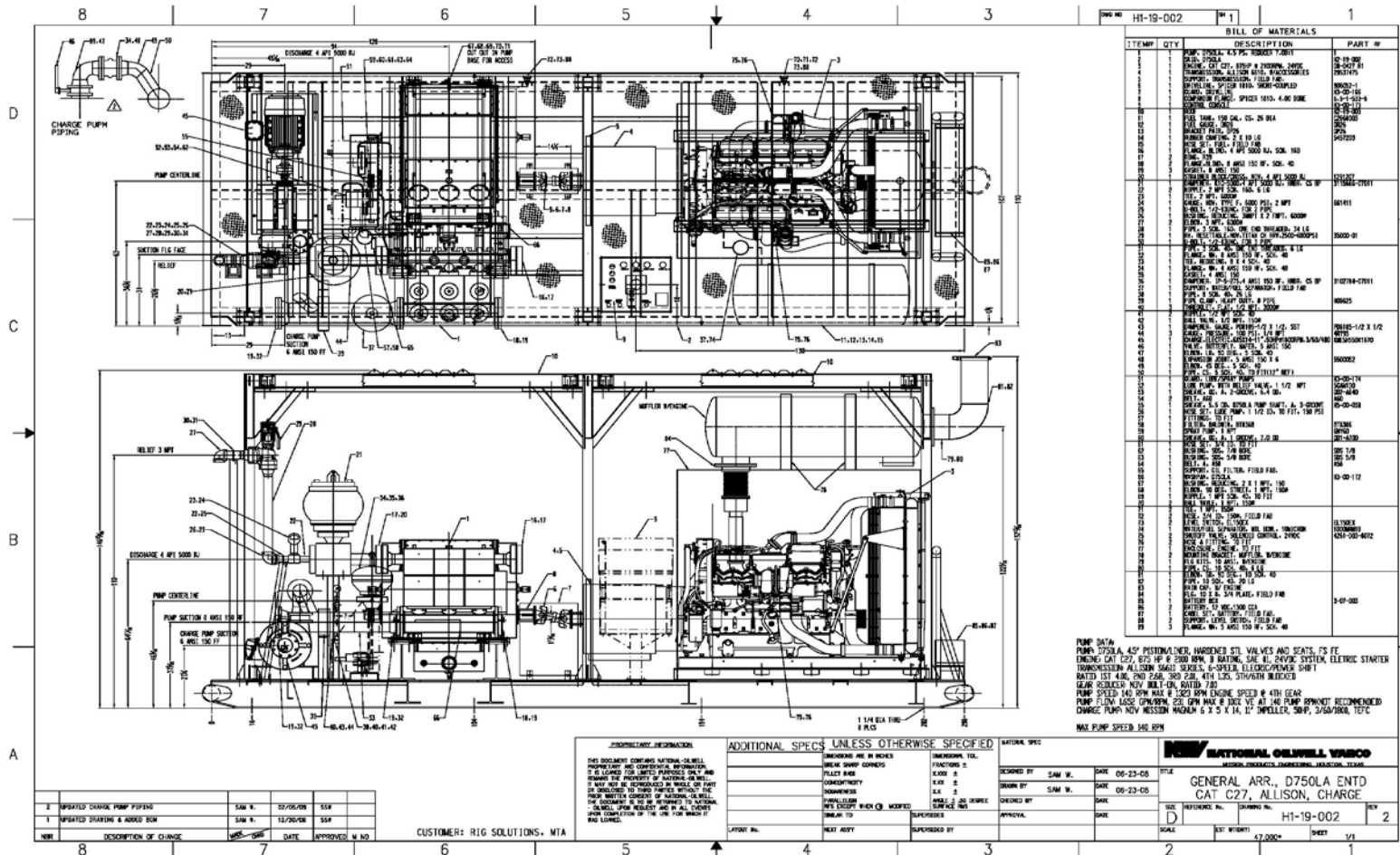




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# Pump Package Drawing & Engineering



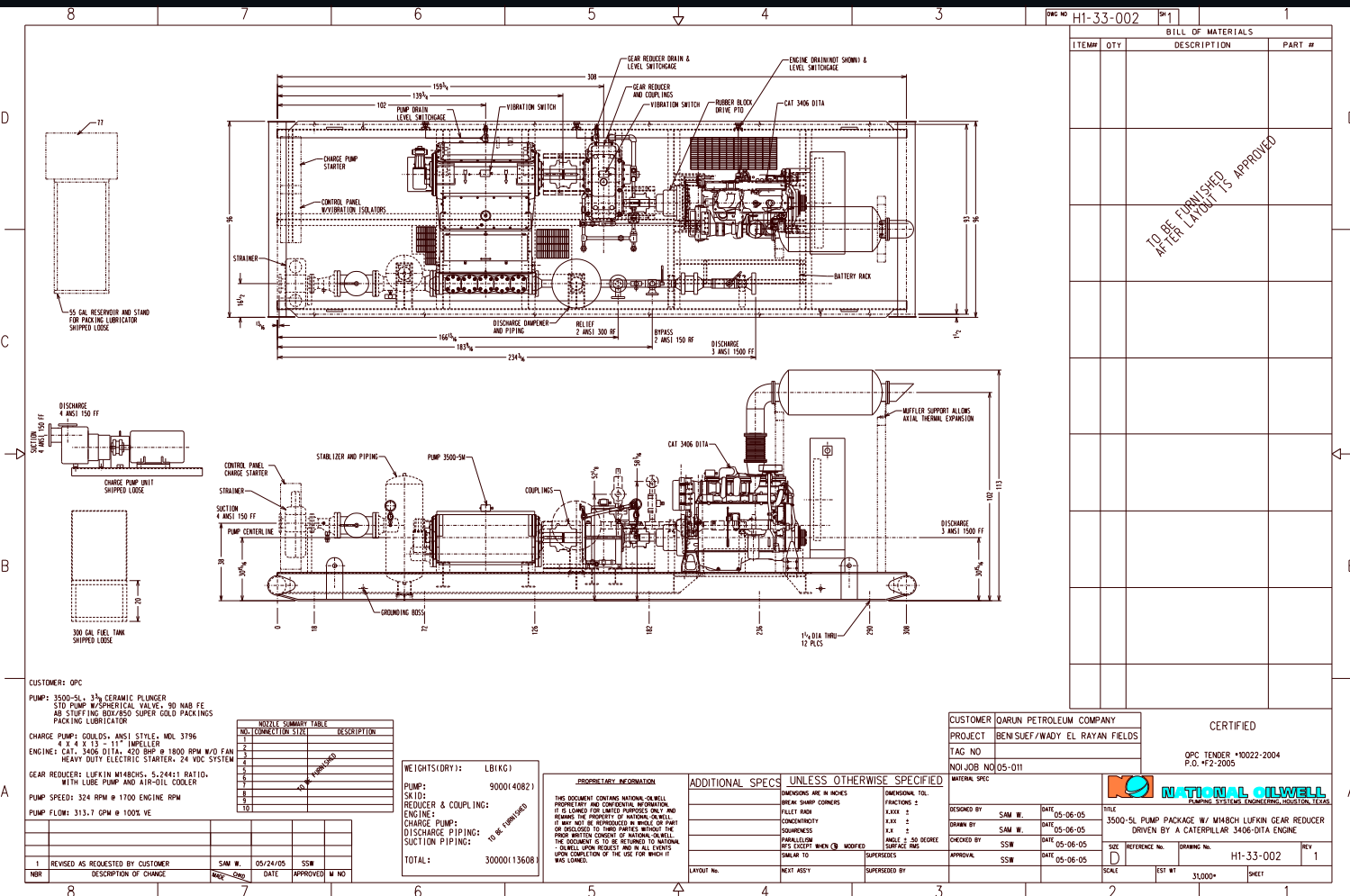




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# Pump Package Drawing & Engineering



BILL OF MATERIALS		
ITEM#	QTY	DESCRIPTION
TO BE FURNISHED AFTER LAYOUT IS APPROVED		

CUSTOMER: OPEC  
 PUMP: 3500-5L, 3/4 CERAMIC PLUNGER  
 STD PUMP W/ SPHERICAL VALVE, 50 NAB FE  
 AB STUFFING BOX/850 SUPER GOLD PACKINGS  
 PACKING LUBRICATOR  
 CHARGE PUMP: GOULDS, ANSI STYLE, MDL 3796  
 4 X 4 X 13 - 11" IMPELLER  
 ENGINE: CAT, 3406 DITA, 420 SHP @ 1800 RPM W/O FAN  
 HEAVY DUTY ELECTRIC STARTER, 24 VDC SYSTEM  
 GEAR REDUCER: LUFKIN M148CHS, 5:244:1 RATIO,  
 WITH LUBE PUMP AND AIR-OIL COOLER  
 PUMP SPEED: 324 RPM @ 1700 ENGINE RPM  
 PUMP FLOW: 313.7 GPM @ 100% VE

NOZZLE SUMMARY TABLE	
NO.	DESCRIPTION
1	TO BE FURNISHED

WEIGHTS (DRY): LB(KG)  
 PUMP: 9000(4082)  
 GEAR REDUCER & COUPLING:  
 ENGINE:  
 CHARGE PUMP:  
 DISCHARGE PIPING:  
 SUCTION PIPING:  
 TOTAL: 30000(13608)

PROPRIETARY INFORMATION  
 THIS DOCUMENT CONTAINS NATIONAL OILWELL  
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 IF ANY PART IS REPRODUCED IN WHOLE OR PART  
 OR DISCLOSED TO THIRD PARTIES WITHOUT THE  
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 THE DOCUMENT IS TO BE DESTROYED IMMEDIATELY  
 UPON COMPLETION OF THE USE FOR WHICH IT  
 WAS LOANED.

ADDITIONAL SPECS	UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES	DIMENSIONS ARE IN INCHES
BREAK IN SHARP CORNERS	FRACTIONS 1/8
FILLET RADIUS	R. 1/8
CONCENTRICITY	R. 1/8
SURF FINISH	FINISH 1.50 SQUARE
SPRUE/POUR	SURFACE RING
RFS EXCEPT WHEN MODIFIED	
SCALE TO	SUPERSIZES
NEXT ASSY	SUPERSIZES BY

CUSTOMER: OARUN PETROLEUM COMPANY  
 PROJECT: BENI SUEF/WADY EL RAYAN FIELDS  
 TAG NO:  
 NOI JOB NO: 05-011

CERTIFIED  
 OPEC TENDER #0022-2004  
 P.O. #2-2005



DESIGNED BY: SAM W. DATE: 05-06-05  
 DRAWN BY: SAM W. DATE: 05-06-05  
 CHECKED BY: SSW DATE: 05-06-05  
 APPROVAL: SSW DATE: 05-06-05

TITLE: 3500-5L PUMP PACKAGE W/ M148CH LUFKIN GEAR REDUCER  
 DRIVEN BY A CATERPILLAR 3406-DITA ENGINE  
 REFERENCE No. DRAWING No. REV  
 H1-33-002 1

REV	DESCRIPTION OF CHANGE	SAM W.	DATE	SSW
1	REVISED AS REQUESTED BY CUSTOMER		05/24/05	





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# Drilling Mud Pump Package







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# Water Injection/Disposal Pump







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# Water Injection/Disposal Pump



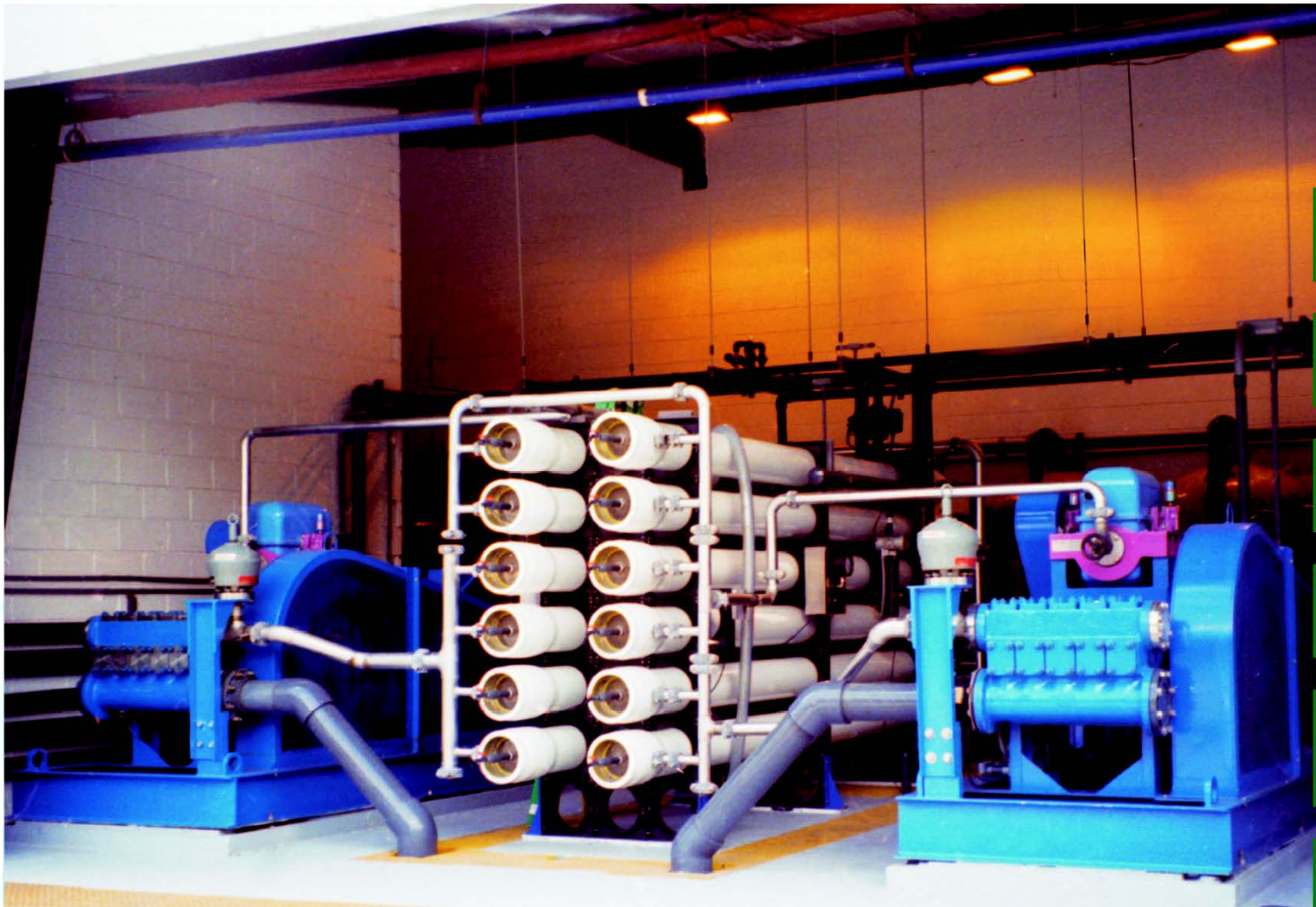




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# Desalination Pumps

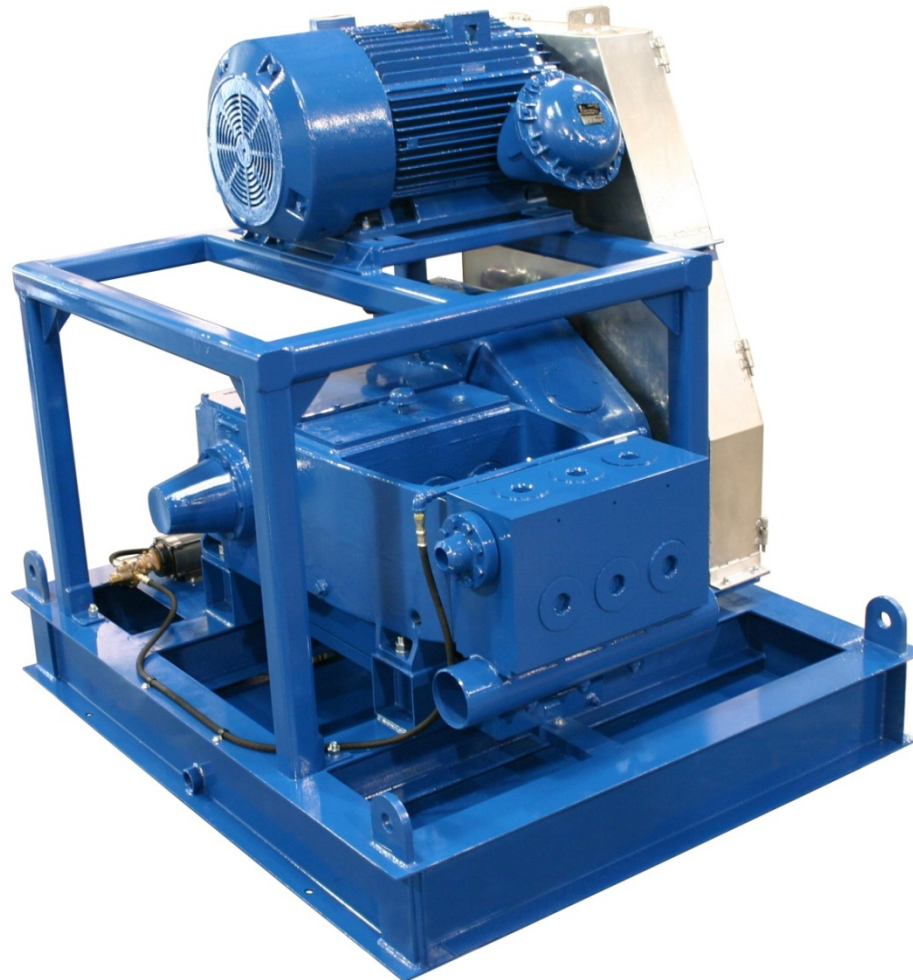




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# Cuttings Re-injection Pump



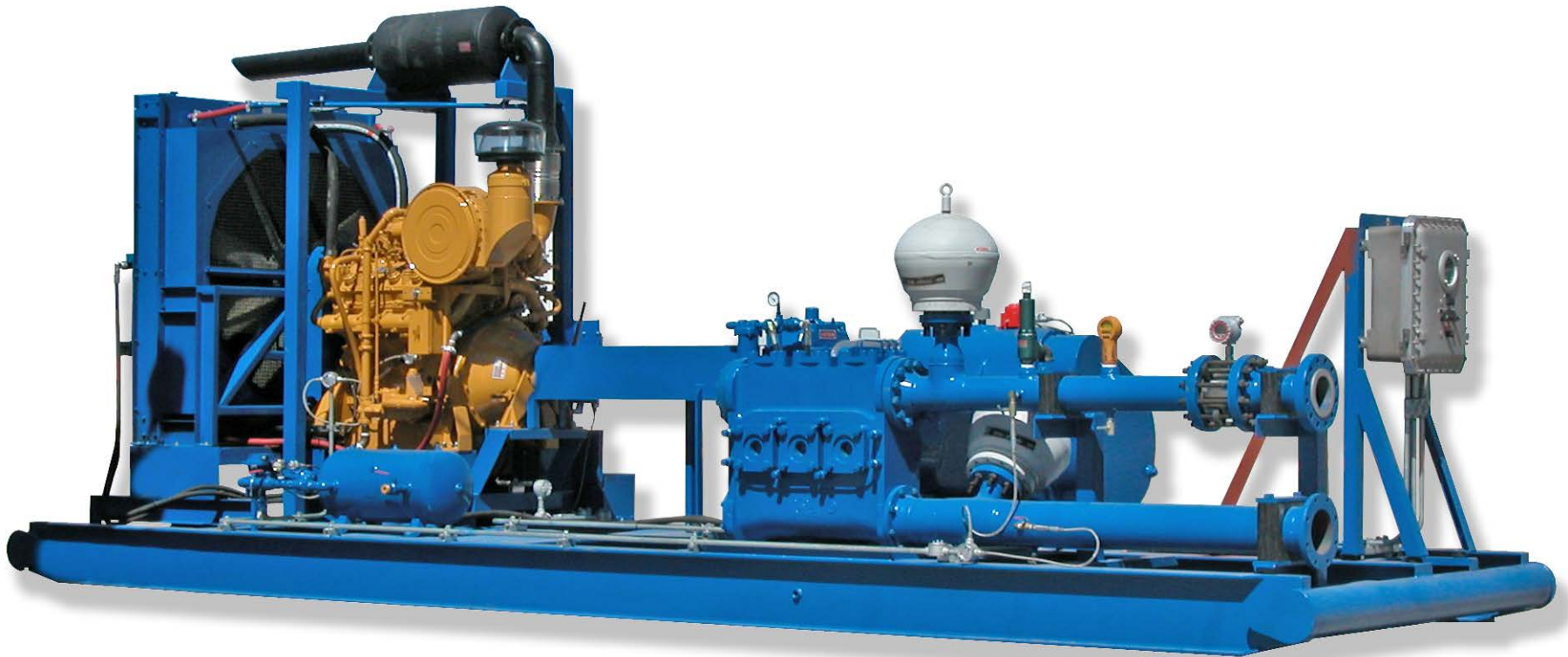




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# Crude Oil Dispatch Pump

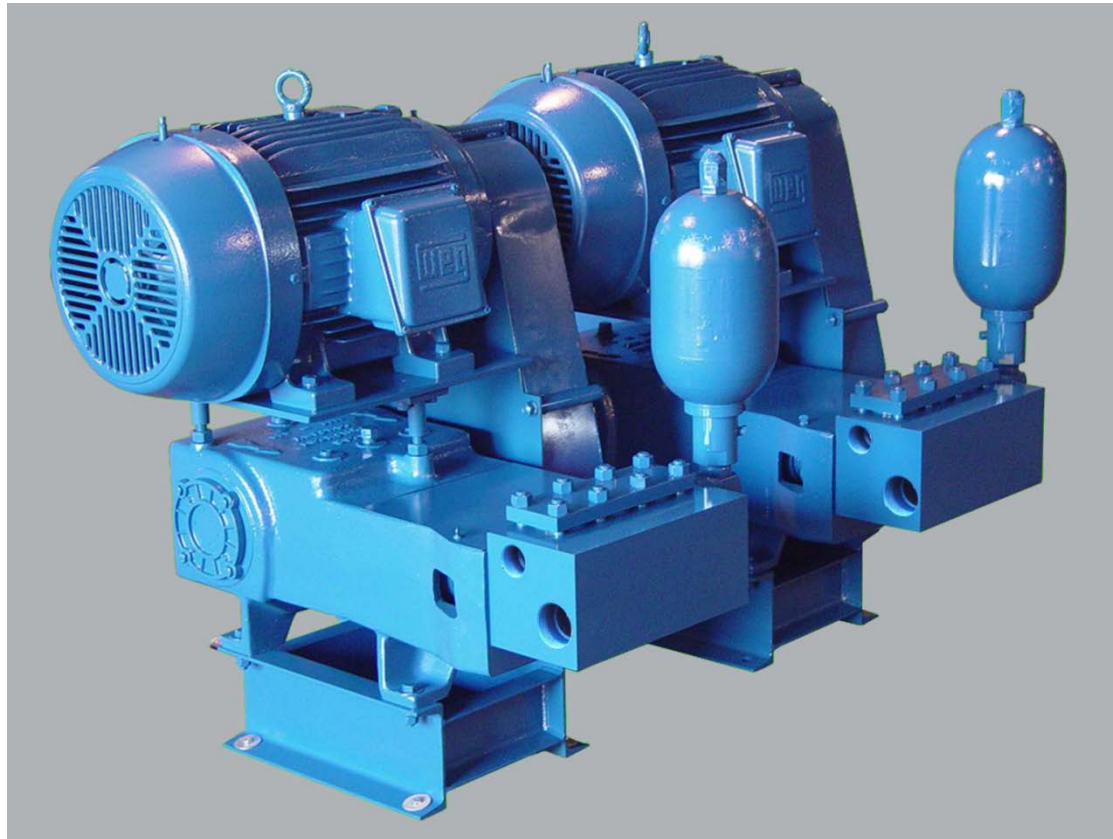




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# Amine Unit







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## Fluid King Expendables

A versatile offering of high quality plunger pump fluid end expendables for all major pump manufactures







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## Plungers and Packing

- Sizes and styles for all brands of plunger pumps





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## Plungers and Packing



- Superior Surface Finish  
Spray Metal Plungers
- Precision Ground  
Ceramic Plungers
- Clamped and Threaded  
Intermediate Rods
- Wide Variety of Packing  
Styles
- Complete Offering of  
Stuffing Box Brass and  
Gaskets



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# Valves

- Sizes and styles for all brands of plunger pumps



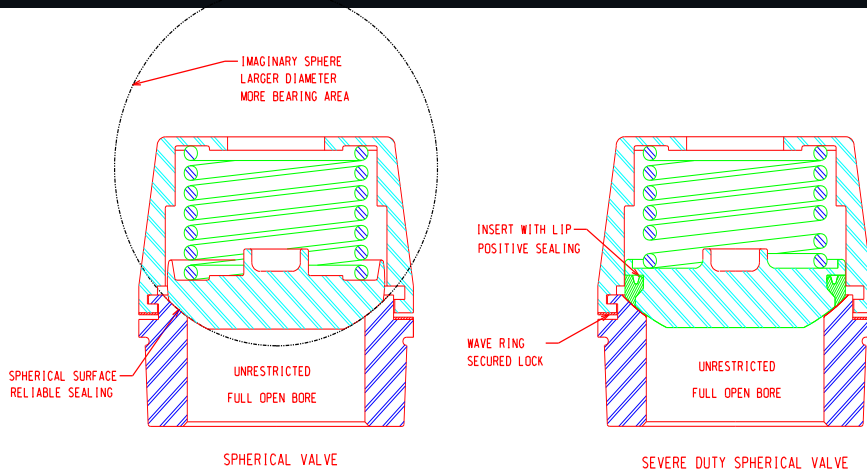




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# NOV Spherical Valves



**National Oilwell Spherical Valves are available in three different designs**

**Standard Duty (Regular and Wave Ring):** For general and corrosive applications including crude oil, water re-injection and condensate service.

**Severe Duty (abrasion resistant):** Typically used in low concentration slurry and solid laden liquid applications.





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## **Spherical Valve Advantages**

- 1. Produces more flow through area**
- 2. Reduces obstructed flow**
- 3. Reduces NPSH requirement**
- 4. Produces high volumetric efficiency**
- 5. Extends mean time between failures**
- 6. Reduces maintenance and operating cost**



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# MSP – Multistage Surface Pump



**IN GENERAL COMPLIANCE TO  
API610**





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# MSP APPLICATIONS

## ■ Oil and Gas

- Produced water injection, disposal
- Pipeline booster
- Crude oil transfer
- Jet pumping - power fluid
- Amine/NGL/CO2/LPG

## ■ Mining

- De-watering
- Dust suppression
- Hydraulic power fluid

## ■ Industrial

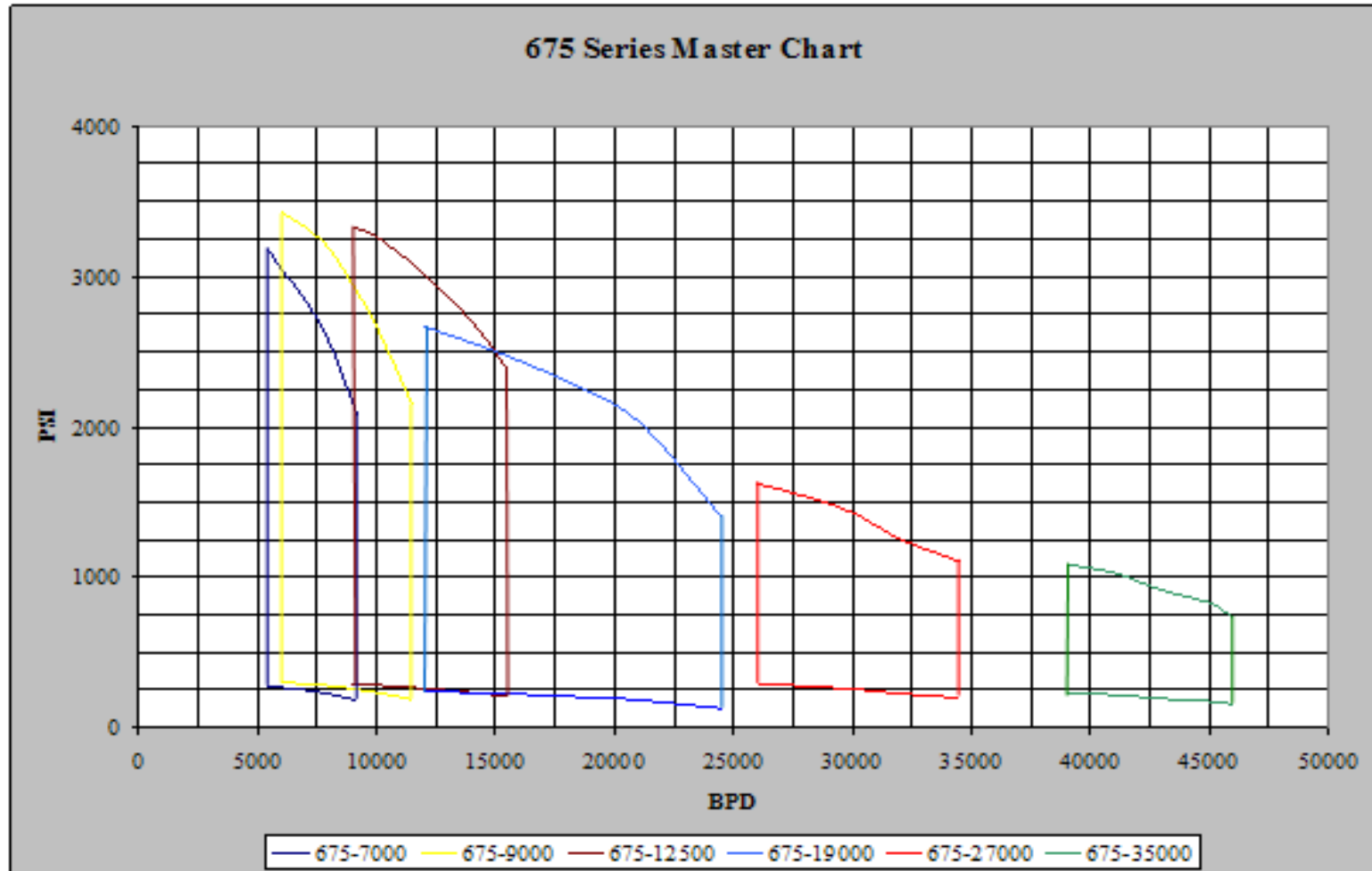
- Industrial process fluids
- Reverse osmosis
- Geothermal injection
- Wash-down
- De-scaling
- Effluent disposal
- Pipeline booster



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# MSP 675-series Performance

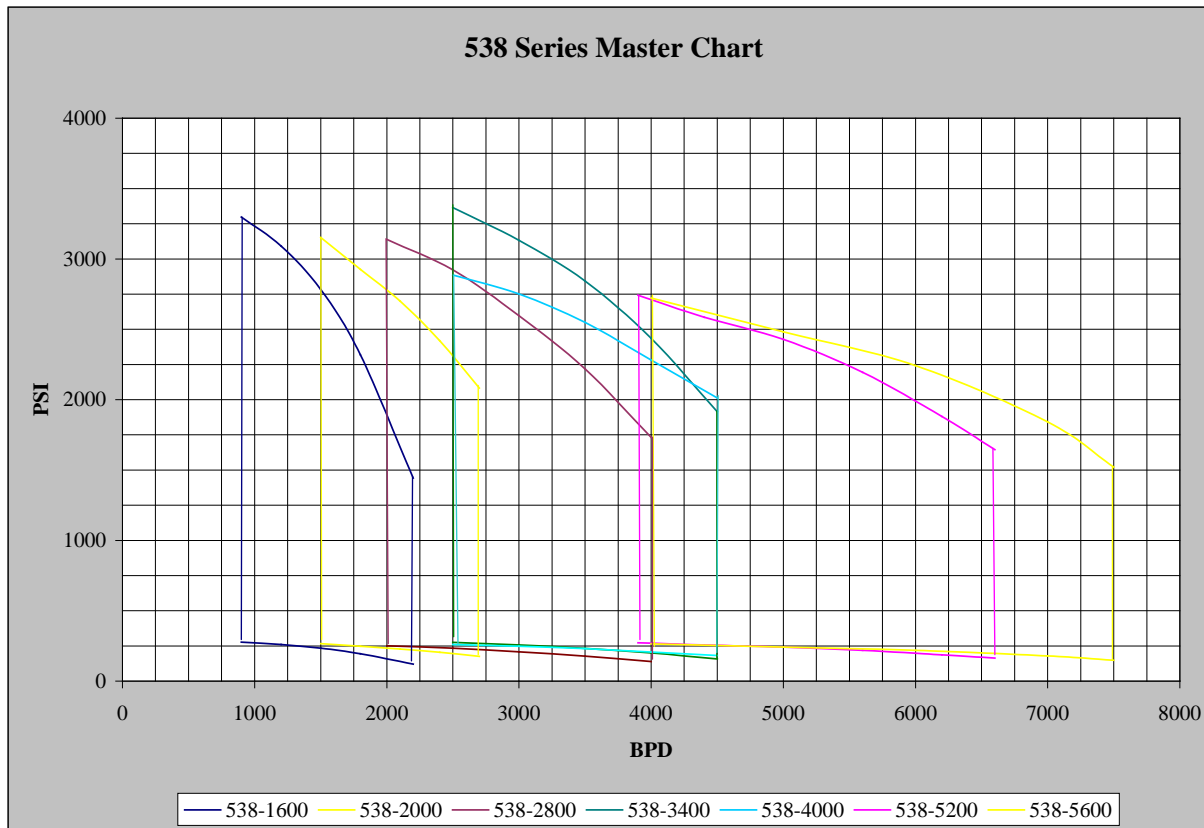




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# MSP 538-series Performance



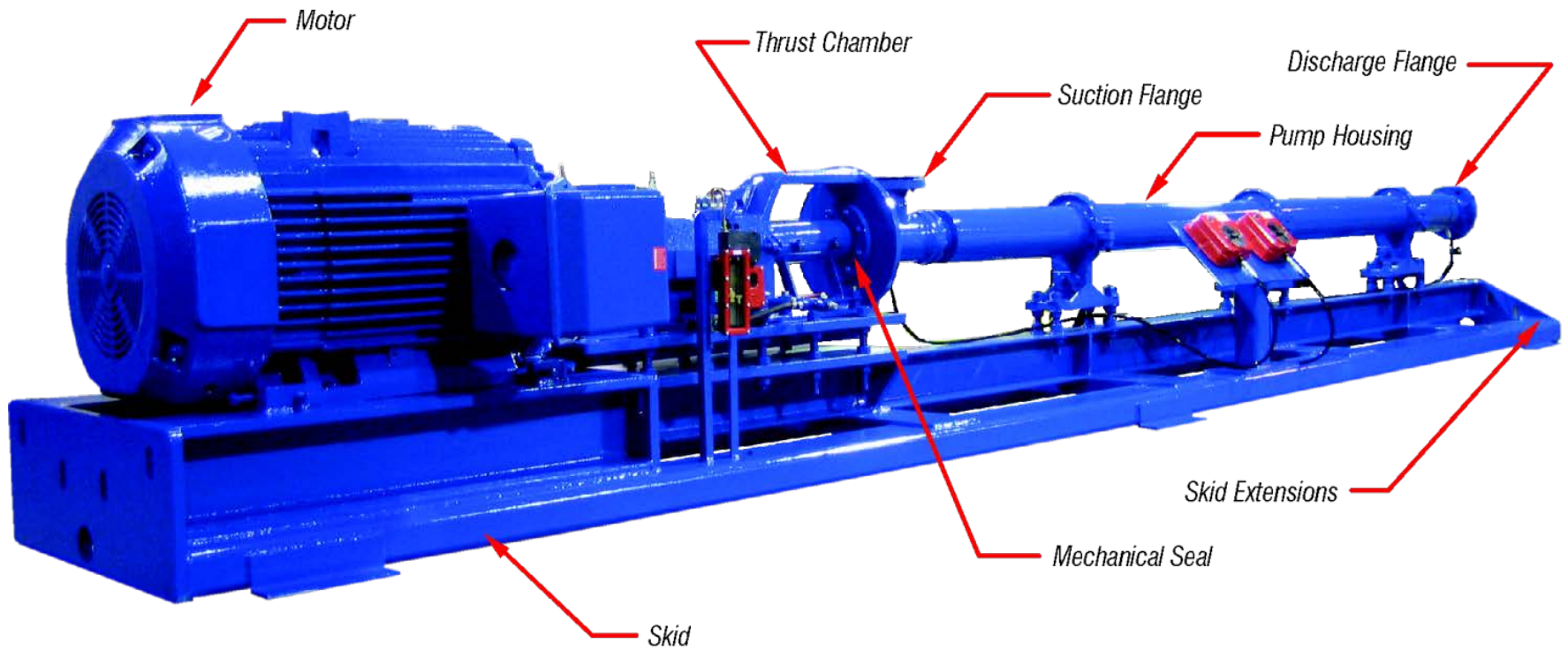




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# MSP Pump Layout





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Water Injection/Disposal Pumps

# MSP – Multistage Surface Pump



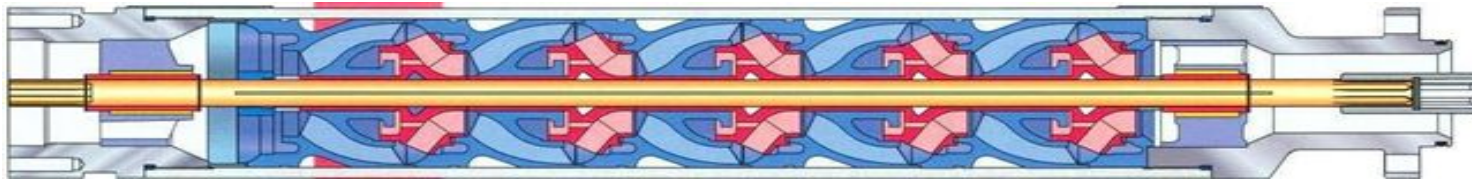




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## MSP Materials of Construction



- MONEL K500 shaft
- NI-RESIST Type 1 impeller, bushings and diffusers
- Tungsten Carbide Bearings
- 316 SS Suction/Discharge Heads
- TC/TC Type 1 Mechanical Seal



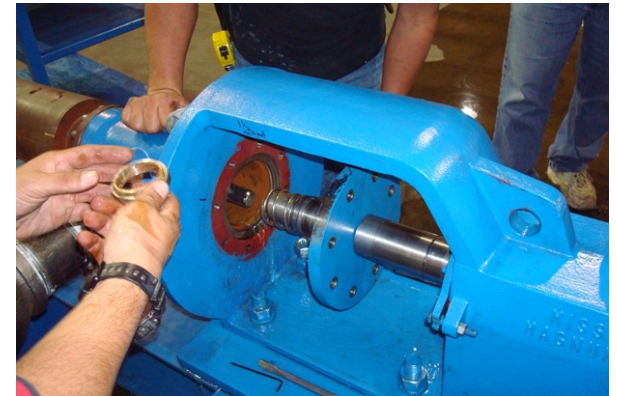
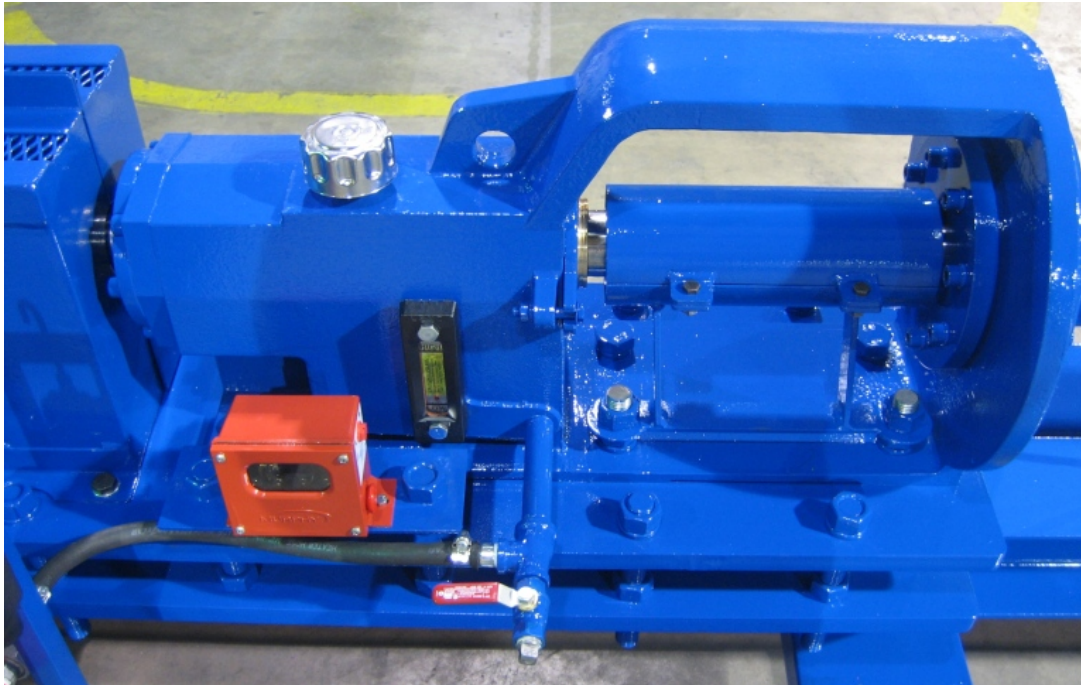


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## NOV MSP Advantage

Mechanical seal can be replaced in less than 1 hour without disturbing piping or motor coupling

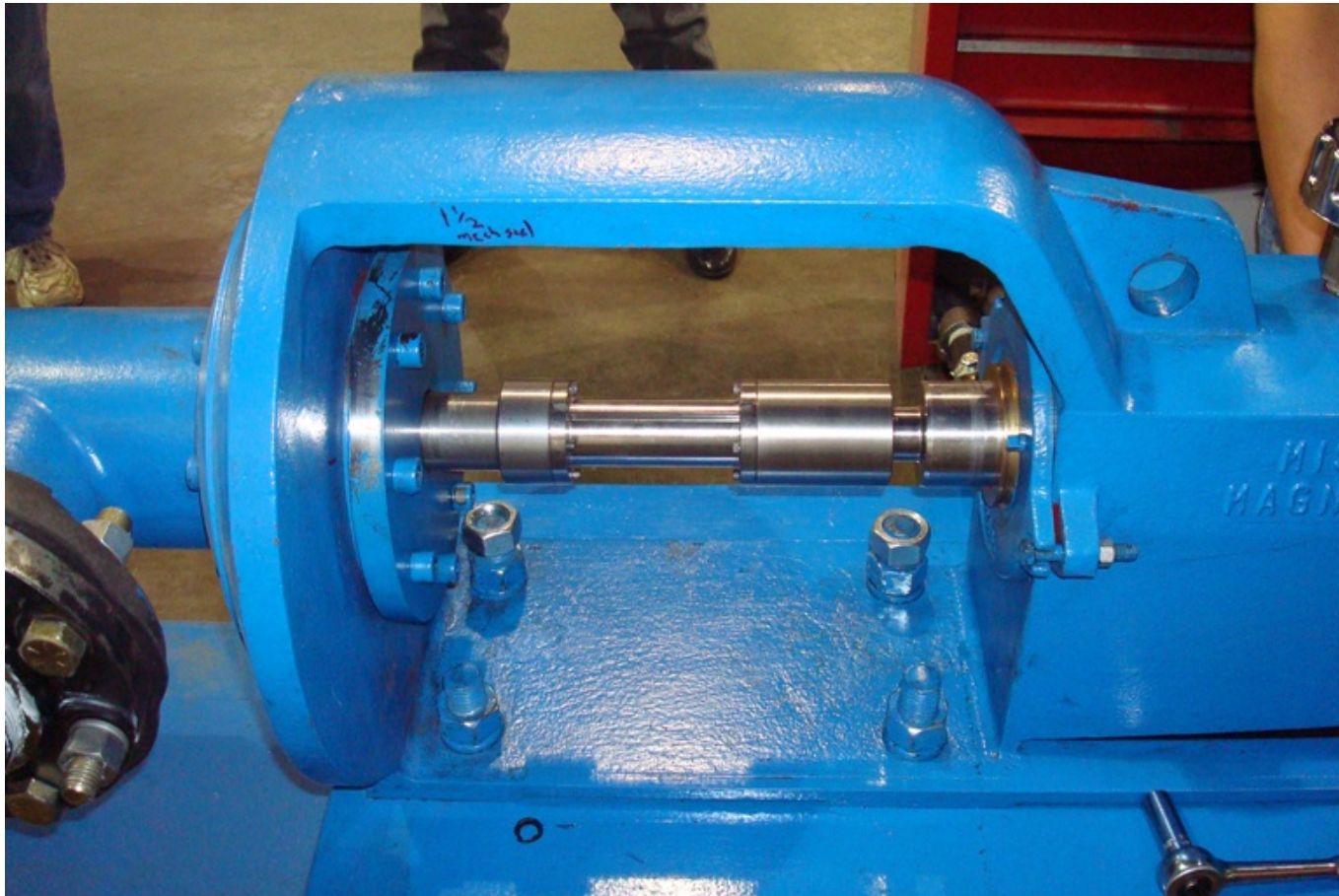




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# NOV Thrust Chamber Advantages



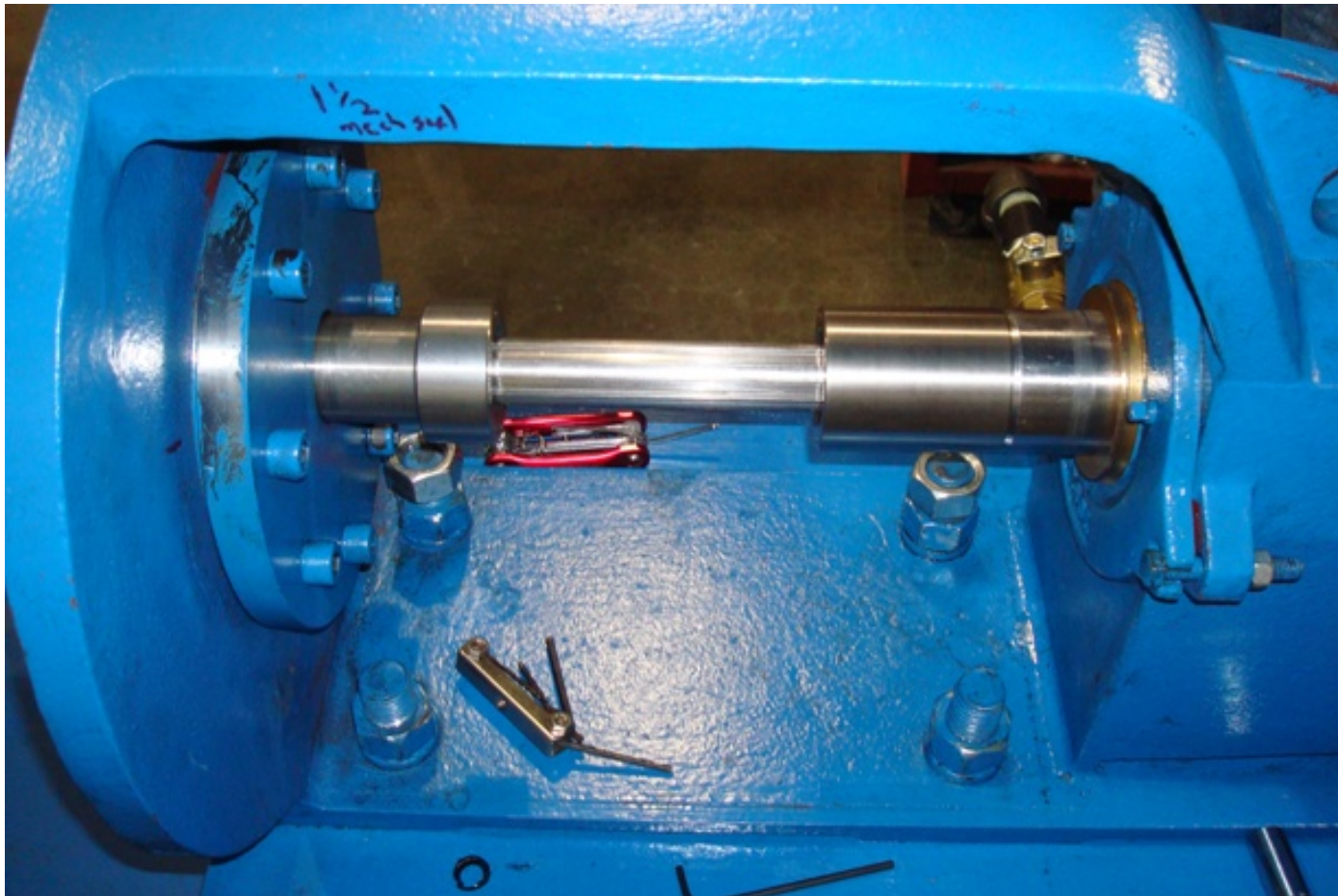




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# Mechanical Seal replacement



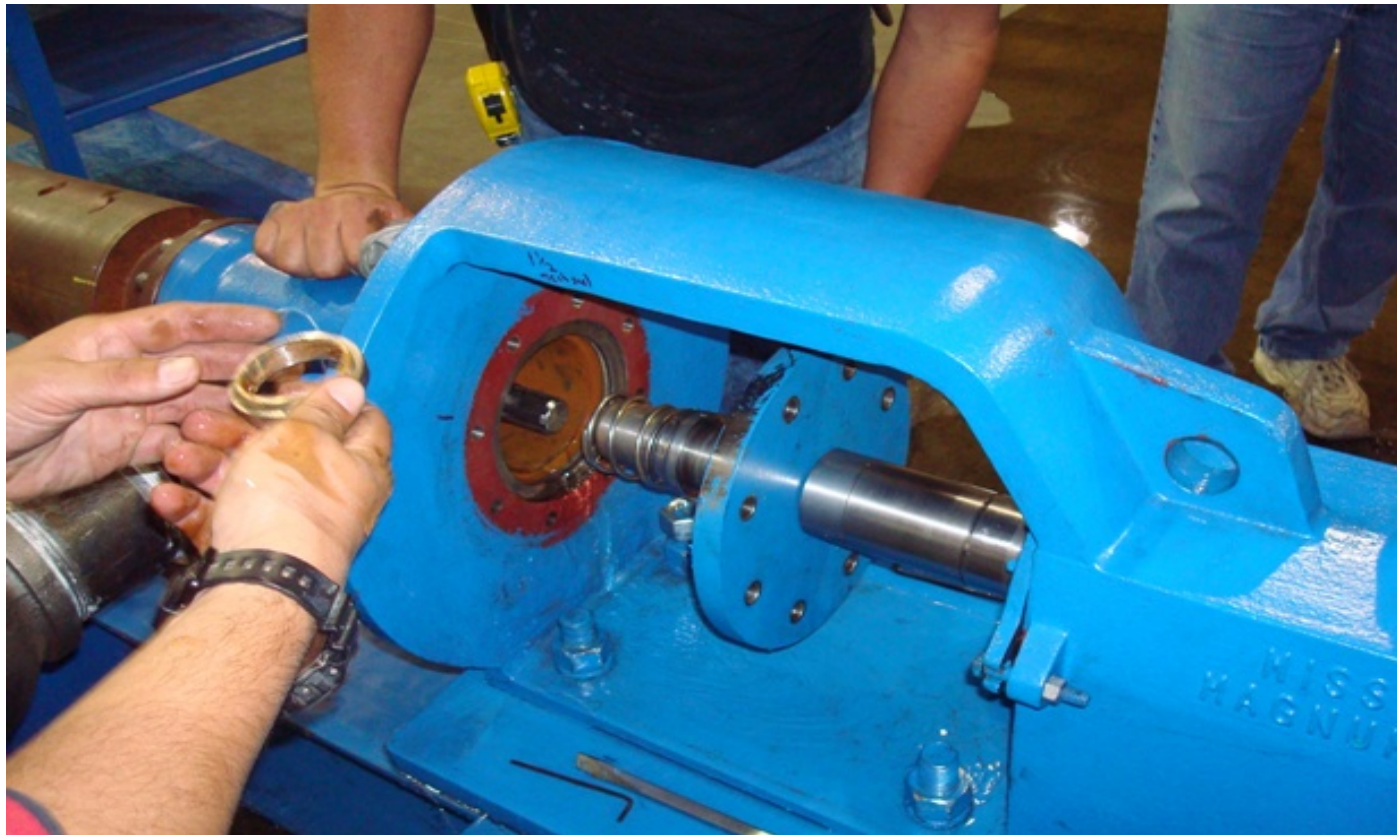




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# Mechanical Seal replacement



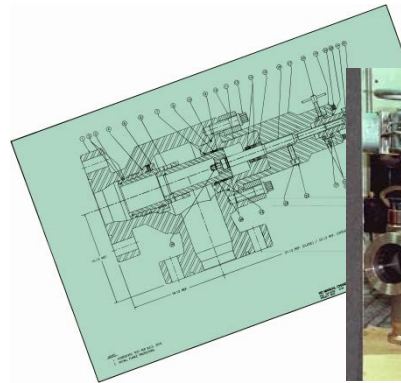
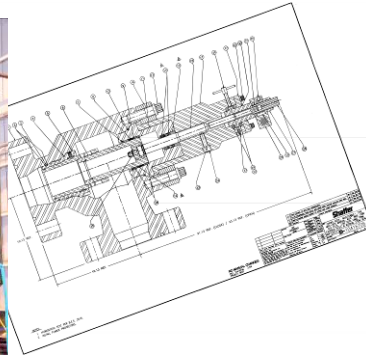
It is not necessary to disconnect any piping or disturb the pump to motor alignment to change mechanical seal



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# API 6A : PRODUCTION CHOKE VALVES



Best Flow Products (Varco/Best)



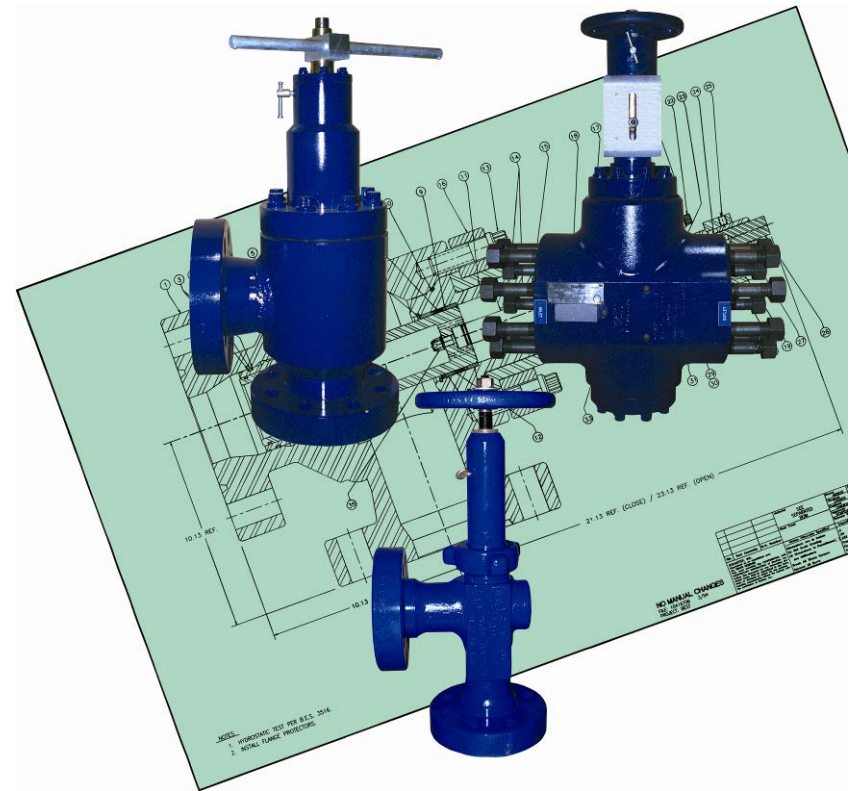


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## BEST - Application Experience

- Production chokes -
  - Proven in high rate wells with sand production
  - Two and three phase flow conditions
- Water Injection Chokes -
  - Proven with produced water & with high chlorides
- Gas Lift/Injection Chokes -
- WAG Chokes
- Cryogenic Service
  - Tested to  $-108^{\circ}\text{C}$  ( $-165^{\circ}\text{F}$ )
- Drilling Choke & Kill Manifolds



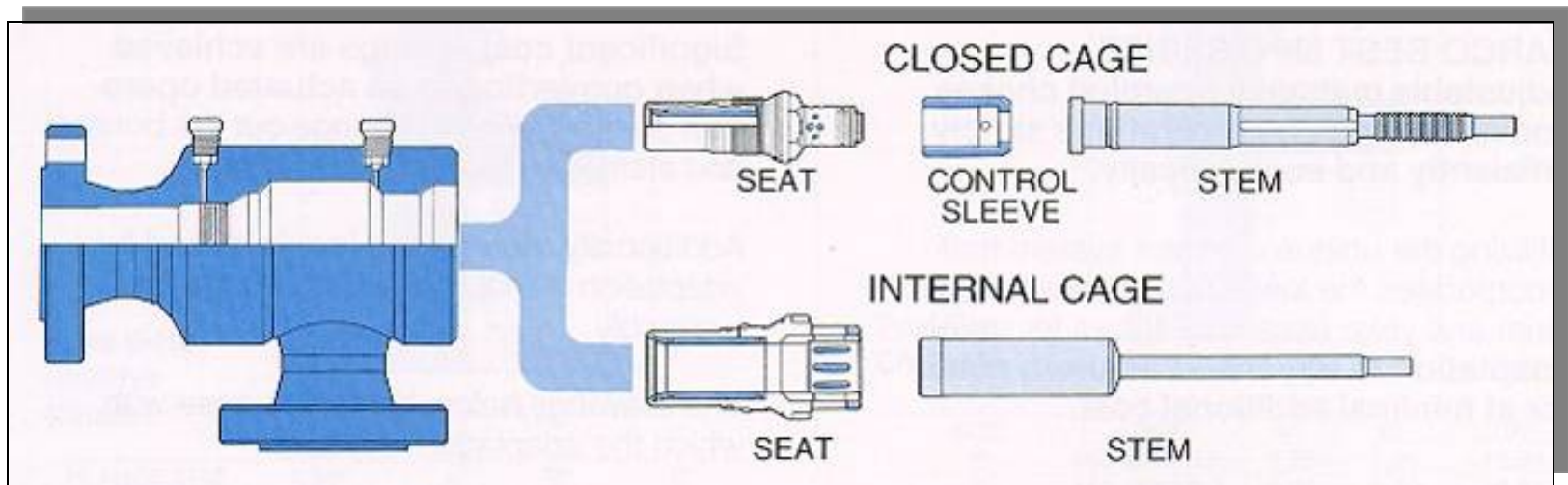




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## Choke Sizing: trim type



- **CLOSED CAGE TRIM**
  - Designed For Severe Service, High Pressure, Multi-Phase Flow & Erosive Fluids
- **INTERNAL CAGE TRIM**
  - Designed For Medium Service, Medium Pressures, High Flow Capacity & Mild Erosive Fluids

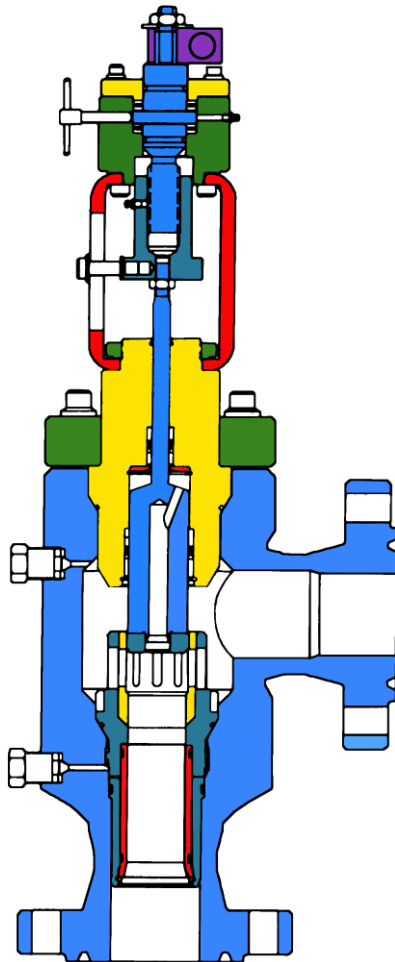


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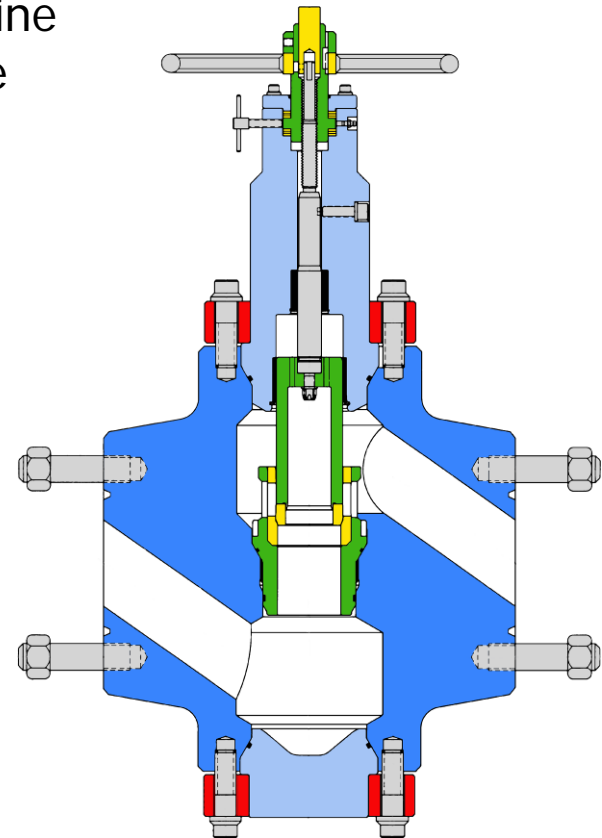
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# MPC Series Chokes

Angle Type



In-Line Type



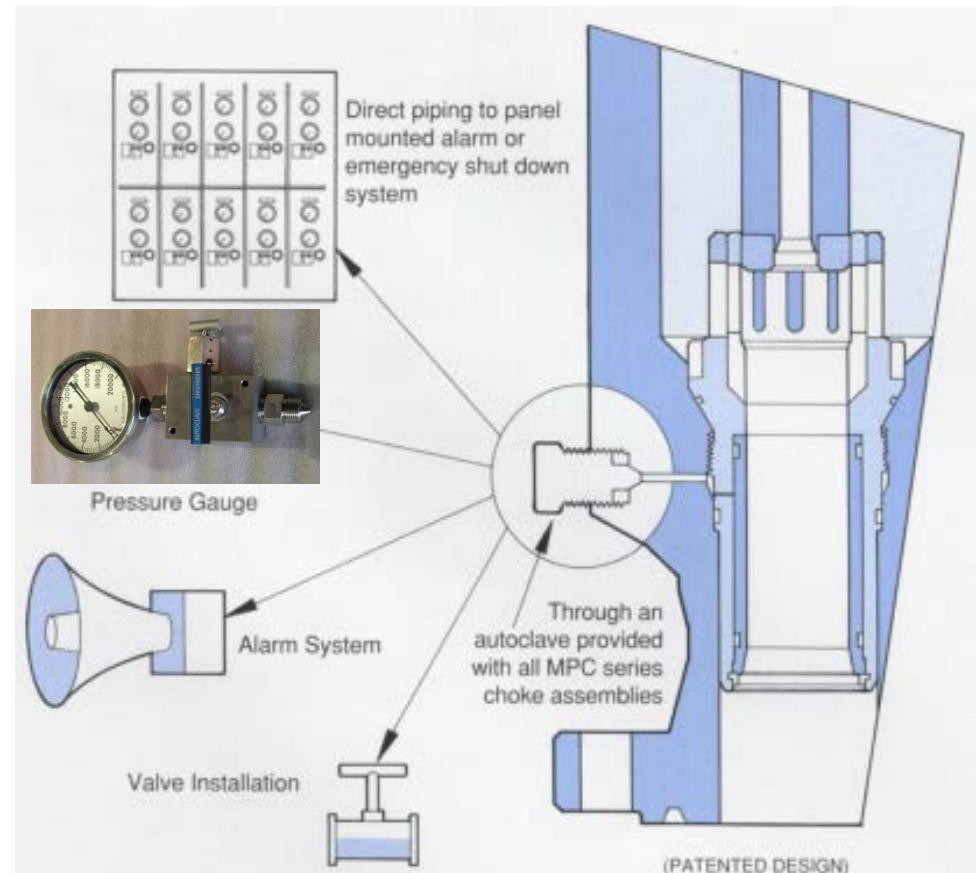


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## The Best Flow Products Advantage

- Proprietary Seat Wear Monitor
- Alerts you of washout in seals or seat liner before it causes damage to the seat body







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# The Best Flow Products Advantage



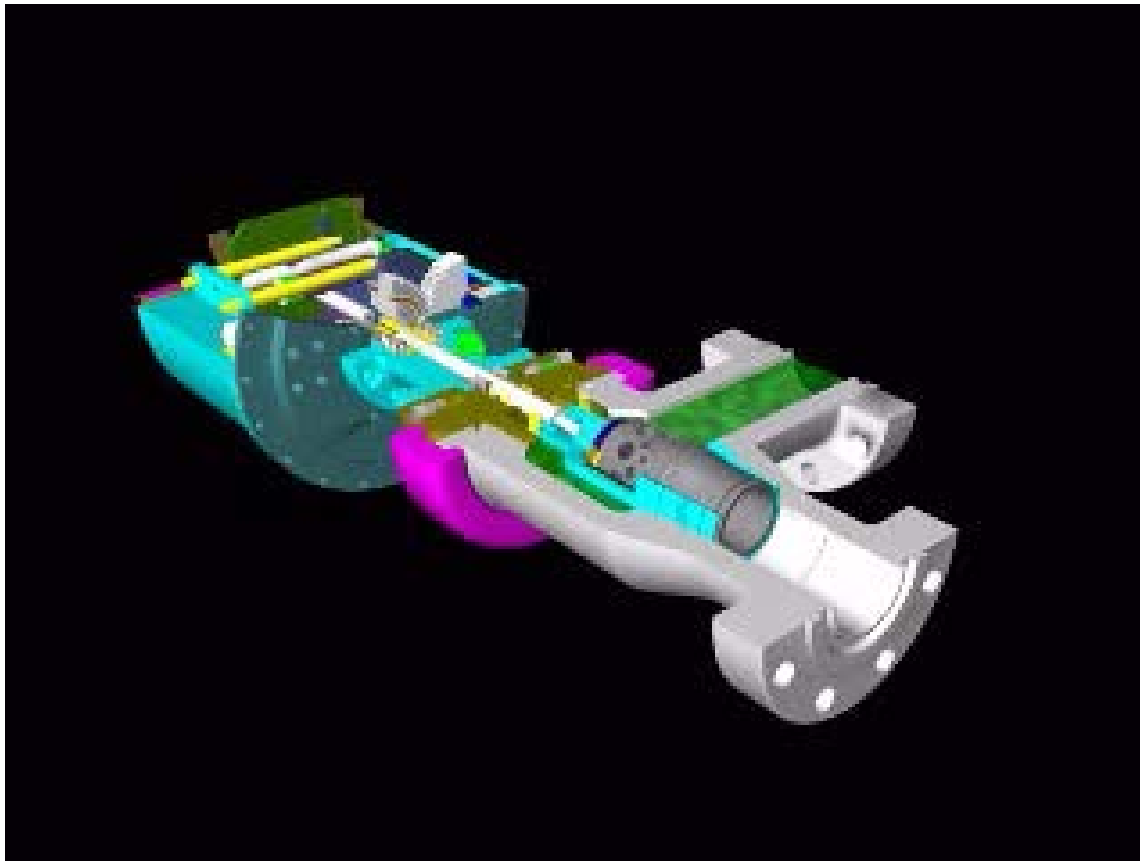
Wear Monitor  
connected to  
pressure  
transducer  
linked to  
SCADA Alarm



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# Choke Trim Technology





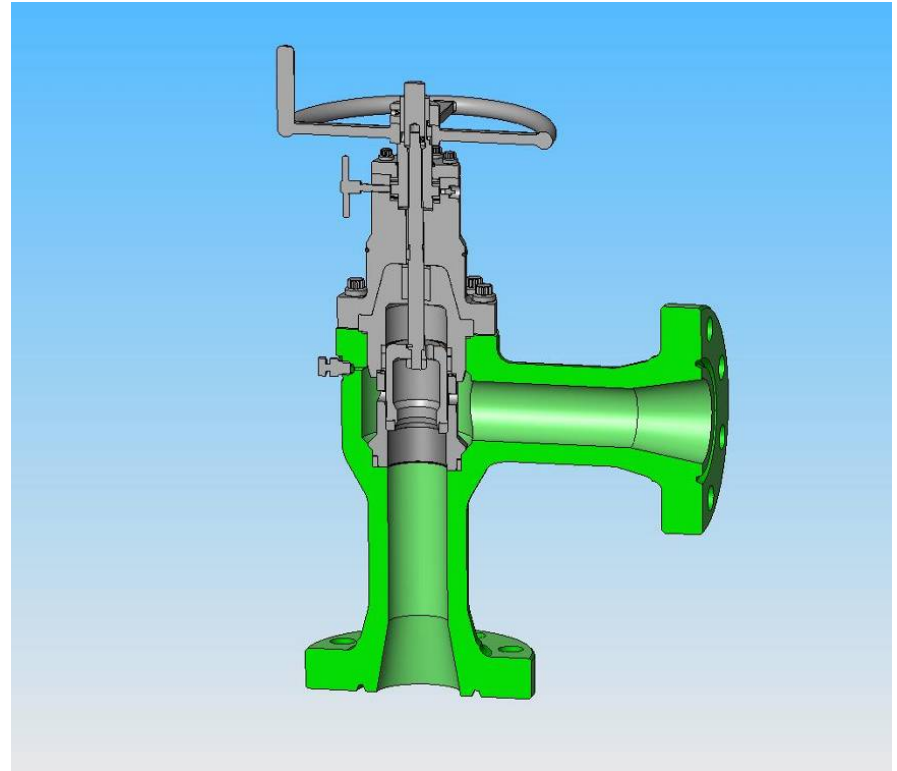
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Lower cost Cage Type  
Choke

## MPX Model Choke

- 1 piece forged body
- Non threaded seat
- No special tools required to change trim
- Easily converted to actuated operation







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# MPC-60S Severe Service Choke Valve

## Special Features:

- Carbide cage that extends from the choke outlet to the bonnet and a solid carbide plug
- solid 25% Cr Duplex Stainless body and bonnet
- New VBS-100a actuator





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## PLF Choke Valves

### Special Features:

- Precise control on low flow control applications ranging from 0.01 – 1.5  $C_v$  with a resolution accuracy down to .005" stem travel.
- Special “bubble-tight” shutoff seal – pressure assisted shutoff with proprietary seal technology ensures a complete seal every time
- Extreme Wear Resistance material – 5x longer life wear resistance than tungsten carbide for severe service applications including  $H_2S$ , sand, and severe abrasives.





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# COMMODITY CHOKE VALVES



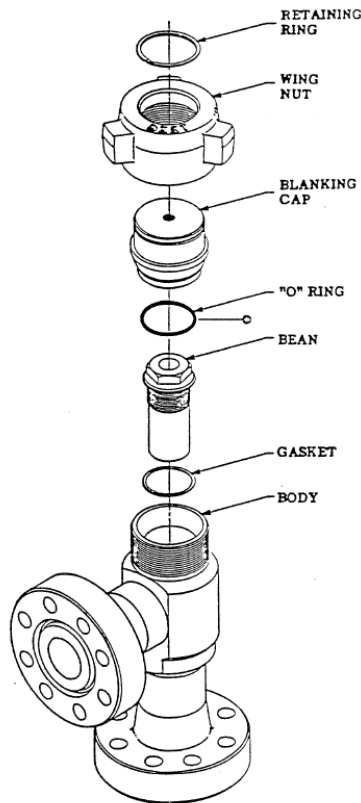




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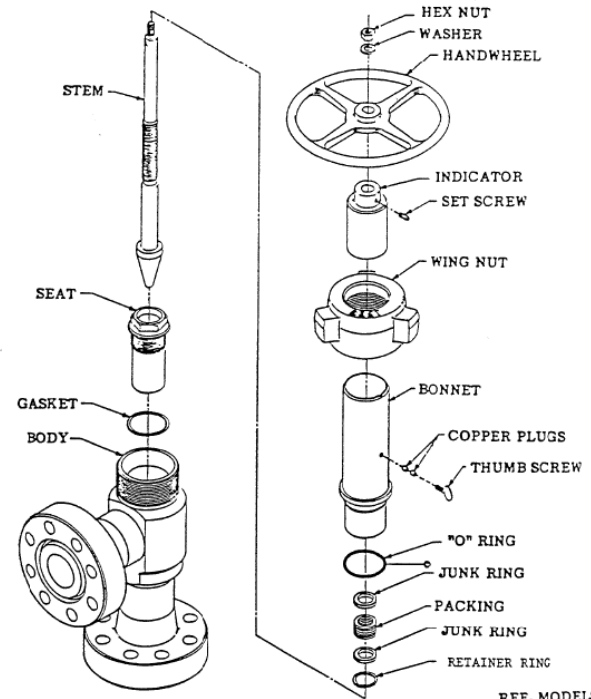
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# TYPES OF COMMODITY CHOKE VALVES



TYPICAL POSITIVE CHOKE

REF. MODELS  
B-H2  
B-36X



TYPICAL ADJUSTABLE CHOKE

REF. MODELS  
B-36X  
B-H2



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# Commodity Choke: Theory of Operation

## **POSTIVE CHOKE**

- A positive choke, is similar to an orifice plate and simply controls the flow of the gas, liquid and pressure.
- It has a fixed flow based upon the size of the bean, measured in 1/64” sizes.
- It does not allow an operator to stop or adjust the flow unless the bean size is changed.

## **ADJUSTABLE CHOKE**

- An adjustable choke utilizes a seat much like a positive choke, but allows for limited control of the flow and pressure by means of a needle/stem sliding up and down, via a Manual Hand wheel, into the OD of the seat. This gives the operator limited ability to control/change flow without changing the seat.



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# Commodity Choke Limitations

- An adjustable choke is used when the operator requires the ability to directly control the flow and pressure.
- Positive and Adjustable chokes are limited in application. They are used in certain sizes and pressures up to 3" 15K and 4" 10K service.
- The limiting factor of using commodity chokes is type of process media, corrosion, erosion, large delta P, large delta T, Vibration, Noise, Choked flow and Cavitation.
- In severe service applications, an engineered choke with a specifically sized plug and engineered cage/body is required.

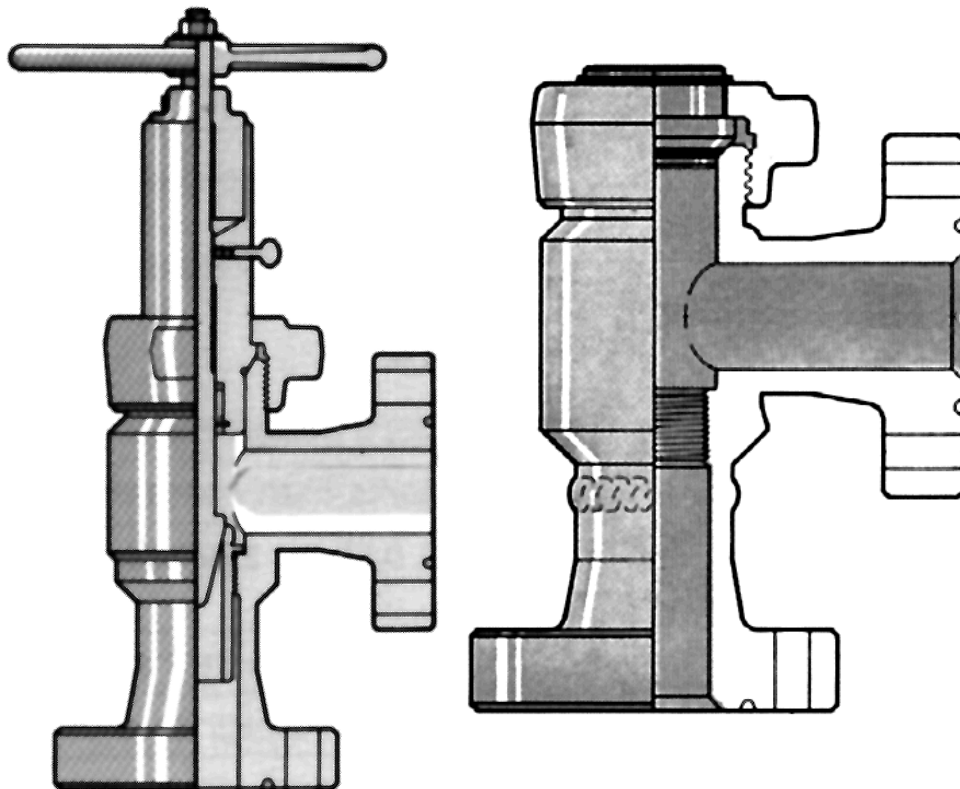




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## B-H2 / B-36X Adjustable & Positive Chokes



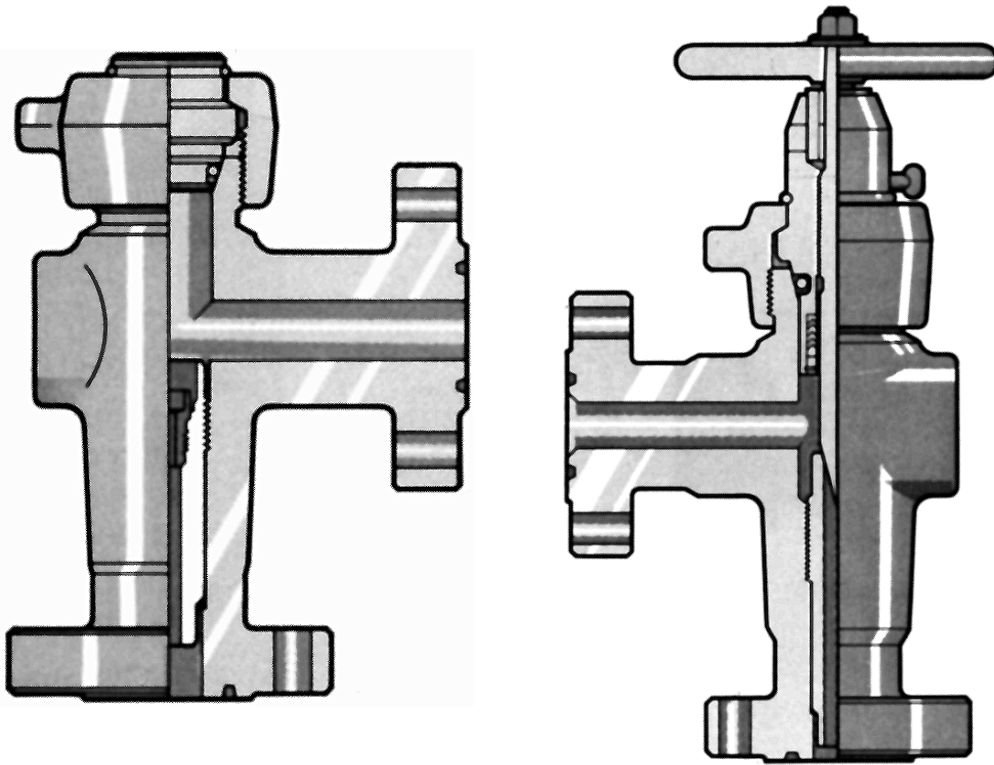
- Needle & Seat Type Chokes
- API Pressure Ratings 3k to 15k
- API Flanges 2-9/16" to 4-1/16"
- ANSI 150 -1500 Flanges
- Quick Opening Hammer Lug Bonnet
- Convertible between Positive and Adjustable with Same Body.
  
- The main differences between the B-36X and the B-H2 are that the B-36X is designed for ANSI flange connection size and pressure class and the B-H2 is designed for API flange connection size and pressure class.



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## Models B-PC Positive & B-JWA Adjustable



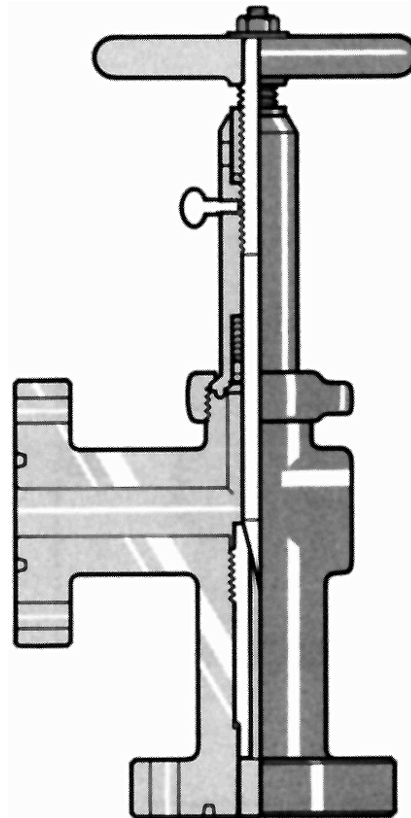
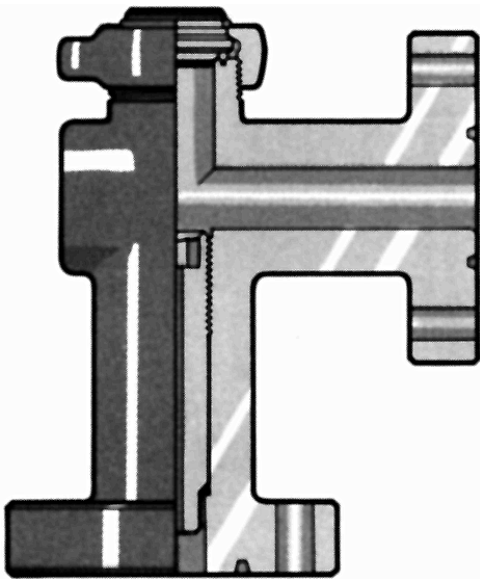
- Needle & Seat Type Chokes
- API Pressure Ratings 5k to 15k
- API Flanges 1-13/16" to 2-9/16"
- Quick Opening Hammer Lug Bonnet
- Convertible between Positive and Adjustable with Same Body.



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## Models B-T-1 & B-N-62



- Needle & Seat Type Chokes
- 2k – 5k API & 150 – 600 ANSI Pressure Ratings
- 2" API & ANSI Flanges
- Quick Opening Hammer Lug Bonnet
- Convertible between Positive and Adjustable with Same Body.





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## Differences in Commodity Chokes

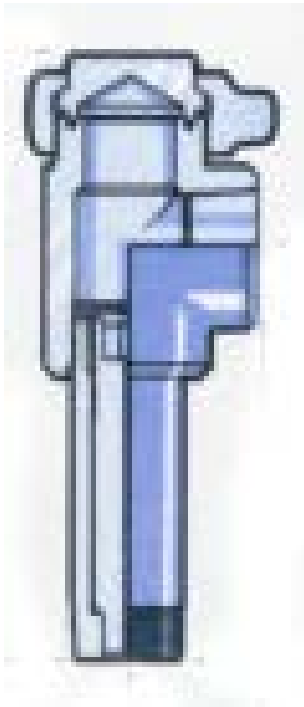
- BH2/B36X are available in both Positives/Adjustables and have 3 “ bodies
- BJWA’s/BN62’s are only Adjustables and have 2” bodies
- BT-1’s/BP-C’s are only Positives have 2” bodies
- The choice of commodity choke valve design/style is determined from the customer using the wellhead Christmas tree.
- The orifice size specified by the customer will determine the size of the choke valve body



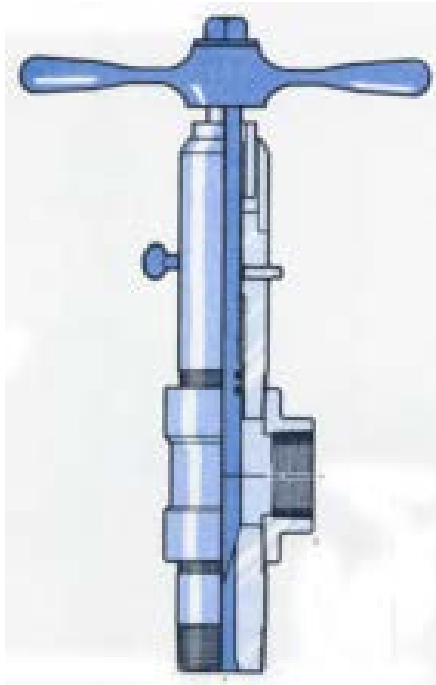
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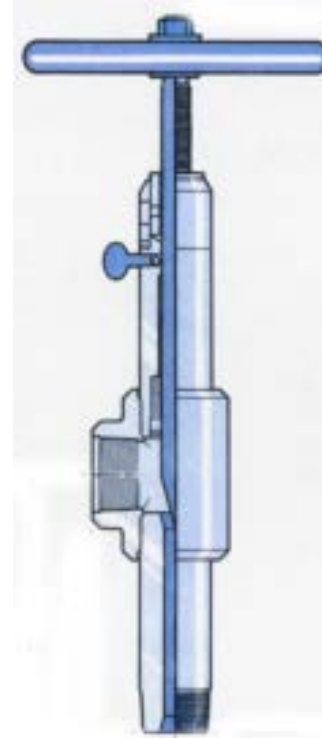
## Threaded Chokes



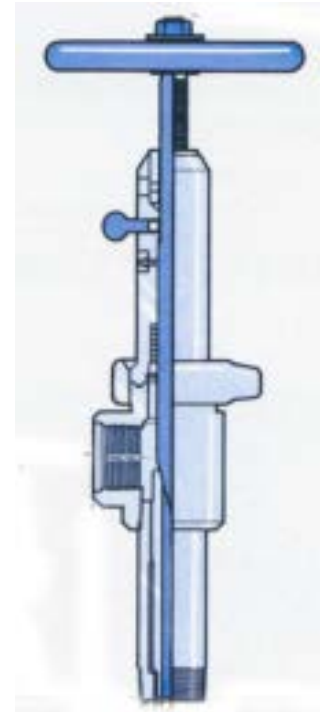
B-FT-108  
2" LP 5k



B-29  
2" LP 2k



B-N-60  
2" LP 5k



B-O-60  
2" LP 2k



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# Choke Automation





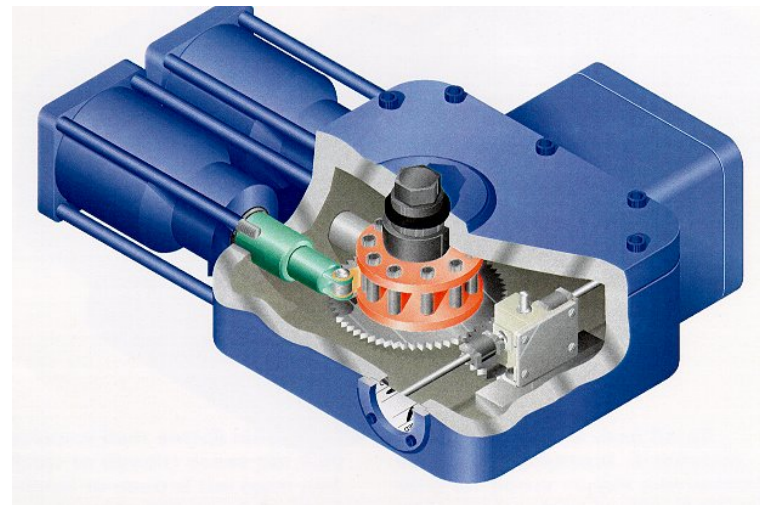


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# VBS-100a Stepping Actuator

- Pneumatic and hydraulic operated actuator
- Positive 36° Rotation with each pulse.
- Visual position indicator and 4-20 mA transmitter for remote position indication
- Manual override via hex drive shaft
- Fail in last position with loss of power to the actuator
- Water-tight marine grade aluminum construction
- PR-2 Tested to meet API 6A requirements

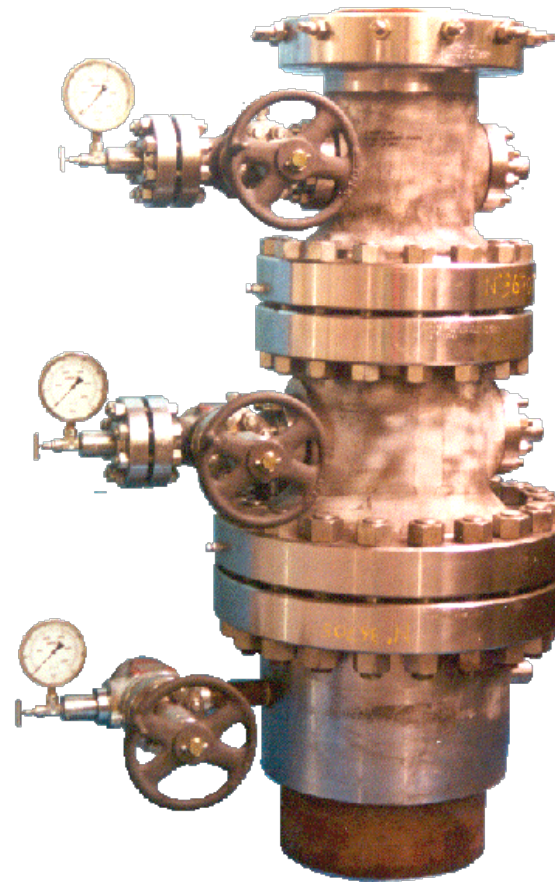




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# Surface Wellhead Equipment





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# Accreditations and Memberships

- ISO 9001
- API 6A and Q1
- FPAI
- ACHILLES
- GOST
- EIC
- UKAS Testing
- RAAD VOOR
- ASTM
- AWHEM
- PED



International  
Organization for  
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# Customers

## Operators

- Shell
- BP
- NNPC
- Tullow
- Enrana
- Gazprom
- Total
- Marathon
- Exxon
- Transocean



## Services

- Weatherford  Weatherford
- Halliburton 
- Schlumberger 
- Geoservices  EXPRO
- Newco 
- Expro
- Pressure Integrity 
- Petrofac  Petrofac
- BJ Process
- Cebo



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# Flowline

- Hammer Unions
- Pup Joints
- Fittings
- Swivels
- Loops
- Plug Valves
- Check Valves
- Relief Valves
- Hose Lifters



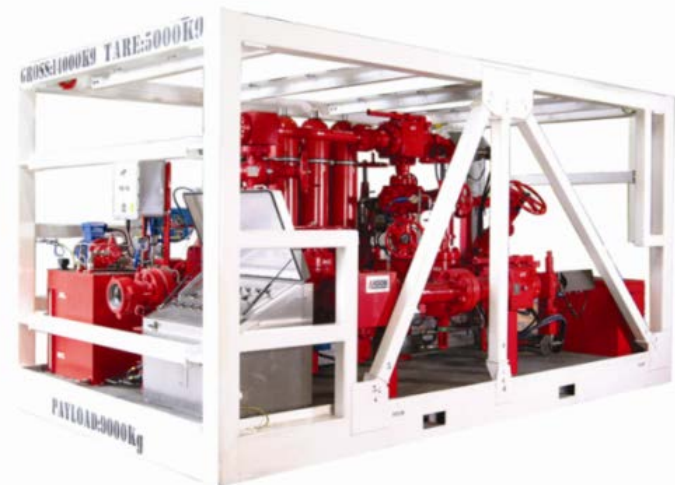


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# Valves

- Through Conduit Valves
- Mud Gate Valves
- Flanged Plug Valves
- Surface Flowheads
- Choke Valves
- Standpipe Manifolds
- Cement Manifolds
- Manifold Fittings
- Control System







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# Wellhead Spools

## Casing Heads

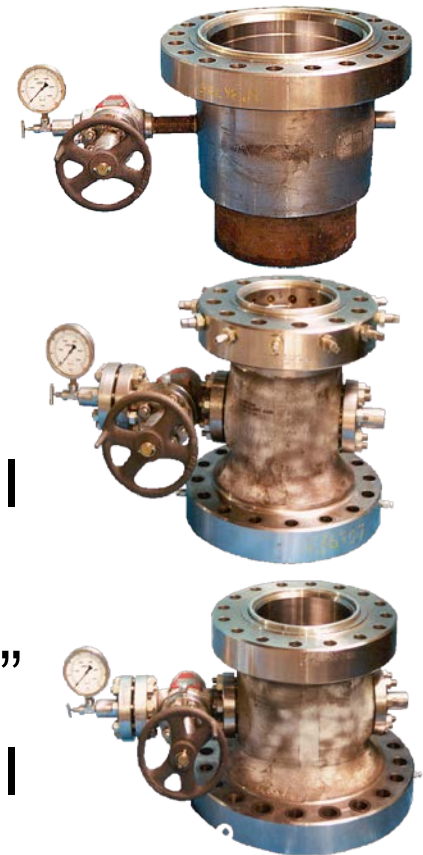
- Size: 7" to 21.1/4"
- Pressure Range: Up to 5,000 PSI

## Casing Spools

- Size Range: 11" to 21.1/4"
- Pressure Range: Up to 15,000 PSI

## Tubing Heads

- Size Range: 7.1/16" to 13.5/8"
- Pressure Range: Up to 15,000 PSI





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## Solid Forged Construction

- Straight bore design with 45° load shoulder
- Full opening vertical bore
- Spool top bowls can accept either slip or mandrel style hangers
- Bottom bowl design can accommodate various casing sizes by the use of crossover bushings
- Available with threaded, flanged or studded outlets
- Valve removal threads standard on all outlets
- Casing head bottom connection can be threaded or sow
- Internal seal available on sow bottom heads
- All NOV Anson casing heads can accommodate baseplate installation



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# Slip Type Casing Hangers

- Wrap around design
- Can be installed through BOP stack
- Annular seal is automatically energised using casing weight
- Seal requires only 20,000lbs to energise, can be used on short strings
- Hanger latch locks halves together automatically





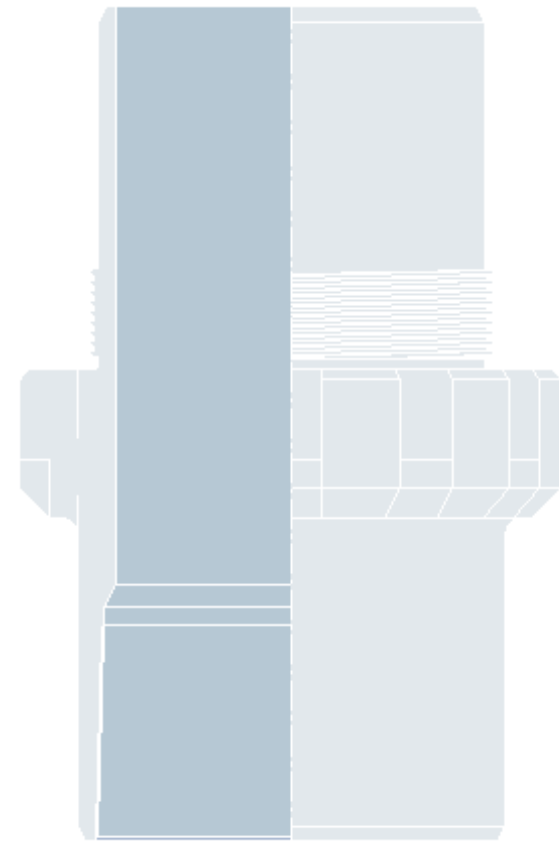


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# Mandrel Casing Hangers

- Solid construction with fluted flow-by areas
- Matched strength threaded box bottom (standard), pin down optional
- Extended neck design
- External ACME lift threads
- Full bore to casing drift size





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# Pack-off Assemblies

- Positive lock onto casing hanger body
- Choice of compression or interference type seals
- Run and inspect bop





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# Tubing Hangers

- Solid construction
- Matched strength threaded box bottom (standard), pin down optional
- Extended neck design (standard)
- Full bore matching tubing drift size
- Choice of compression or interference type seals
- Run and installed through BOP







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## Crossover Bushing

- Wide variety of sizes available to accommodate different casing sizes
- Choice of plastic energised or interference type seals
- Available for pressure rating up to 15,000 PSI
- Optional integral bit guide available on most sizes
- Simple installation and retention by snap ring



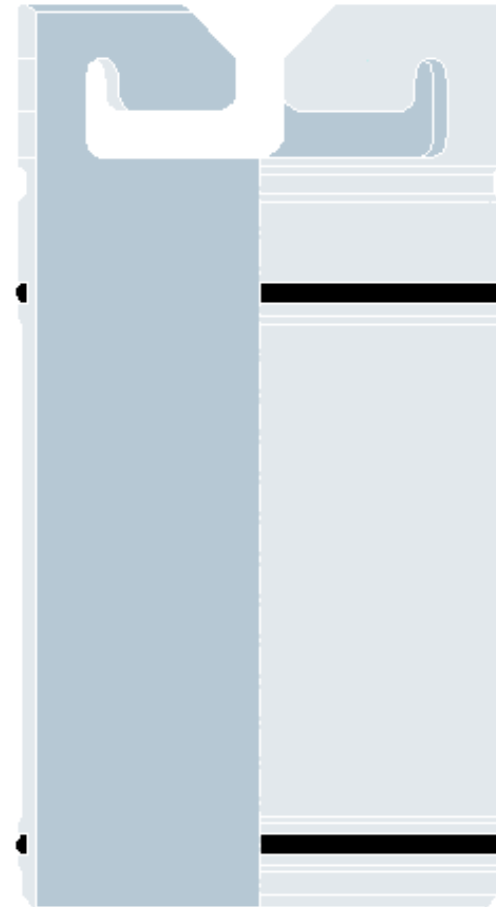


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## Bore Protectors

- Compatible with all NOV Anson straight bore wellhead spools
- Elastomeric wiper ring fitted on OD to avoid metal contact with spool bores during drilling operations
- Secured in place by lock down screws in order to prevent rotation during drilling
- Installed and retrieved by J-Slot style running tool



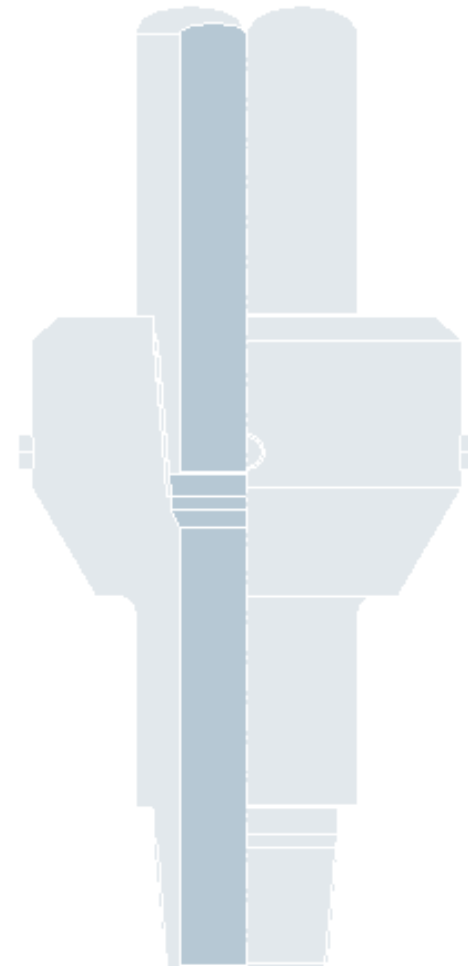


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## Bore Protector R & R Tools

- Simple effective design which is run on drill pipe or casing
- Locks in place in bore protector by turning clockwise 45° and released by counter-clockwise 45° turn.







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# BOP Test Plug Tools

- Simple design which is run on drill pipe
- Provision for testing vi drill string or annulus by the inclusion by-pass ports
- Blind test plug design available
- Drill pipe can be installed below the plug therefore negating the need to retrieve all pipe from well bore
- Available in a variety of tool joint thread styles





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## Combination Tools

- Multi-functional tool which can be run either way up
- Basic design has box top and pin down layout
- Run pin down the tool is used as a bore protector R&R tool
- Provision for testing via drill string or annulus by the inclusion of by-pass ports when used as a test plug
- Drill pipe can be installed below the plug therefore negating the need to retrieve all pipe from well bore.



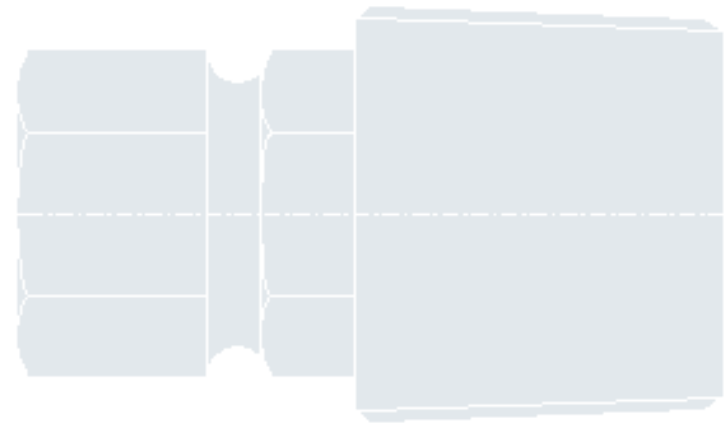


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# Valve Removal Plugs & Lubricators

- Standard low pressure VR plugs have tapered threads
- High pressure VR plugs available with straight threads and tapered sealing surfaces
- VR lubricators are available with a wide range of adaptors to suit all pressure ratings and connection type



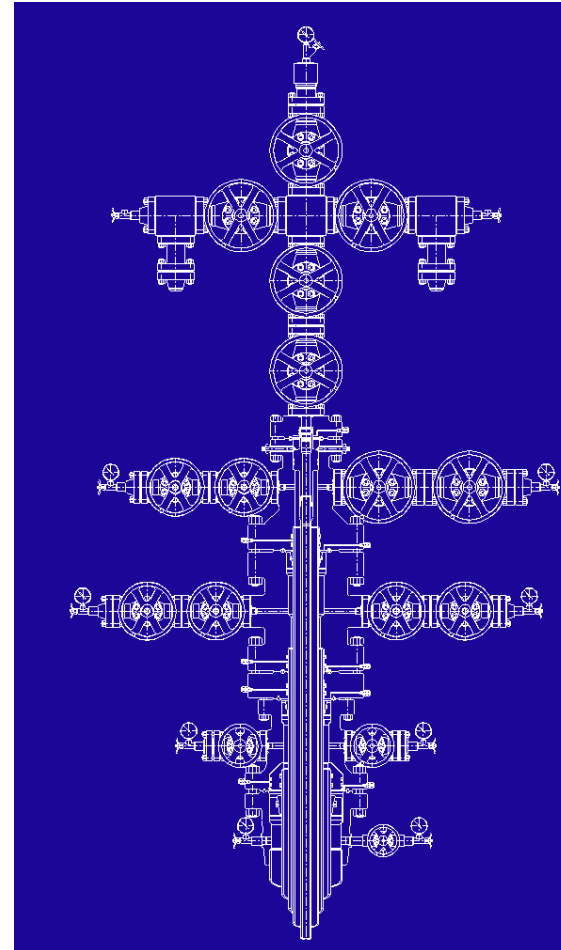
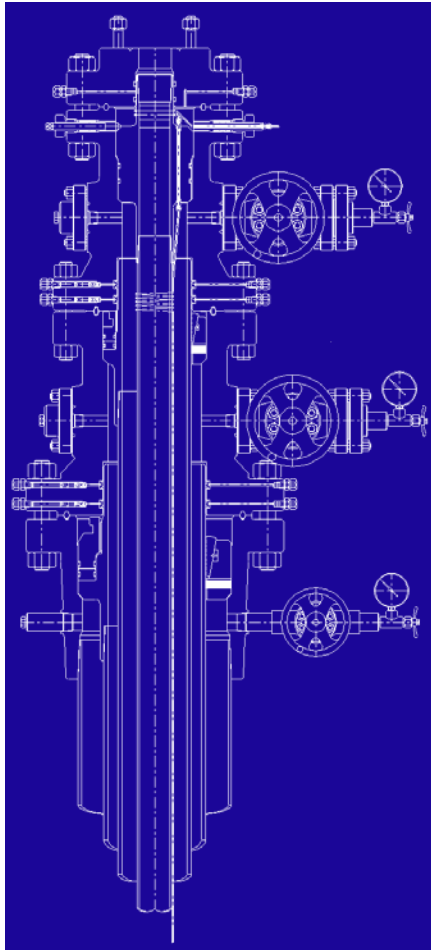




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# NOV ANSON Type F Surface Wellhead Assembly



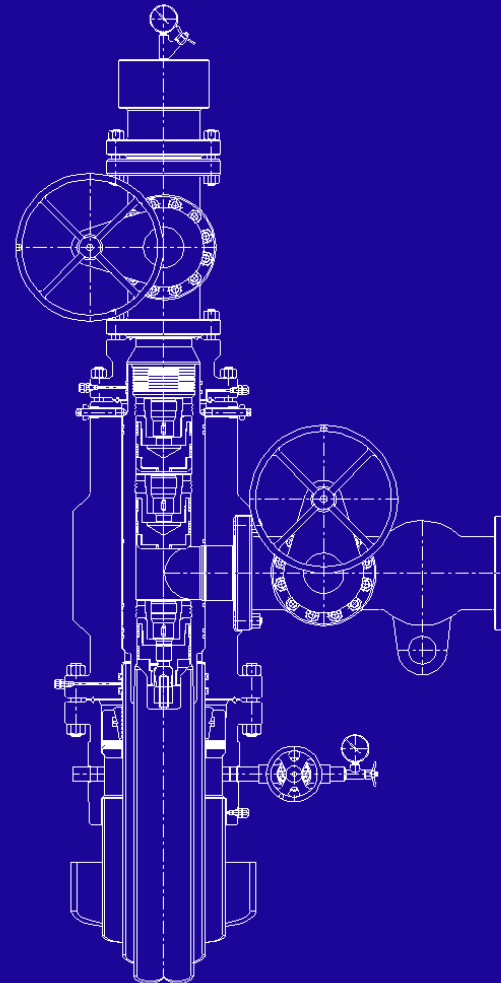




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# Horizontal Completion







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Thank  
You!