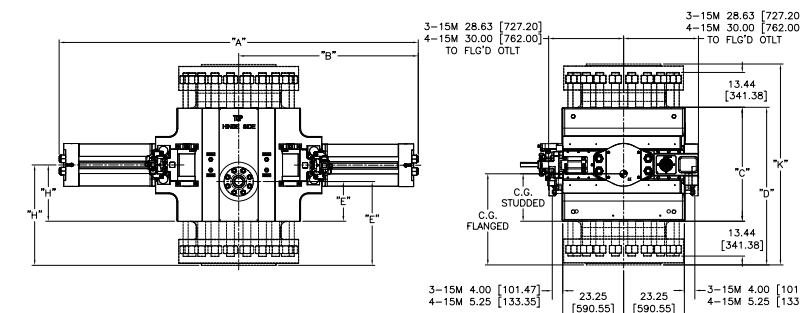
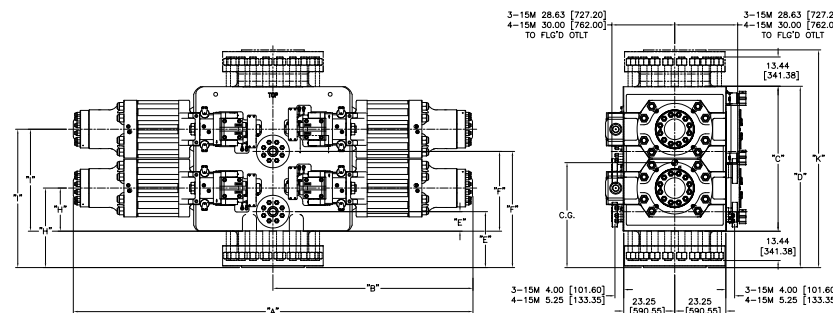
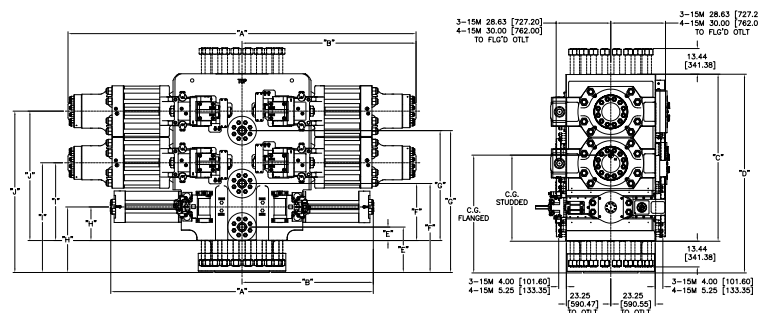


Pressure Control Equipment

- NXT BOP
- NXT-M BOP
- Corrosion Resistant Enhancement Package - sheet 1 & 2
- Low Force Shear Rams - LFS-5
- RCX multiplex pod
- RCX low shock valves - sheet 1 & 2
- EHBS Adjustable Timing Circuit Actuator
- RCX emergency hydraulic backup system acoustic pod
- Depth compensated bottles - sheet 1 & 2
- Hands free gooseneck
- Riser
- Wellhead connectors - sheet 1 & 2
- CMX 1527 LMRP wellhead connector
- Shuttle stack tool



Triple									
Flange Configuration	Height		Cavity			Outlet			Est. Assembly Weight w/out blocks (+1000lbs/cavity)
	D	H	I	J	E	F	G		
14x14x14 SXF	89.3	35.7	52.7	69.7	24.4	44.4	64.4	63,000 lbs	
22x22x14 SXF	104.1	34.5	57.5	84.5	23.8	46.5	74.2	101,700 lbs	
22x22x22 SXF	110.3	36.7	63.7	90.7	25.1	52.7	80.4	121,650 lbs	
14x14x14 SXS	N/A	19.5	36.5	53.5	8.0	28.0	48.8		

Double									
Flange Configuration	Height		Cavity			Outlet			Est. Assembly Weight w/out blocks (+1000lbs/cavity)
	D	K	H	I	E	F			
14x14 SXF	72.3	N/A	35.9	52.9	24.4	44.4	46,700 lbs		
14x14 FXF	N/A	88.7	35.9	52.9	24.4	44.4	51,850 lbs		
22x14 SXF	81.1	N/A	36.4	50.1	28.9	51.6	65,250 lbs		
22x22 SXF	83.2	N/A	36.6	63.6	25.7	53.3	85,100 lbs		

Single									
Flange Configuration	Height		Cavity			Outlet			Est. Assembly Weight w/out blocks (+1000lbs/cavity)
	C	D	K	H	E				
14 SXF	N/A	60.8	N/A	38.8	32.3	35,150 lbs			
14 FXF	N/A	N/A	77.3	38.6	32.3	38,200 lbs			
22 SXF	N/A	61.9	N/A	39.1	28.7	56,650 lbs			
22 SXS	45.0	N/A	N/A	22.2	11.8	53,800 lbs			

Center of Gravity					
DIM	BOP	Door Configuration			± 1" (± 25mm)
		Upper	Middle	Lower	
C.G.	14X14X14	14" UIIB	14" UIIB w/ ILF	14" UIIB	50.2 (1274.2)
C.G.	22X22X14	22" PSLK	22" PSLK	14" PSLK	61.7 (1566.3)
C.G.	22X22X22	22" PSLK LFS	22" PSLK LFS	22" PSLK LFS	61.9 (1572.7)

Center of Gravity				
DIM	BOP	Door Configuration		± 1" (± 25mm)
		Upper	Lower	
C.G.	14X14 SXF	14" UIIB	14" UIIB	41.9 (1064)
C.G.	14X14 FXF	14" PSLK 14" BSTR	14" MNLK	44.9 (1140)
C.G.	22X14 SXF	22" PSLK	14" MNLK	48.4 (1229)
C.G.	22X22 SXF	22" PSLK	22" PSLK	48.2 (1224)

Center of Gravity				
DIM	BOP	Door Configuration		± 1" (± 25mm)
C.G.	14 SXF	14" UIIB		35.3 (896.6)
C.G.	14 FXF	14" MNLK		38.5 (978)
C.G.	22 SXF	22" PSLK		37.4 (950.0)
C.G.	22 SXS	22" PSLK		22.5 (571.5)

18-15m NXT BOP Assembly Features					
Operator Characteristics	14" UIIB	14" U2B ILF	22" PSLK SMX	14" PSLK 14" BSTR LFS	14" PSLK 14" BSTR
Operator Weight (w/ fluid)	3,300 lbs	3300 lbs	8,600 lbs	4,250 lbs	4,200 lbs
OPEN	15.8 lbs	15.8 Gal	42.8 Gal	32.1 Gal	26.6 Gal
CLOSE	16.8 Gal	16.8 Gal	46.1 Gal	33.7 Gal	27.9 Gal
Max. Working Pressure	3,000 psi	3,000 psi	5,000 psi	3,000 psi	3,000 psi

Shaffer™ NXT BOP Systems are unique in providing a means of significantly improving safety and efficiency in the critical path of activity. With the replacement of the door bolts in ram BOPs, National Oilwell Varco has eliminated the time consuming manual practice of using brute force to torque up numerous large door bolts. A number of benefits have been realized with this development:

- Reduced Weight (lightest BOP systems in the industry)
- Reduced Height (smallest BOP systems in the industry)
- Elimination of Manual Labor Under Time Pressure

Multi-Rams

Shaffer™ addresses the need for changing out rams on a tapered drillstring by offering Multi-Ram assemblies to cover a range of varying ODs of drill pipe:

Supported Inner Diameter Range:

- 3 1/2" - 5 7/8"
- 3 1/2" - 6 5/8"
- 4 1/2" - 6 5/8" HT
- 5" - 7 5/8"

Hydraulic System

Hydraulic power to operate a Model NXT ram BOP can be furnished by any standard oil field accumulator system. Hydraulic passages drilled through the body eliminate the need for external manifold pipes between the hinges. Each set of rams requires only one opening and one closing line. There are two opening and two closing hydraulic ports, clearly marked, on the back side of the BOP. The extra hydraulic ports facilitate connecting the control system to the preventer. A standard hydraulic accumulator unit will close any Model NXT ram with rated working pressure in the well bore.

Ultra-Temp™

The conservative Shaffer™ testing procedures call for maintaining pressure and temperature for the duration of the test. Even with these stringent demands, the UltraTemp rams hold in witnessed testing. Shaffer™ UltraTemp ram assemblies are designed to safely withstand wellbore pressures up to 15,000 psi and extreme temperatures up to 350°F (177°C) for prolonged periods. This translates into rigsite capability to safely evacuate personnel and equipment in the event of a major high temperature, high pressure kick.

Low Force Blind Shear (LFS) Rams

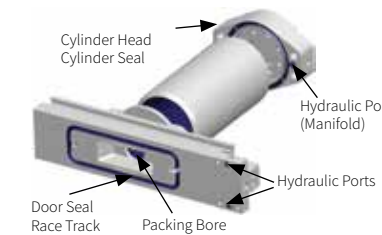
The force required to shear casing is reduced by at least 50%. The LFS Ram sever 14", 113ppf, Q-125 casing at 2700 psi with a 22" operator. Multiple shear and seal sequences can be performed with the same assembly, including conditions where the drill pipe is hung-off below the shear ram cavity, enhancing reliability and extending the length of the BOP stack deployment.

- Less pressure required to shear
- Capable of centering pipe before shearing
- Shearing range
- Wireline to 14"
- Temperature Range: 30°F to 300°F (-1°C to 149°C)

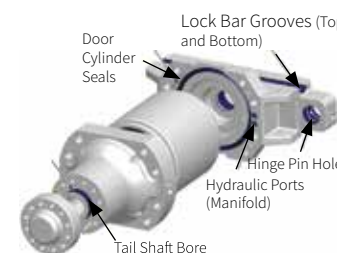
Weldless Cavity

The introduction of no weld cavities in previous Shaffer™ BOP designs is carried on in the NXT models. This feature introduces replaceable parts to the cavity to eliminate extensive in-shop repairs and post weld heat treatments. The seal seat, skid plate and side pads can be replaced upgrading the BOP cavity tolerances to as new condition.

14" Ultra Lock II (B) Door



22" PosLock Door



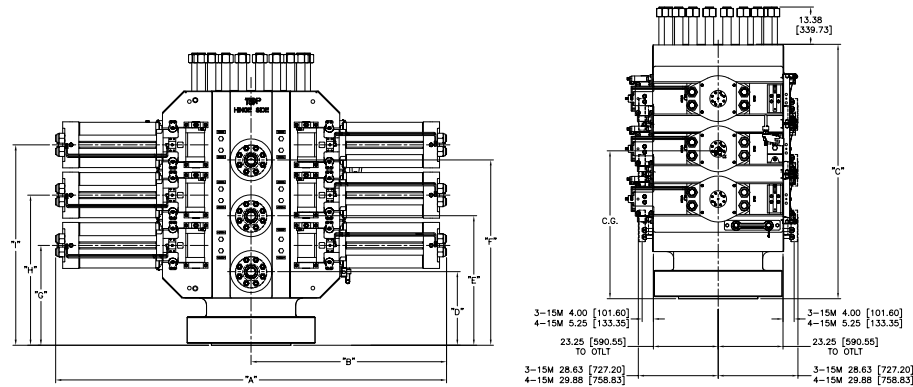
*For 22" PosLock door-specific applications, refer to the table titles "NXT Door-CREP Level Variants-22"Door" on DOC# 10832351-INF

NXT Body-CREP Level 7

Body Area	Inlay/Coating
Door Seal	Inconel
Top Seat	Inconel
Bottom Seat (reversible cavity only)	Inconel
Hydraulic Ports	Inconel
Left/Right Face	Phosphate
Lock Rod Groove	Phosphate
Ring Groove	Inconel

NXT Door - CREP Levels*

Door Area	CREP Level H	CREP Level J	CREP Level K
Hinge Pin Hole	Phosphate	Phosphate	Inconel
Door Seal Race Track	Inconel	Inconel	Inconel
Hydraulic Ports	Phosphate	Phosphate	Inconel
Cylinder Ports	Phosphate	Phosphate	Inconel
Packing Bore	Inconel	Inconel	Inconel
Lock Bar Groove	Phosphate	Phosphate	Phosphate
Cylinder Bore	Phosphate	Chrome	Inconel



Triple								
Flange Configuration	Height	Cavity			Outlet		Weight (lbs)	
	C	H	I	D	E	F		
14 X 14 X 14	93.1	35.9	53.9	71.9	26.4	46.4	66.4	65,000

Center of Gravity				
DIM	BOP	Door Configuration		± 1" (± 25mm)
		Upper	Middle	Lower
C.G.	14X14X14	14" U2B	14" U2B	14" U2B
C.G.	14X14X14	14" U2B ILF	14" U2B ILF	14" U2B ILF
C.G.	14X14X14	14" PSLK 14" BSTR LFS	14" PSLK 14" BSTR LFS	14" PSLK 14" BSTR LFS

18-15m NXT-M BOP Assembly Features							
Operator Characteristics	14" MNLK	14" U2B	14" U2B ILF	14" MNLK 14" BSTR	14" MNLK 14" BSTR LFS	14" PSLK 14" BSTR LFS	14" PSLK 14" BSTR CVX
Operator Weight (w/ fluid)	2,590 lbs	3,040 lbs	3,070 lbs	3,455 lbs	3,655 lbs	3,950 lbs	3,840 lbs
OPEN	13.3 Gal	15.7 Gal	15.7 Gal	27.0 Gal	31.5 Gal	32.1 Gal	26.6 Gal
CLOSE	13.3 Gal	16.8 Gal	16.7 Gal	27.3 Gal	31.8 Gal	33.7 Gal	27.9 Gal
Max. Working Pressure	3,000 psi	3,000 psi	3,000 psi	3,000 psi	3,000 psi	3,000 psi	3,000 psi

Boltless BOP Doors

Shaffer™ NXT-M BOP Systems are unique in providing a means of significantly improving safety and efficiency in the critical path of activity. With the replacement of the door bolts in ram BOPs, National Oilwell Varco has eliminated the time consuming manual practice of using brute force to torque up numerous large door bolts. A number of benefits have been realized with this development:

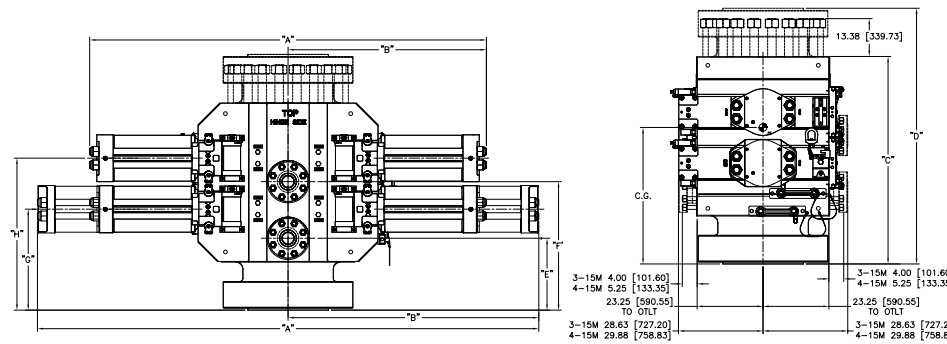
- Reduced Weight (lightest BOP systems in the industry)
- Reduced Height (smallest BOP systems in the industry)
- Elimination of Manual Labor Under Time Pressure

Multi-Rams

Shaffer™ addresses the need for changing out rams on a tapered drillstring by offering Multi-Ram assemblies to cover a range of varying ODs of drill pipe:

Supported Inner Diameter Range:

- 3 1/2" - 5 7/8"
- 3 1/2" - 6 5/8"
- 4 1/2" - 6 5/8" HT
- 5" - 7 5/8"



Double							
Flange Configuration	Height	Cavity		Outlet		Weight (lbs)	
	C	D	H	E	F		
14X14 SXF	73.3	N/A	35.6	53.6	25.4	45.4	45,700
14X14 FXF	N/A	89.8	35.6	53.6	25.4	45.4	51,850

Center of Gravity				
DIM	BOP	Door Configuration		± 1 (± 25mm)
		Upper	Lower	
C.G.	14x14 SXF	14" U2B	14" PSLK 14" BSTR LFS	41.8 (1062)
C.G.	14x14 SXF	14" U2B	14" U2B	42.0 (1067)
C.G.	14x14 SXF	14" MLNK 14" BSTR	14" MLNK 14" BSTR	42.1 (1069)
C.G.	14x14 FXF	14" PSLK 14" BSTR LFS	14" PSLK 14" BSTR LFS	42.2 (1072)
C.G.	14x14 FXF	14" U2B ILF	14" U2B ILF	42.0 (1067)

Hydraulic System

Hydraulic power to operate a Model NXT-M ram BOP can be furnished by any standard oil field accumulator system. Hydraulic passages drilled through the body eliminate the need for external manifold pipes between the hinges. Each set of rams requires only one opening and one closing line. There are two opening and two closing hydraulic ports, clearly marked, on the back side of the BOP. The extra hydraulic ports facilitate connecting the control system to the preventer. A standard hydraulic accumulator unit will close any Model NXT-M ram with rated working pressure in the well bore.

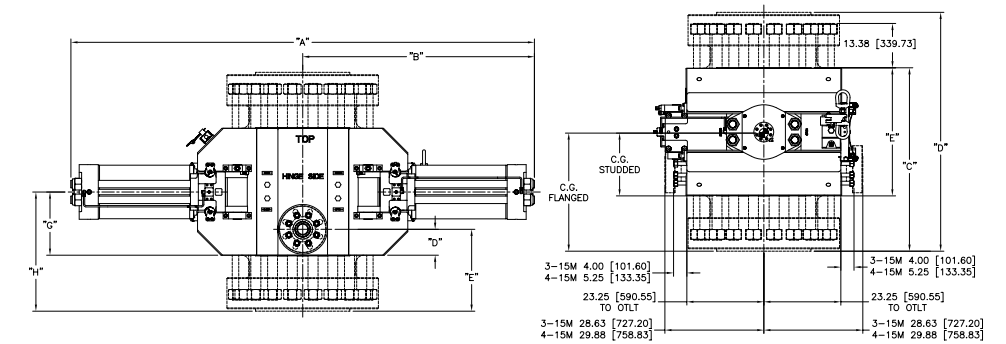
Ultra-Temp™

The conservative Shaffer™ testing procedures call for maintaining pressure and temperature for the duration of the test. Even with these stringent demands, the UltraTemp rams hold in witnessed testing. Shaffer™ UltraTemp ram assemblies are designed to safely withstand wellbore pressures up to 15,000 psi and extreme temperatures up to 350°F (177°C) for prolonged periods. This translates into rigsite capability to safely evacuate personnel and equipment in the event of a major high temperature, high pressure kick.

Low Force Blind Shear (LFS) Rams

The force required to shear casing is reduced by at least 50%. The LFS Ram sever 14", 113ppf, Q-125 casing at 2700 psi with a 22" operator. Multiple shear and seal sequences can be performed with the same assembly, including conditions where the drill pipe is hung-off below the shear ram cavity, enhancing reliability and extending the length of the BOP stack deployment.

- Less pressure required to shear
- Capable of centering pipe before shearing
- Shearing range
- Wireline to 14"
- Temperature Range: 30°F to 300°F (-1°C to 149°C)



Single				
Flange Configuration	Height	Cavity		Weight (lbs)
	C	D	H	
14 SXS	N/A	N/A	41.0	39,000
14 SXF	55.4	N/A	N/A	38,500
14 FXF	N/A	72.12	N/A	62,100

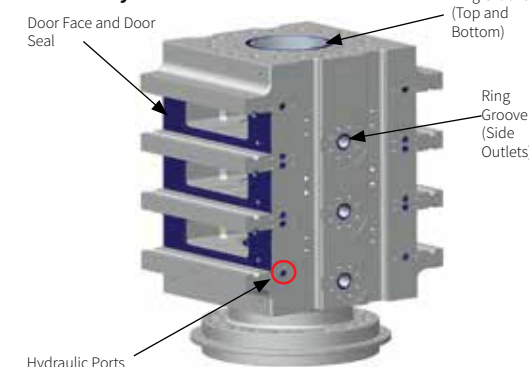
Center of Gravity			
DIM	BOP	Door Configuration	± 1" (± 25mm)
C.G.	14 SXF	14" U2B	36.0 (916)
C.G.	14 SXF	14" U2B ILF	36.1 (916)
C.G.	14 SXF	14" MNLK x 14" BSTR LFS	36.1 (916)
C.G.	14 SXF	14" PSLK x 14" BSTR LFS	36.1 (916)

Weldless Cavity

The introduction of no weld cavities in previous Shaffer™ BOP designs is carried on in the NXT-M models. This feature introduces replaceable parts to the cavity to eliminate extensive in-shop repairs and post weld heat treatments. The seal seat, skid plate and side pads can be replaced upgrading the BOP cavity tolerances to as new condition.

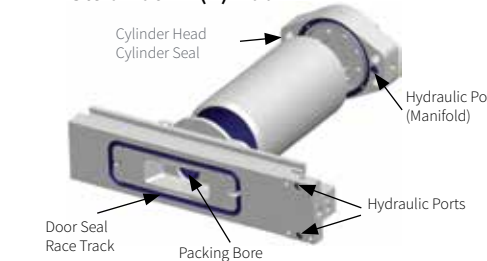
CREP- Corrosion Resistance Enhancement Package

BOP Body- CREP Overview



NXT-M Body- CREP Level 7	
Body Area	Inlay/Coating
Door Seal	Inconel
Top Seat	Inconel
Bottom Seat (reversible cavity only)	Inconel
Hydraulic Ports	Inconel
Left/Right Face	Phosphate
Lock Rod Groove	Phosphate
Ring Groove	Inconel

14" Ultra Lock II (B) Door



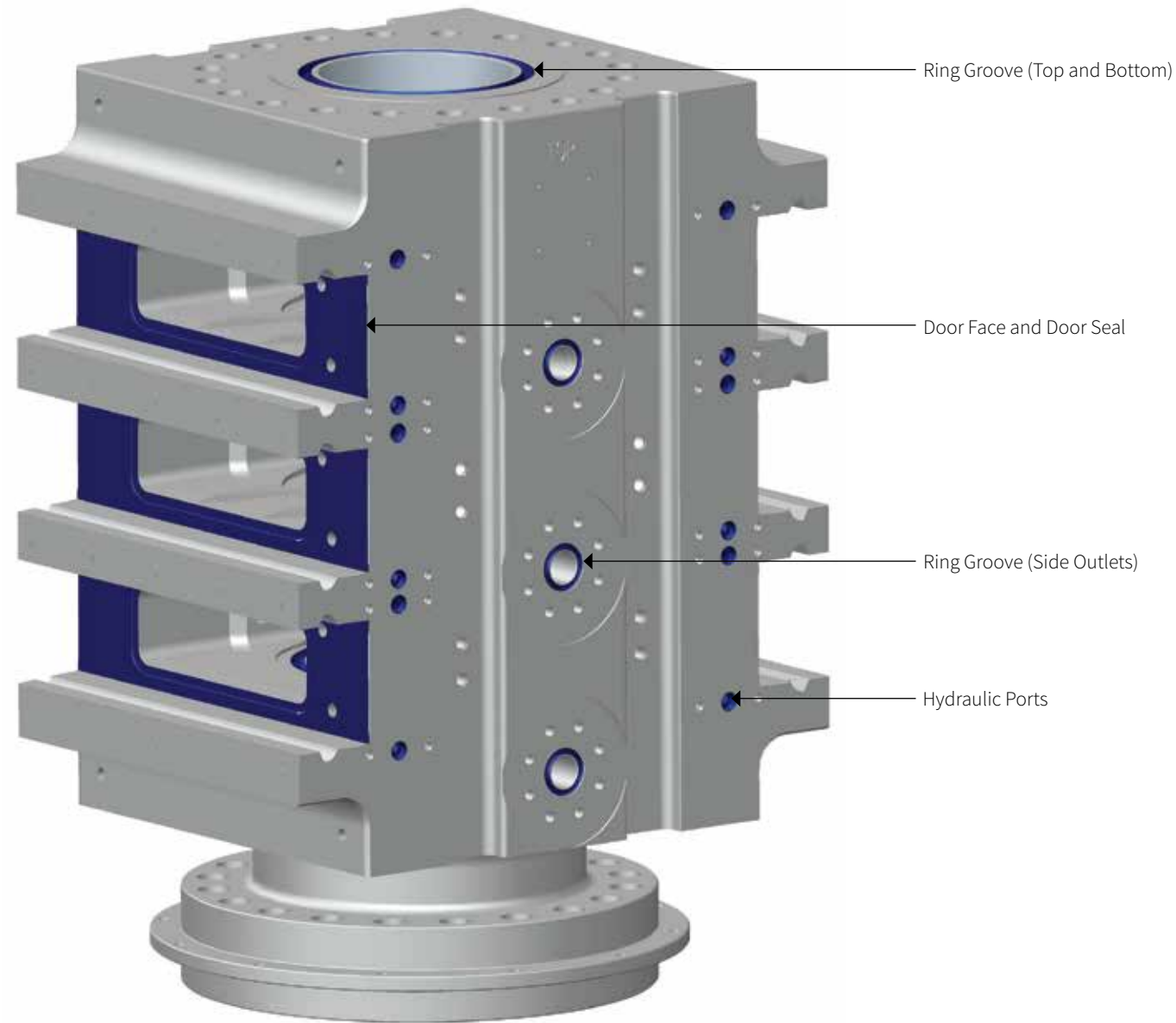
NXT-M Door-CREP Levels*			
Door Area	CREP Level H	CREP Level J	CREP Level K
Hinge Pin Hole	Phosphate	Phosphate	Inconel
Door Seal Race Track	Inconel	Inconel	Inconel
Hydraulic Ports	Phosphate	Phosphate	Inconel
Cylinder Ports	Phosphate	Phosphate	Inconel
Packing Bore	Inconel	Inconel	Inconel
Lock Bar Groove	Phosphate	Phosphate	Phosphate
Cylinder Bore	Phosphate	Chrome	Inconel

CREP Purpose and Definition

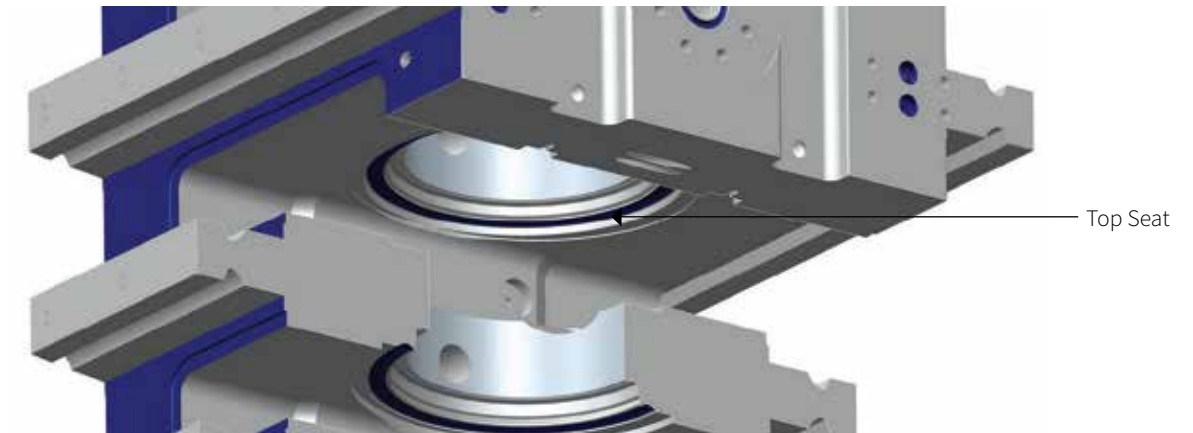
In an effort to reduce corrosion in the critical sealing areas of the BOPs, NOV provides a Corrosion Resistant Enhancement Package (CREP) on all of the 18-3/4" NXT and SLX BOPs. This CREP package is designed to reduce down time and extend the useful life of the BOP assembly prior to the need for field machining on the BOPs. On the BOP bodies, NOV only provides the maximum level of protection. Customers can choose the level of protection

they desire for the BOP doors. This sheet describes the different CREP options available. Coating and inlay locations are indicated on by the shaded areas on the included graphics. Inconel is inlaid, while chrome, ever-silk®, and phosphate are applied as coatings. The information provided is derived from NOV Engineering Specification AX070224.

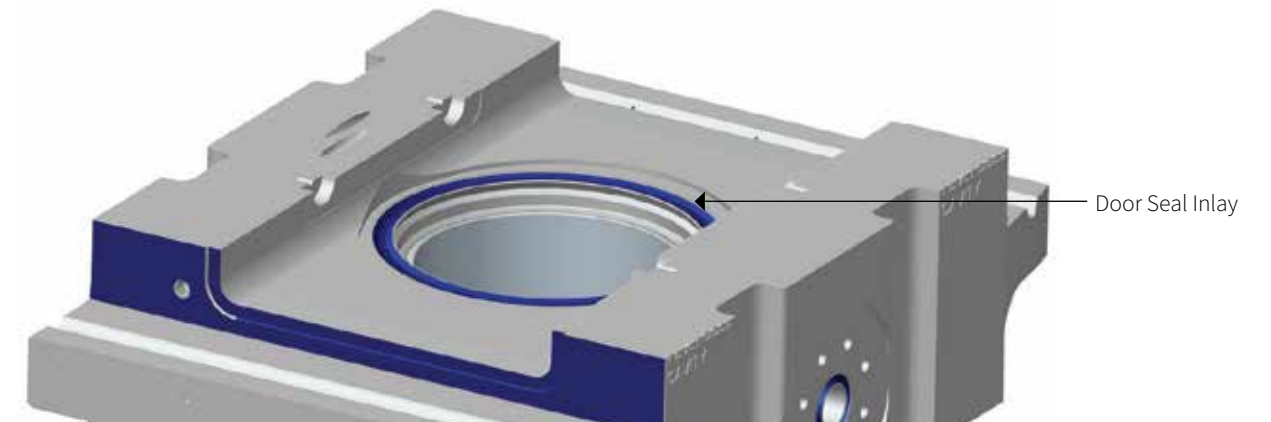
NXT Body View



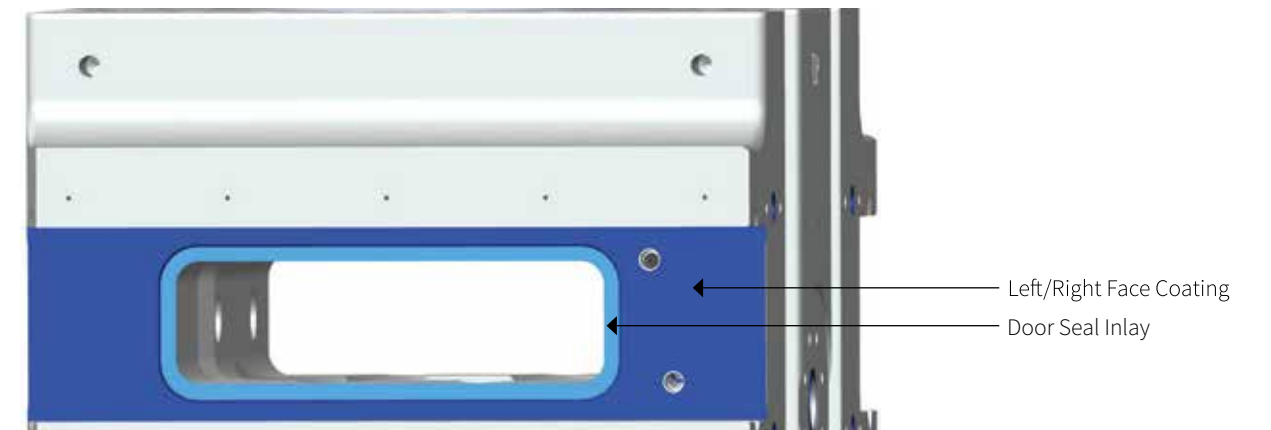
Top Seat View



Bottom Seat—Reversible Cavity Only

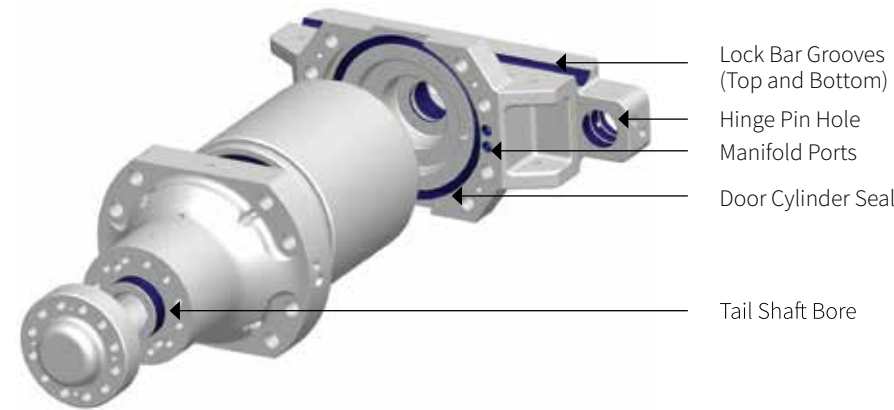
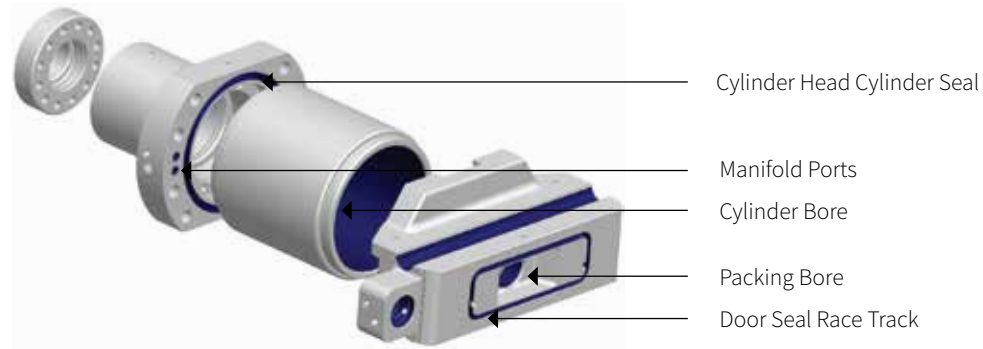


Door Seal Inlay—Detail View



NXT Body	
BODY AREA	CREP LEVEL 7
Door Seal	Inconel
Top Seat	Inconel
Bottom Seat	Inconel
Hydraulic Ports	Inconel
Ring Grooves	Inconel

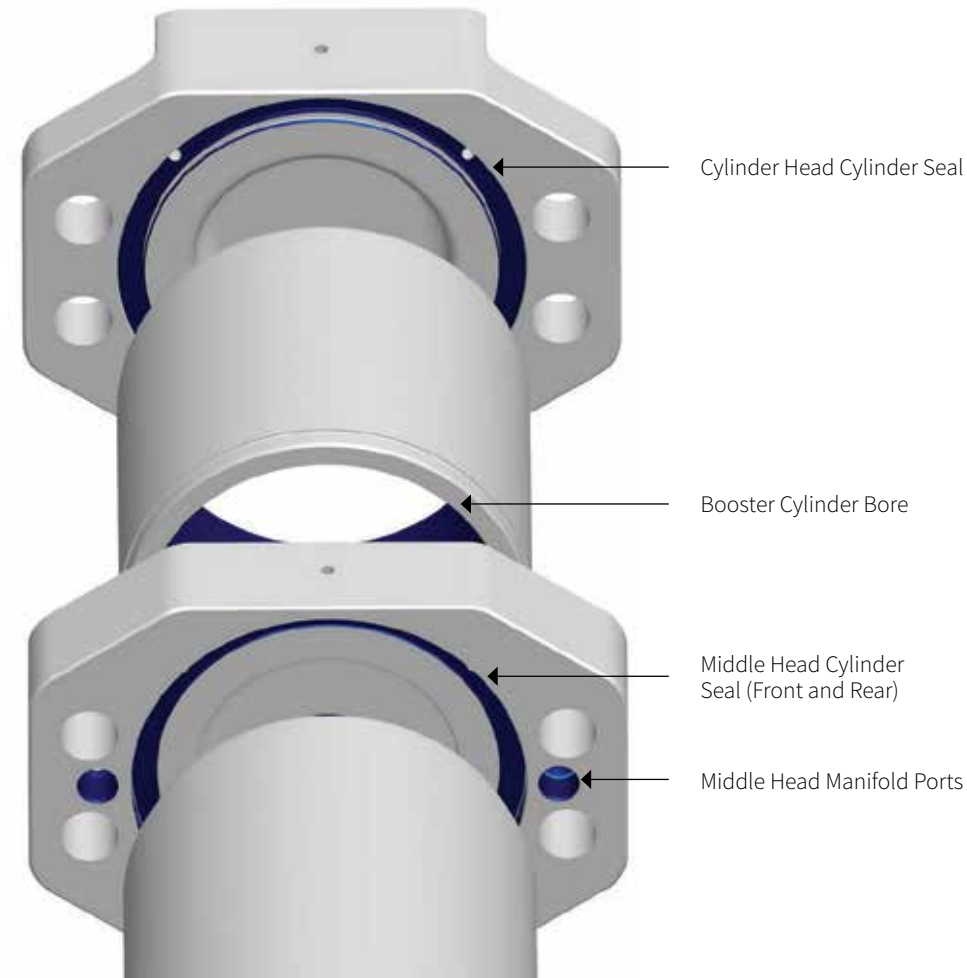
22" PosLock Door



NXT Door CREP Levels - 22" PosLock Door			
DOOR AREA	CREP LEVEL H	CREP LEVEL J	CREP LEVEL K
Cylinder Head Cylinder Seal	Ever-slik®	Ever-slik®	Inconel
Manifold Ports	Ever-slik®	Ever-slik®	Inconel
Cylinder Bore	Phosphate	Chrome	Chrome
Packing Bore	Inconel	Inconel	Inconel
Door Deal Race Track	Inconel	Inconel	Inconel
Lock Bar Groove	Phosphate	Phosphate	Phosphate
Hinge Pin Holes	Phosphate	Phosphate	Inconel
Door Cylinder Seal	Ever-slik®	Ever-slik®	Inconel
Tail Shaft Bore	Phosphate	Phosphate	Inconel

22" PosLock Door CREP locations are indicated by the shaded areas. CREP locations vary by door model due to component variations.

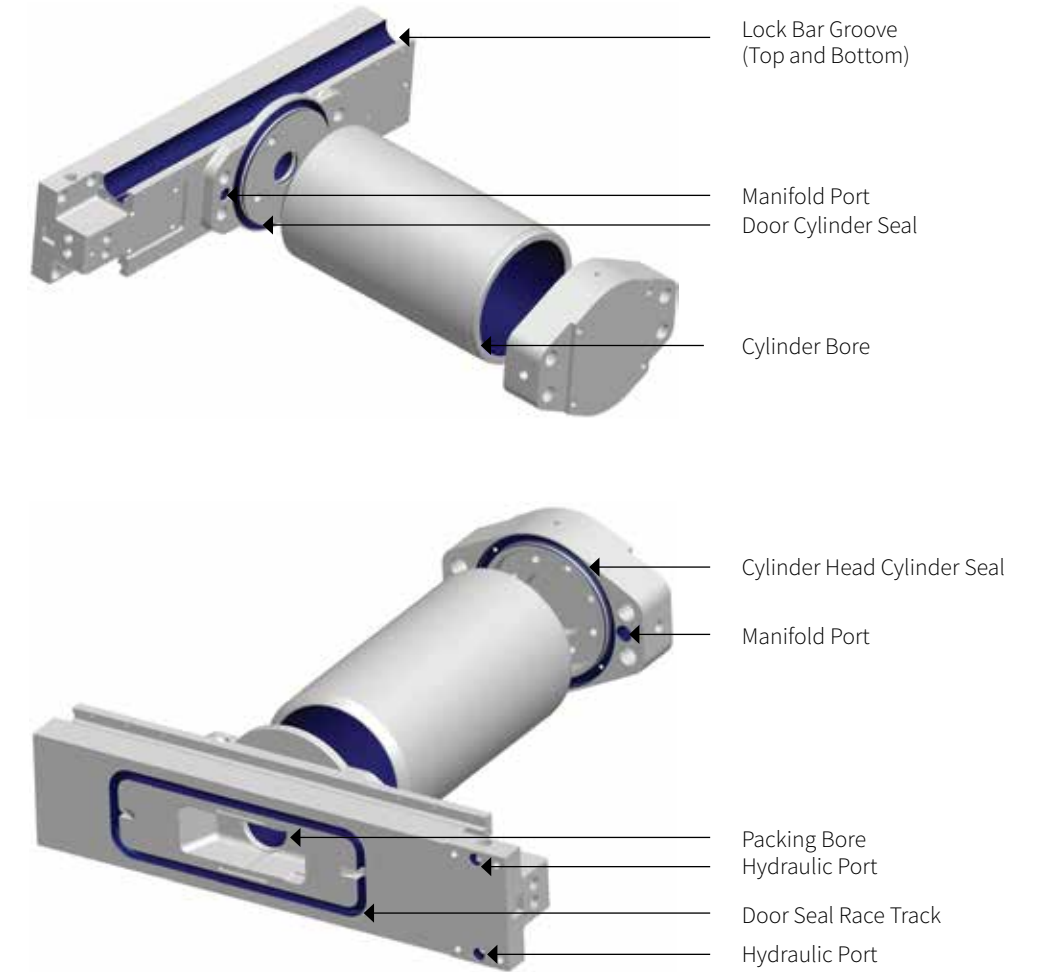
14" PosLock Booster Door



NXT Door CREP Levels - 14" Poslock Booster Door			
DOOR AREA	CREP LEVEL H	CREP LEVEL J	CREP LEVEL K
Cylinder Head Cylinder Seal	Phosphate	Phosphate	Inconel
Booster Cylinder Bore	Phosphate	Chrome	Chrome
Middle Head Cylinder Seal	Phosphate	Phosphate	Inconel
Middle Head Manifold Ports	Phosphate	Phosphate	Inconel

14" PosLock with Booster Door CREP locations are indicated by the shaded areas. CREP locations vary by door model due to component variations.

14" UltraLock II(B) Door



NXT Door CREP Levels - 14" Ultralock II (B) Door			
DOOR AREA	CREP LEVEL H	CREP LEVEL J	CREP LEVEL K
Lock Bar Groove	Phosphate	Phosphate	Phosphate
Manifold Ports	Phosphate	Phosphate	Inconel
Door Cylinder Seal	Phosphate	Phosphate	Inconel
Cylinder Bore	Phosphate	Chrome	Chrome
Cylinder Head Cylinder Seal	Phosphate	Phosphate	Inconel
Packing Bore	Inconel	Inconel	Inconel
Hydraulic Ports	Phosphate	Phosphate	Inconel
Door Deal Race Track	Inconel	Inconel	Inconel

14" UltraLock II (B) Door CREP locations are indicated by the shaded areas. CREP locations vary by door model due to component variations.

LFS-5 is the latest application of the NOV Low Force Shear technology, now with enhanced shearing performance on high-strength, heavy-weight drill pipe and landing string. Through creative engineering, the centering assembly has been eliminated while maintaining pipe centering geometry across the entire width of the wellbore. Only NOV can shear and seal today's stronger drill pipe and landing strings.

Features

- Shear efficiencies improved by up to 40%
- Automatically centers pipe by sweeping the entire throughbore to accommodate off-center wire line
- Centers pipe with 10,000 lbs side pull
- Designed to shear and seal landing string and work string consecutively
- Passed API16 A qualification testing
- Rated ED (30°F to 250°F)
- Will retrofit to current LFS capable doors
- Improved seal design with increased cycle life

Ram Geometry



Proven Performance Results



Successful Shear and Seal

- 6 5/8", 50ppf, S-135 followed by 5 7/8", 27ppf, S-135
- 6 5/8", 57ppf, UD-165 followed by 5 7/8", 27ppf, S-135
- 6 5/8", 64ppf, V-150 followed by 5 7/8", 27ppf, S-135
- 7 1/8" x 5 1/2", VIT, CR-115 followed by 5 7/8", 27ppf, S-135
- THRA followed by 5 7/8" 27ppf, S-135
- 7 5/8", 54ppf, V-150 followed by 5 7/8", 27ppf, S-135
- 10 3/4", 104ppf, P-110 followed by 10 3/4", 104ppf, P-110
- 14", 115ppf, Q-125 followed by 14", 115ppf, Q-125

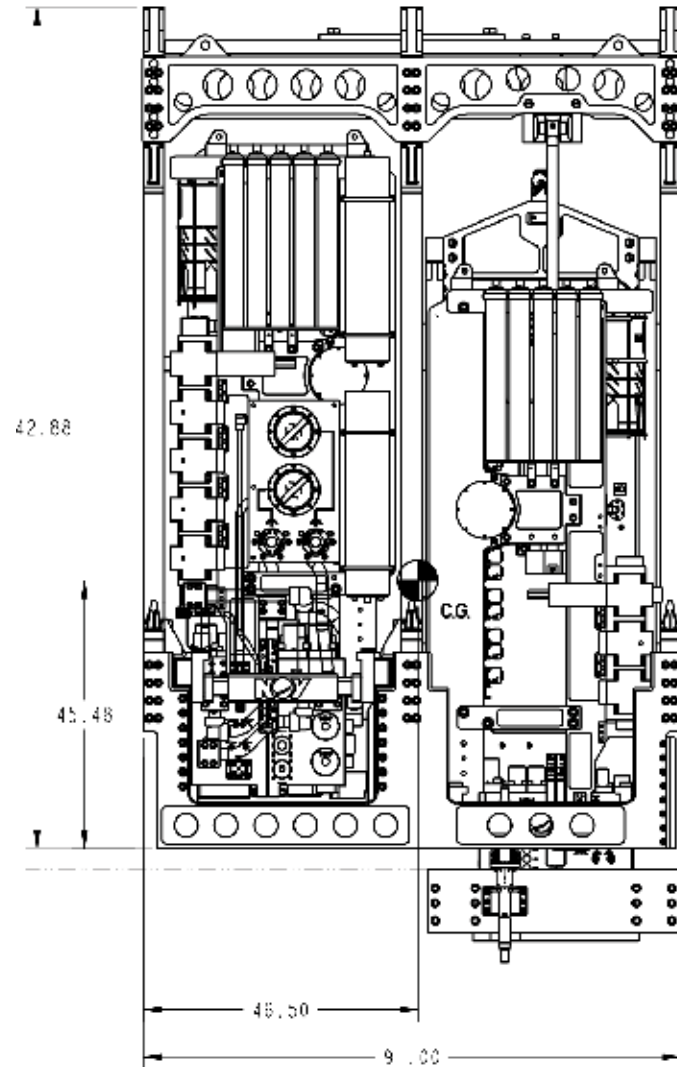
*All of the above shear and seal tests (and more) were performed using the same set of shear rams.

Shear and Seal Wireline

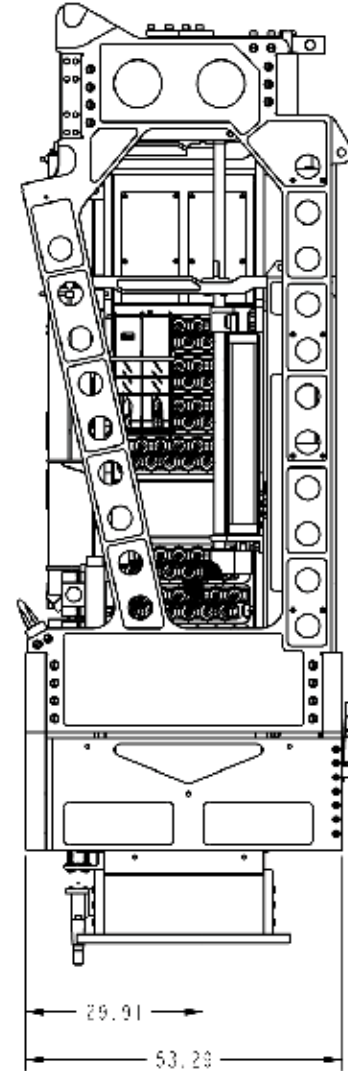
- Schlumberger 7-48A SUS
 - Rochester 7-H-490K
 - Rochester 1-H-314K
- *All with no tension on wireline

LFS-5 Shear Performance						
DESCRIPTION	PIPE OD	LB/FT	GRADE	OPERATOR	LFS-5 ACTUAL SHEAR PRESSURE	
Drill Pipe	5.875	27	S-135	22"	929	
Drill Pipe	5.875	27	S-135	14" x 14"	1189	
THRA	6.14	33.45	S-135	22"	1559	
THRA	6.14	33.45	S-135	14" x 14"	1996	
Landing String	6.625	64	V-150	22"	3350	
Landing String	6.625	64	V-150	14" x 14"	4288	
Casing	10.75	85	Q-125	22"	3050	
Casing	10.75	85	Q-125	14" x 14"	3904	

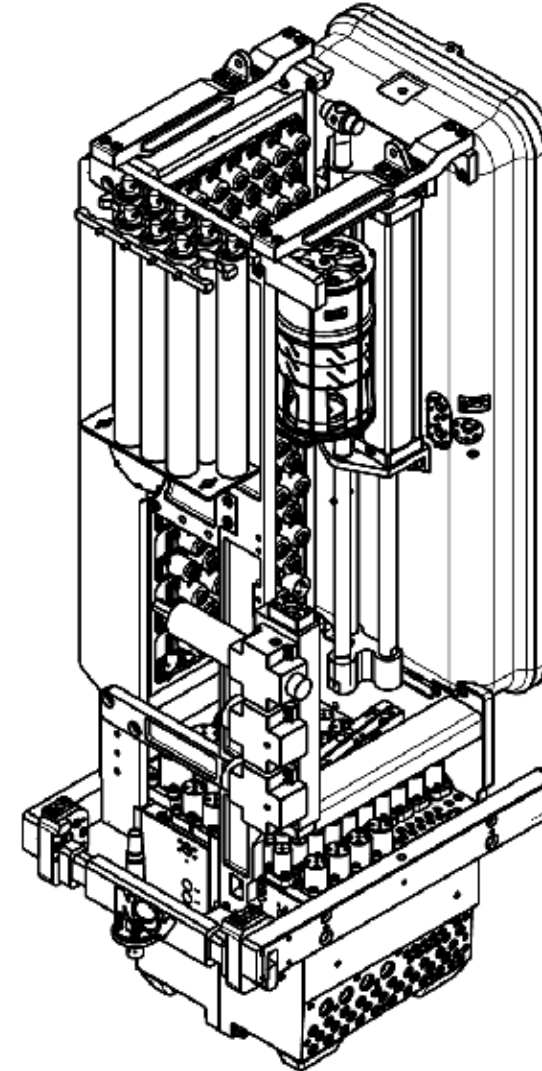
LMRP and Lower Stack Pod Assembly



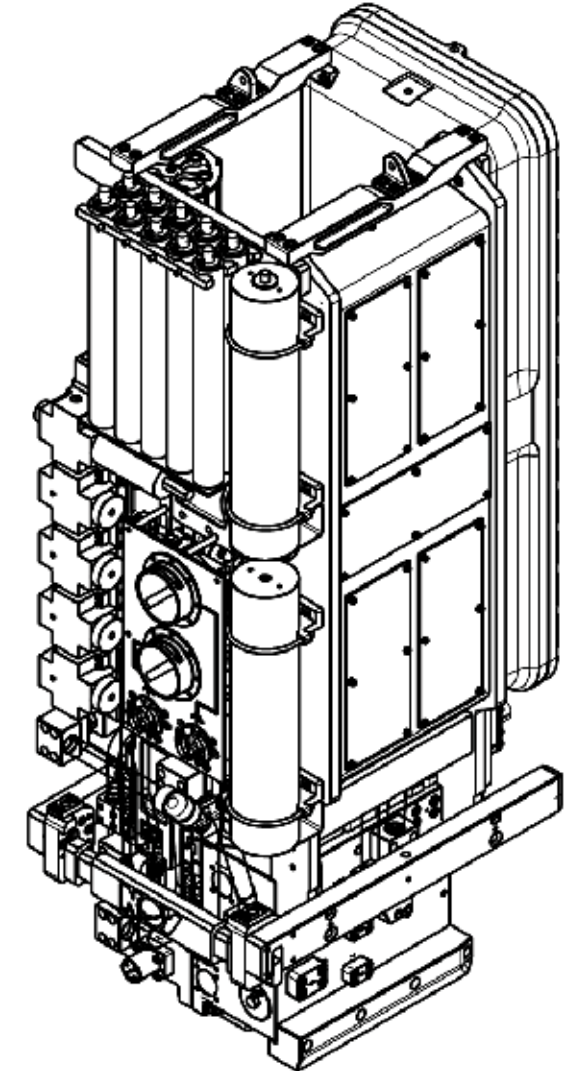
LMRP and Lower Stack Pod Assembly



Lower Stack Module removed from pod frame



LMRP Module removed from pod frame



Description

The RCX Multiplex (MUX) Pod is NOV's next generation control system. Components from Sub-plate Mounted Valves (SPM) to the full electronics package were targeted to improve quality. Combining high reliability achieved through meticulous component redesign with retrievability, the RCX system was built to keep you drilling.

The pod takes in hydraulic supply, electrical power, and control data from the rig and distributes pressure via a network of valves to individual stack-mounted functions. Each valve is controlled by a pilot valve which is solenoid operated and controlled by the Subsea Electronics Assembly (SEA).

Features

- Retrievable
- RCX Low Shock SPM Valves
- Dual pod design with independent retrieval for both BOP and LMRP sections
- Improved packer seal design
- Pod-mounted conduit manifold for directing fluid from either conduit to either pod
- Manifold-to-manifold connections use dual seal, seal subs
- Streamlined footprint
- Ergonomically designed user interface & HMI
- Unique pod ID - function counting capability even on test stand

Technical Specifications

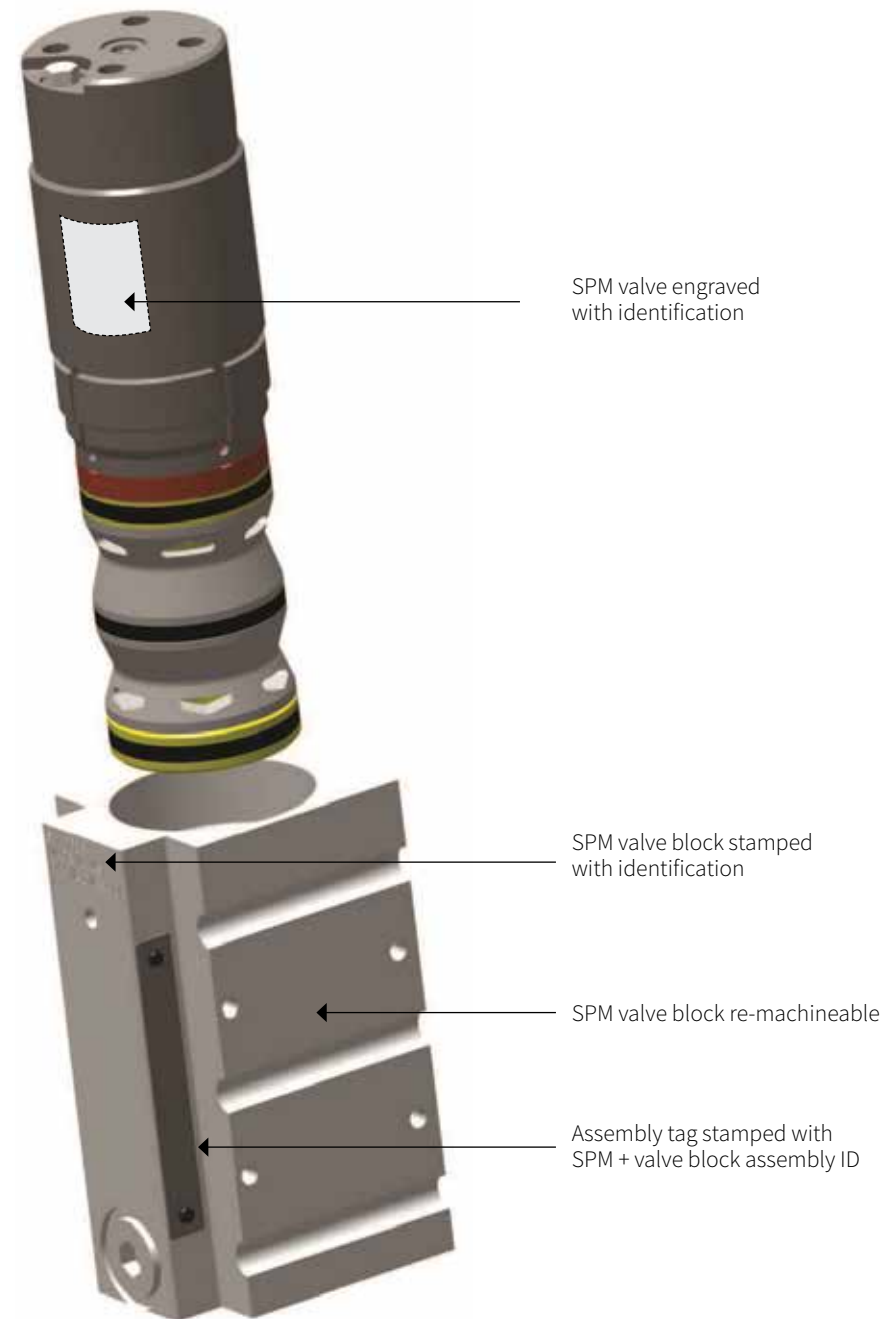
Operating pressure	5000 psi
Combined weight	40,000 lbs
Operating fluid	Water / Glycol / Soluble oil mix
Max allowable working depth	12,000 feet
Functions	140
Voltage rating	480 VAC
Temperature rating	-20°C to 50°C
OTHER SPECIFICATIONS	
Canbus sensors	
Piping of 1/2" and larger functions use schedule pipe with socket welded connections; terminating in SAE Code 62, dual seal connections	
Pilot lines are 1/4" tubing using Swagelok connectors and SAE O-ring boss connections	
Compensated Chamber Solenoid Valves (CCSVs)	
Pressure Balanced Oil Filled (PBOF) Cables	
Machined Stainless Steel Frame - no welding	

RCX Low-Shock SPM Valves

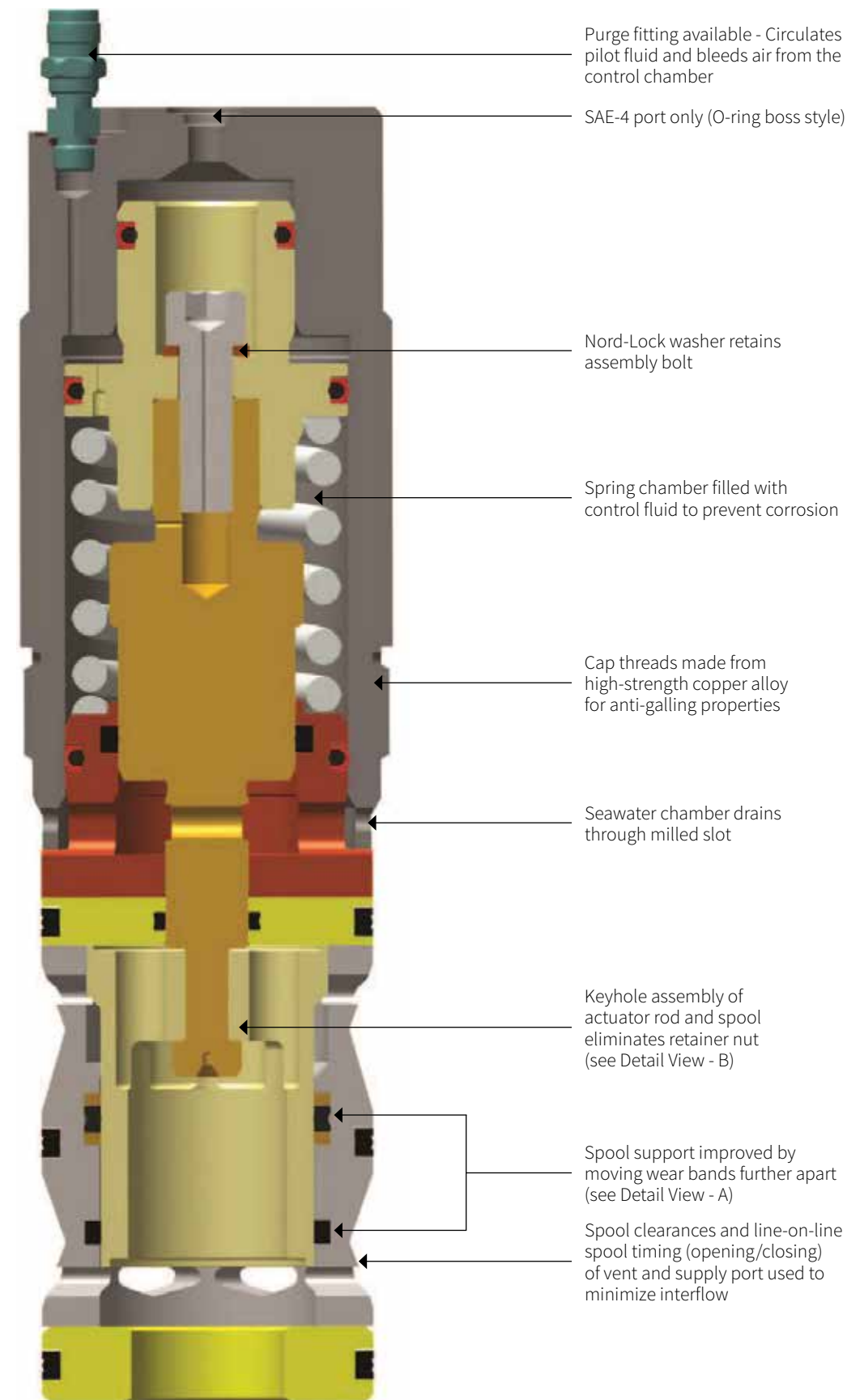
Sub Plate Mounted (SPM) valves are 3-way, 2-position fluid control valves. SPM valves are used throughout National Oilwell Varco (NOV) control systems to direct hydraulic fluid within hydraulic circuits.

- Created to address industry requests for a more robust and reliable valve.
- Direct circuit replacements with matched flow rates. Closing times are not affected.
- Utilize improved materials and are designed to reduce hydraulic shock (water hammer). Test data provided on sheet 2.
- Must be used with RCX Low-Shock SPM valve blocks. RCX Low-Shock SPM valve blocks may be re-machined to NOV specifications. Non-RCX Low-Shock blocks cannot be re-machined.

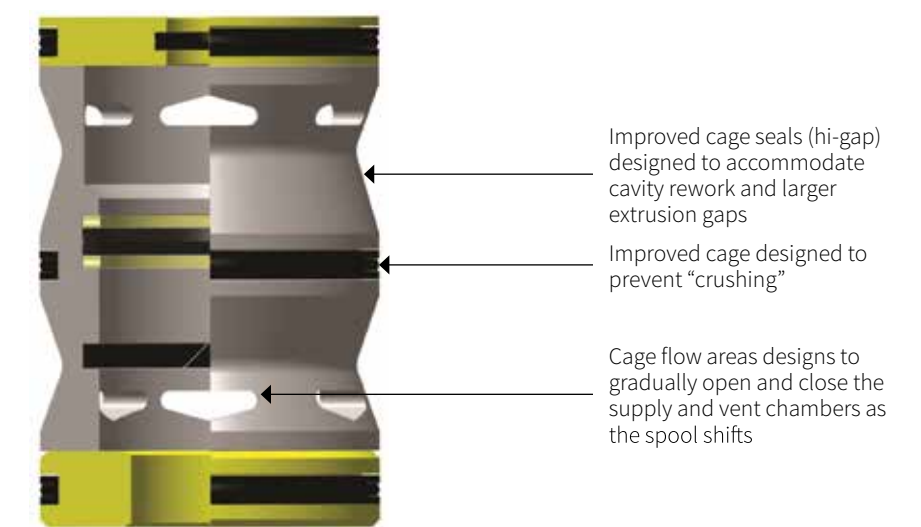
RCX Low-Shock SPM Valve Components



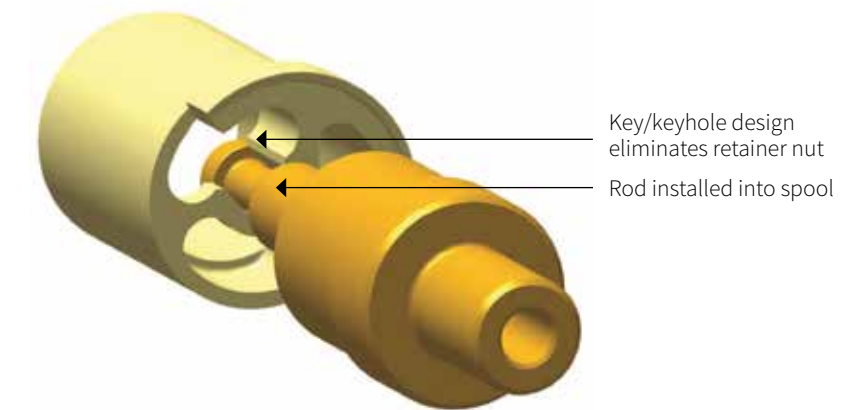
Cross Section View



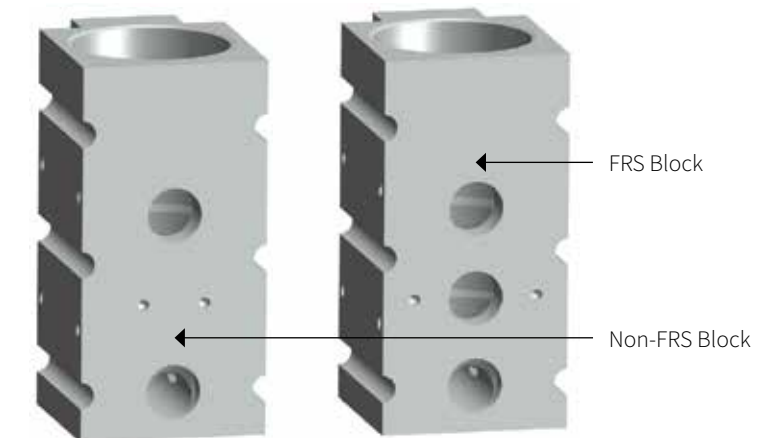
Detail View - A



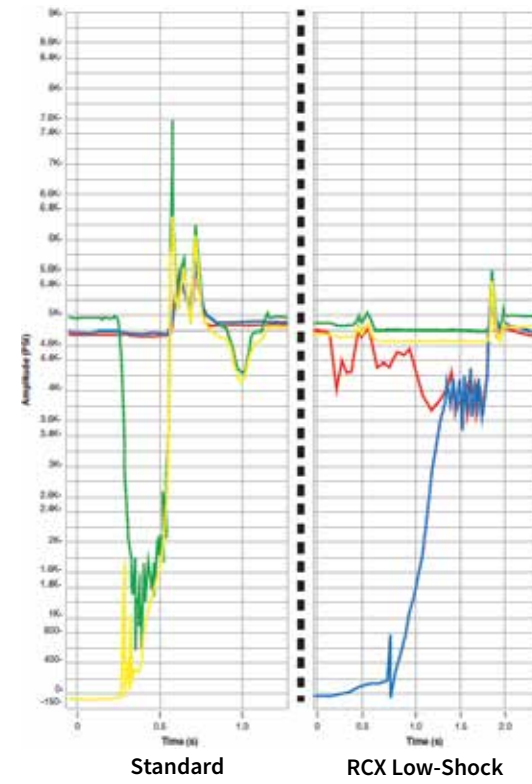
Detail View - B



Block Styles

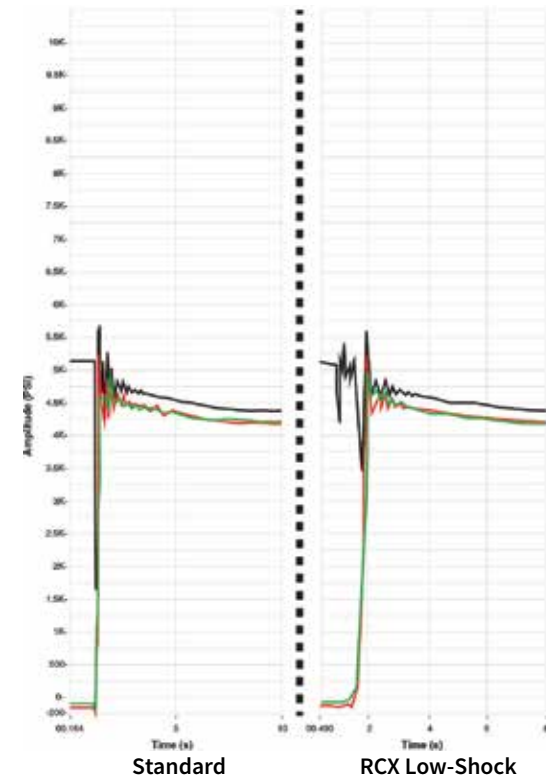


Pod Select



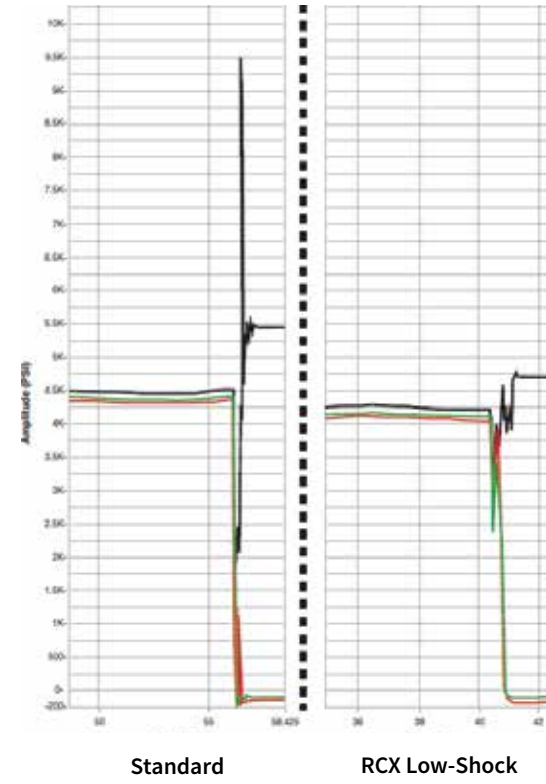
Pod Select Legend	
█	Supply Port - Standard SPM - Yellow pod
█	Work Port - Standard SPM - Yellow pod
█	Supply Port - Low-Shock SPM - Blue pod
█	Work Port - Low-Shock SPM - Blue pod

Shear Accumulator Charge



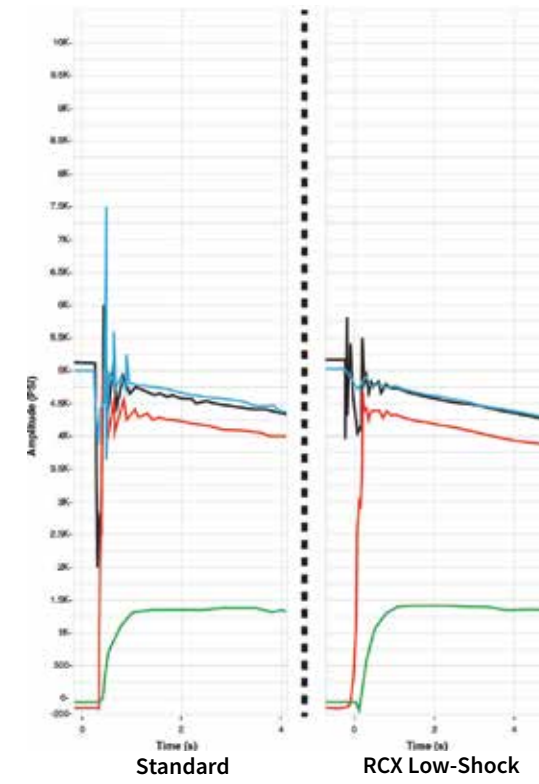
High Pressure Shear Accumulator Legend	
█	Pod Manifold Supply
█	HP Upper Shear Close @ SPM Work Port
█	HP Upper Shear Close @ Accumulators

Shear Accumulator Block



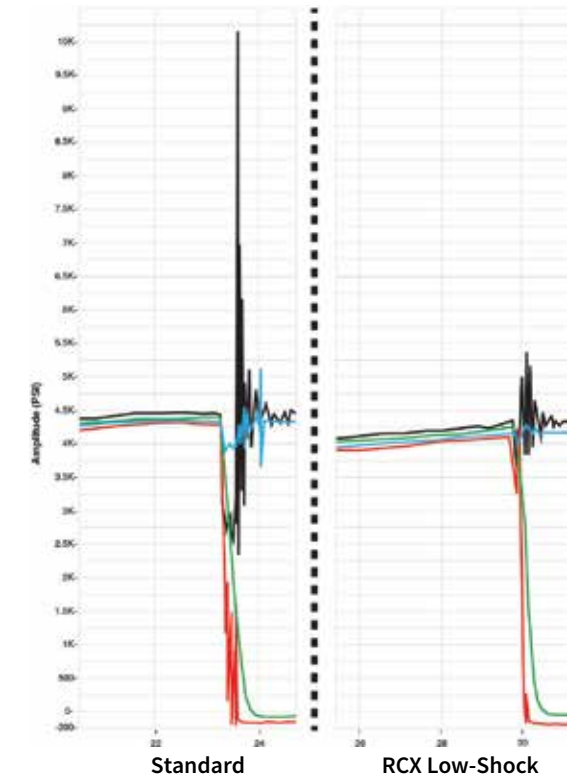
High Pressure Shear Accumulator Legend	
█	Pod Manifold Supply
█	HP Upper Shear Close @ SPM Work Port
█	HP Upper Shear Close @ Accumulators

Shear Close



High Pressure Upper Shear Legend	
█	Pod Manifold Supply
█	HP Upper Shear Close @ SPM Work Port
█	HP Upper Shear Close @ Operator Door
█	LMRP Accumulator Supply @ Accumulators

Shear Block



High Pressure Upper Shear Legend	
█	Pod Manifold Supply
█	HP Upper Shear Close @ SPM Work Port
█	HP Upper Shear Close @ Operator Door
█	LMRP Accumulator Supply @ Accumulators

RCX Low-Shock SPM Assemblies - Part Number and Description							
VALVE SIZE	VALVE CONFIGURATION	VALVE & BLOCK ASSEMBLY P/N	VALVE APPLICATION	VALVE ONLY P/N	SEAK KIT P/N	REPAIR KIT P/N	**BLOCK ONLY P/N
1 1/2"	NC (Normally Closed)	11448757-001	FRS	11394478-001	11444594-001	11444807-001	11327183-001
1 1/2"	NC (Normally Closed)	11448766-001	Non-FRS	11394478-001	11444594-001	11444807-001	11331583-001
1 1/2"	NO (Normally Open)	11449450-001	Pod Select	11395270-001	11444594-001	11444818-001	11398673-001
1 1/2"	NCB (Normally Closed Bi-Directional)	16562565-001	Stack Mounted	11394477-001	11444594-001	11444813-001	16557295-001
1 1/2"	NCB (Normally Closed Bi-Directional)	16574048-001	FRS	11394477-001	11444594-001	11444813-001	16574045-001
1 1/2"	NCB (Normally Closed Bi-Directional)	16574049-001	Non-FRS	11394477-001	11444594-001	11444813-001	16574046-001
1 1/2"	NOPB (Normally Open, Pressure Balanced)	-	*Rigid Conduit Manifold	11450588-001	16607805-001	16607868-001	-

* Rigid Conduit Manifold must be replaced as a unit
 ** For blocks not listed, contact RA-AftermarketUpgrades@nov.com for information and quotations



EHBS Description

The National Oilwell Varco (NOV) Koomey® Emergency Hydraulic Back-up System (EHBS) is an independent hydraulic control pod mounted on the lower BOP stack. When armed, the EHBS pod performs automatically in the event main conduit hydraulic pressure and electric power to the BOP control system 112-line MUX pod are disconnected or lost. The EHBS is a reliable safety system that activates customer-specified functions in the event of power failure, riser string disconnect or Lower Marine Riser Package disconnect.

Adjustable Timing Circuit Actuator

The Adjustable Timing Circuit Actuator provides a mechanical method for providing a time delay between two hydraulic functions on an (EHBS). The Adjustable Timing Circuit Actuator is easily adjusted to provide a time delay range of 18 to 52 seconds (when supplied with 5,000 psi [345 bar]).

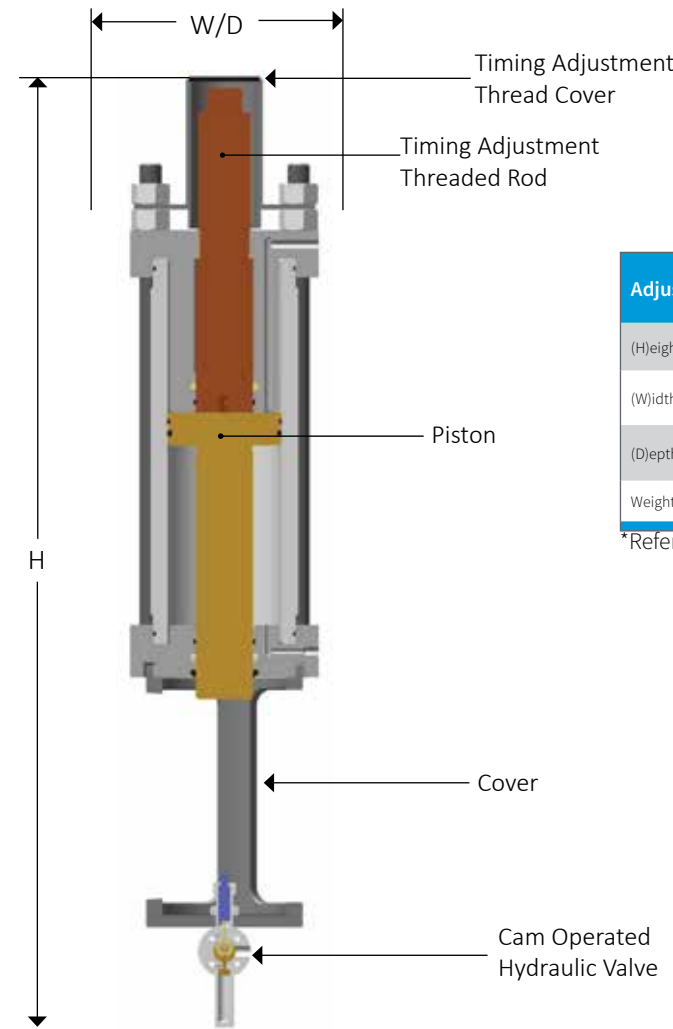
Key Benefits:

- No nitrogen pre-charging for time delay.
- No temperature or depth variables or pre-charge calculations.
- Rugged and reliable.
- Easily adjustable.
- Corrosion resistant.
- Existing timing circuits are easily upgraded.

Operating Principles:

Previous time delay circuits required an accumulator pre-charged for specific depth and water temperature variables. With the Adjustable Timing Circuit Actuator, a timing circuit accumulator and variable dependent precharges are no longer necessary. The timing setting used for surface testing is the same timing setting used for subsea operation.

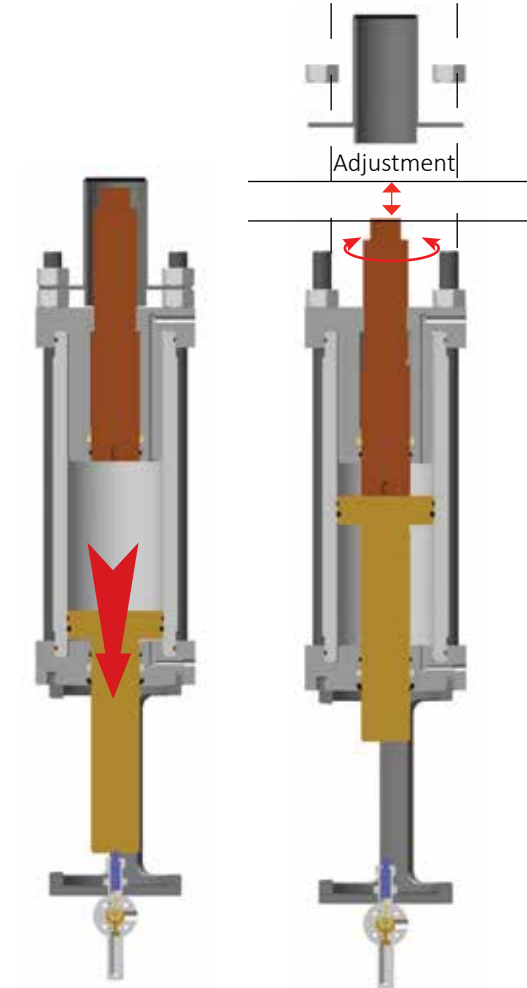
The system can be deployed as tested.



Adjustable Actuator—Cross Section

Adjustable Actuator Properties	
(H)eight	50.2" (127.51 cm)
(W)idth	9.9" (25.15 cm)
(D)epth	9.9" (25.15 cm)
Weight	410 lb (185.0 kg)

*Reference 10856492-ASM



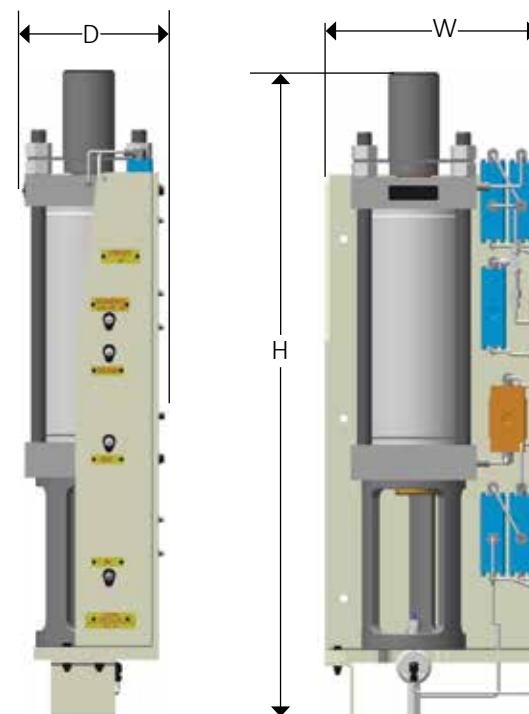
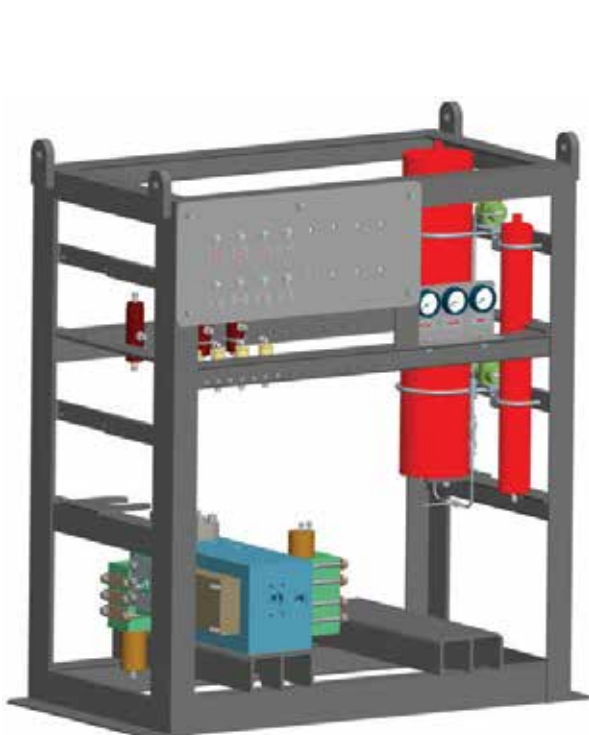
Piston Closing

Timing Adjusted with Threaded Rod

Adjustment Range
Min: 18 - 22 Seconds
Max: 48 - 52 Seconds

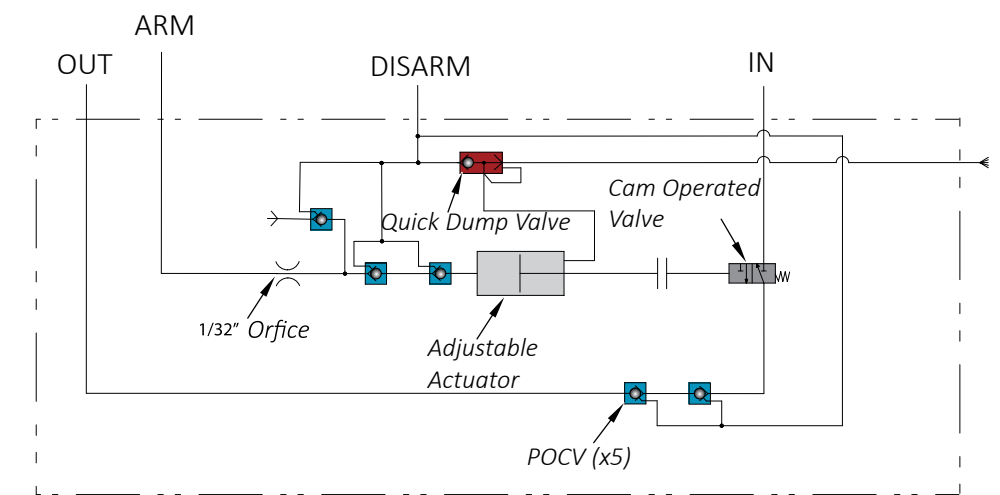
Adjustment
1 inch of adjustment = ± 5 seconds

Adjustment Procedure
To adjust the timing delay of the circuit:
1. Remove the timing adjustment thread cover.
2. Using a socket wrench, thread the adjustment screw inward (shorter delay) or outward (longer delay).
3. Replace the timing adjustment thread cover.



Stack Mounted Timing Circuit Properties	
(H)eight	50.64" (128.63 cm)
(W)idth	20.8" (52.83 cm)
(D)epth	10.96" (27.84 cm)
Weight	1,720 lb (780.2 kg)

*Reference 10874976ASM



Schematic-Adjustable Actuator Timing Circuit

RCX A-HB Pod

The RCX A-HB Pod combines both acoustic and EHBS functionality. Those two circuits are completely isolated hydraulically, however, they share a structural package. Acoustic emergency backup control system provides remote closure of certain BOP stack functions.

- Acoustic emergency back-up consists of two (2) sections of control, acoustic and electrohydraulic
- System is sized for 12,000 feet water depth
- Acoustic Functions will be as listed in later in this document
- System will include HIPAP
- Cables for the connectors to have test ports

Acoustic Electronic Section

- Portable Surface Acoustic Command and Control Unit for two way communication and operation of the control system. Splash proof design, with easy operation from buttons and a small LCD display. Two hands operation of critical BOP functions. Connector for interface to transducer. Internal rechargeable battery for several days' normal operation. Charges from 100 – 220V AC.
- Dunking Transceiver, with 70M cable
- Acoustic Control Subsea Unit. Fully redundant subsea container, with built in dual lithium, two year operating, batteries and electronics. Each electronic section has interface to dedicated transducer connectors (one for each). The electronics/ transducers communicate with the surface system with individual acoustic addresses. Connector and interface cable to 10 solenoid drivers and read backs are standard. Additional 6 optional drivers with read backs are available. GISMA connectors are delivered as standard.
- 2 Subsea Transceivers. Inclusive of 15 meter cable with GISMA connector
- Simulator for testing of ACS Tool for on-deck-testing of the ACS before the BOP enters the sea. Connector and interface cable simulating solenoid drivers and read backs are standard. The connector mates directly into the ACS interface cable (solenoid end).

EHBS

Emergency Hydraulic Backup System (EHBS) (also referred to as Auto Shear Circuit), commonly called a "Deadman System" is an independent hydraulic control pod circuit mounted on the BOP stack which performs the following stack functions automatically if main conduit and electrical power to the BOP control system are disconnected or otherwise lost.

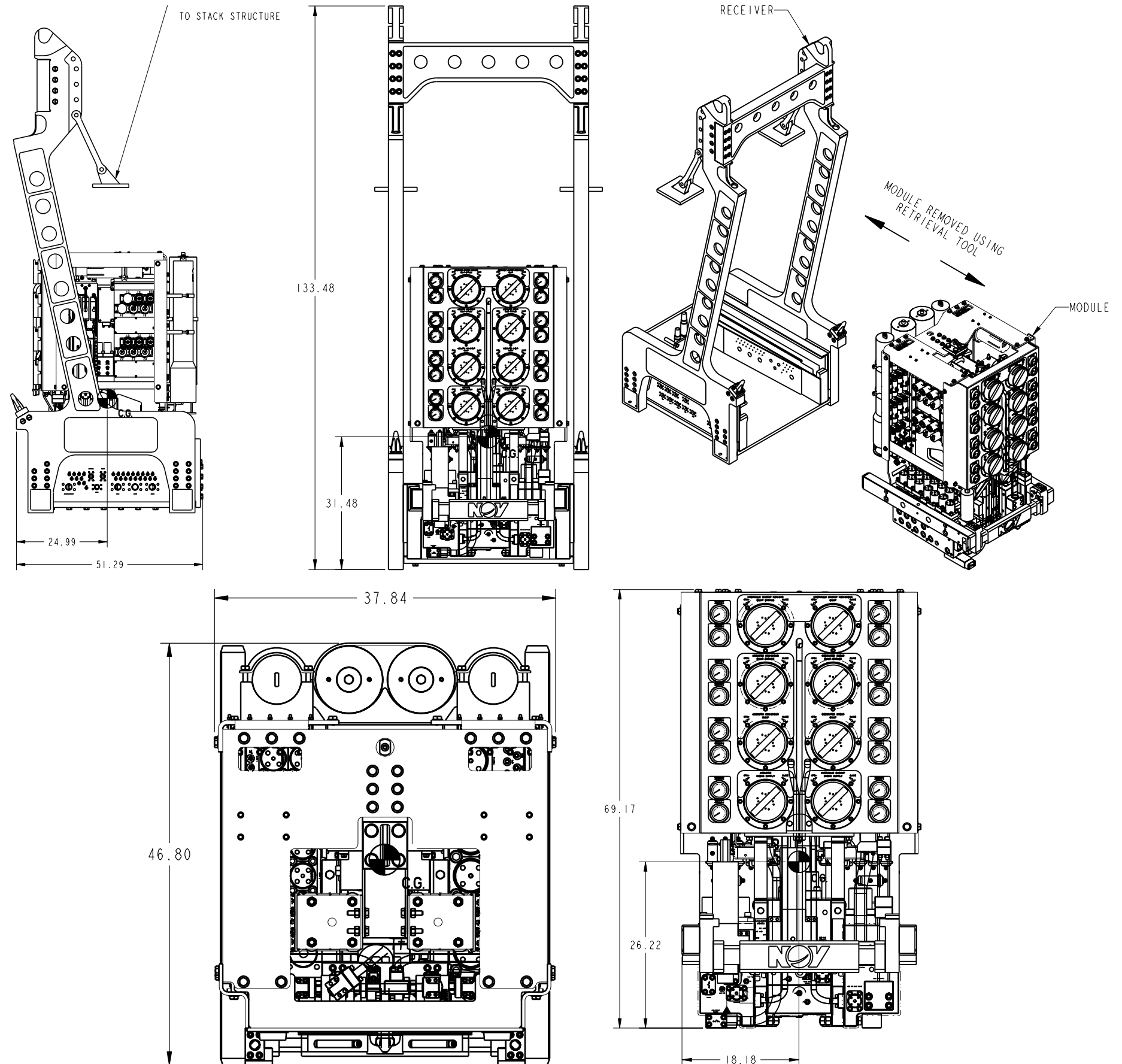
The EHBS is hydraulically powered from the stack-mounted Shear Accumulator Bank. The EHBS system consists of the following major components:

- EHBS Assembly, housed in a steel frame attached to the BOP stack. All inputs, outputs and manual valves are labeled. All manifold valve functions are stamped on the manifold.
- On screen activation for simulation of the Deadman Circuits; "Normal Operation / Test" function for simulation of Loss of Electric and Loss of Hydraulic before stack deployment.
- Two (2) Functions: Close Casing Shear and after 20 second, close the upper blind shear rams.
- Will include one additional valve; 3 valves total.
- Timing Circuit included will be mechanical. No pre-charged bottle.

Electrohydraulic Control Section

Electro-hydraulic mini pod to interface between acoustic system and desired functions. The modularly constructed pod will consist of the following:

- One (1) Stainless steel pressure compensated chamber. The chamber is filled with dielectric insulating fluid and compensated by a pressure compensator complete with a relief valve. The chamber is to contain CCSV environmentally protected solenoid actuators.
- One (1) 3m absolute filtration assembly
- One (1) piston type accumulator for supply pressure storage to the CCSV valves.



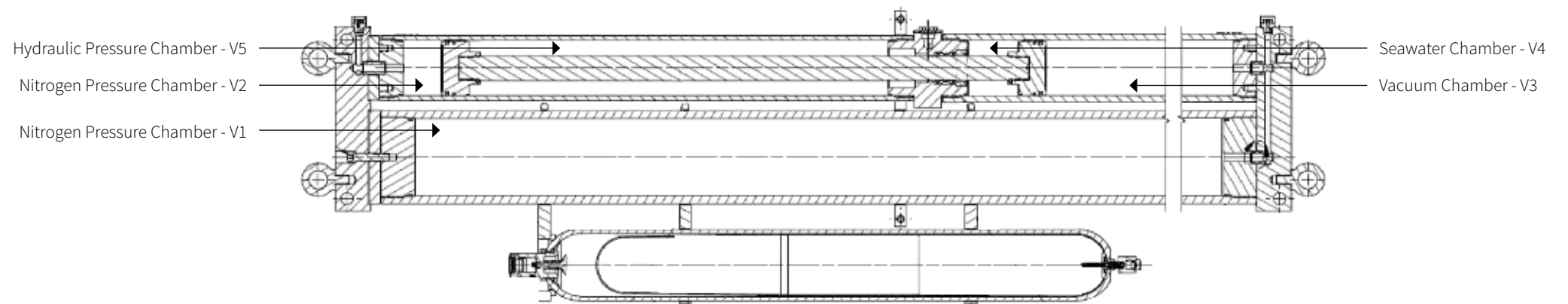
Today's designed operating environment for stack mounted accumulators is challenging. Design criteria include 12,000 ft water depths, temperatures as low as 32°F with surface temperatures of 120°F, rapid discharge (adiabatic), as well as higher minimum system pressures. All of these things add up to a large number of bottles on a lower BOP stack. It is not uncommon to see as many as 126 accumulator bottles on a

lower BOP stack, 98 of which are dedicated to the shear system alone. This adds weight to the overall assembly, increases maintenance requirements, and decreases stack equipment access. By using the water column pressure and mechanically boosting the hydraulic pressure, a Depth Compensated Accumulator has reduced the total number of stack mounted shear circuit bottles dramatically.

Functionality

This system is comprised of a double-piston accumulator. The two pistons are connected by a piston rod. This creates five separate chambers within the DCB, plus the transfer barrier.

- The first two chambers (V1 and V2) contain a Nitrogen pre-charge acting against one piston.
- The third chamber (V3) is a vacuum that acts against the other piston.
- The fourth chamber (V4) is filled with BOP fluid from the transfer barrier. The transfer barrier is open to ambient seawater pressure on one end and forces more fluid into V4 as depth increases.
- The fifth chamber (V5) contains the hydraulic fluid.
- The result is 100% usable hydraulic fluid while subsea.



Estimating the number of bottles required:

1 - On the vertical axis, find the required Shear Pressure (Including the effects of Mud Weight and Water Depth) and intersect with the curve for DCB bottle type.

(Example : 3900 psi, 7.9 Gal DCB)

2 - Draw a line down from the point of intersection to the horizontal axis of the chart and read useable volume for one bottle.

(Example : 3.6 gal)

3 - Multiply the required operator volume by 1.1 (API 16D Volume Design factor) to obtain the total required volume.

(Example: 18'-15M NXT 22" Operator, closing volume = 37.3 gal, required volume = 37.3 x 1.1 = 41.03 gal)

4 - Divide the required volume by the useable volume for one bottle to obtain the required number of bottles. (Round up to the next whole number.)

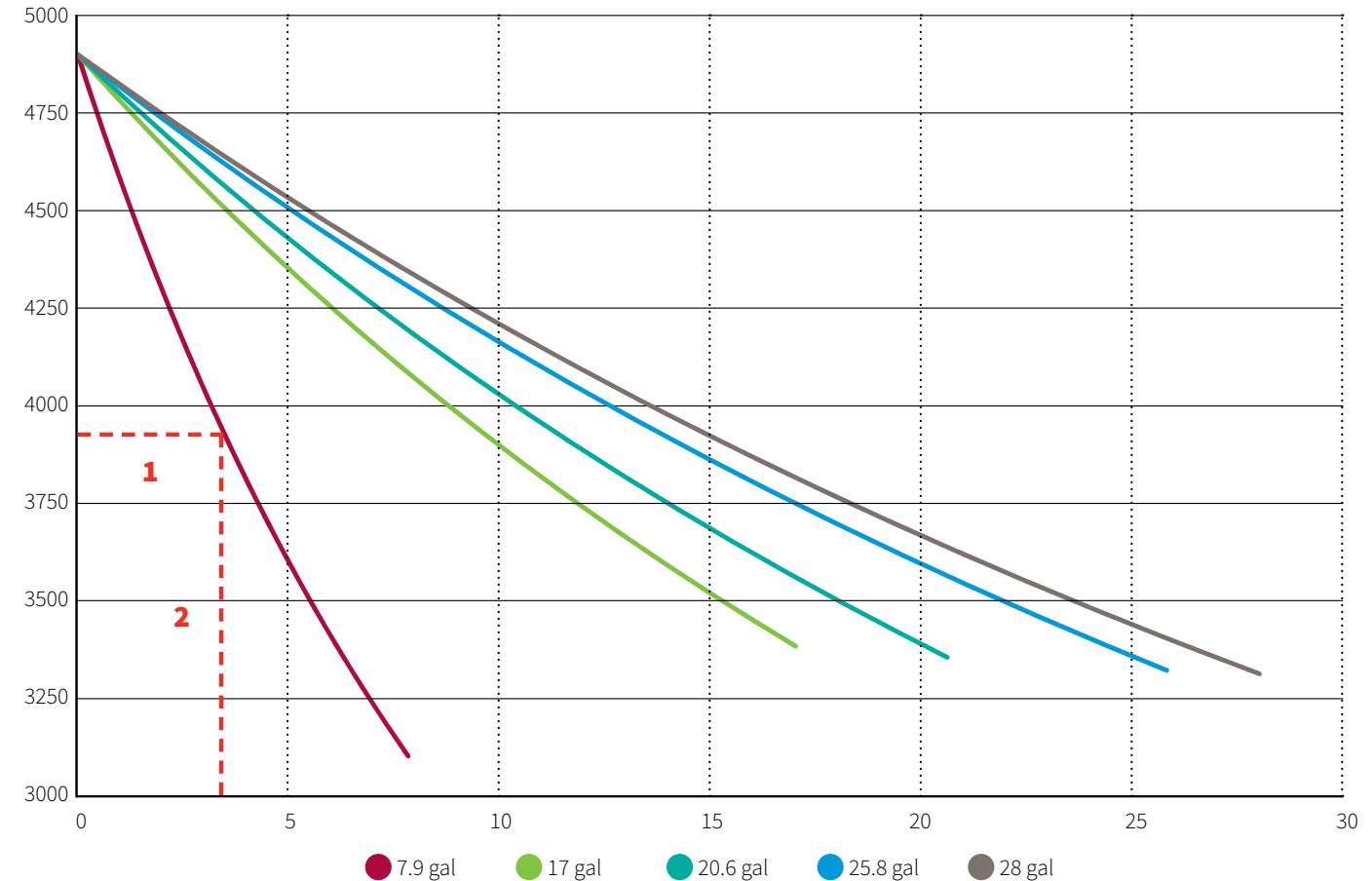
(Example: 41.03/3.6 = 11.4, round up to 12 bottles)

Equation

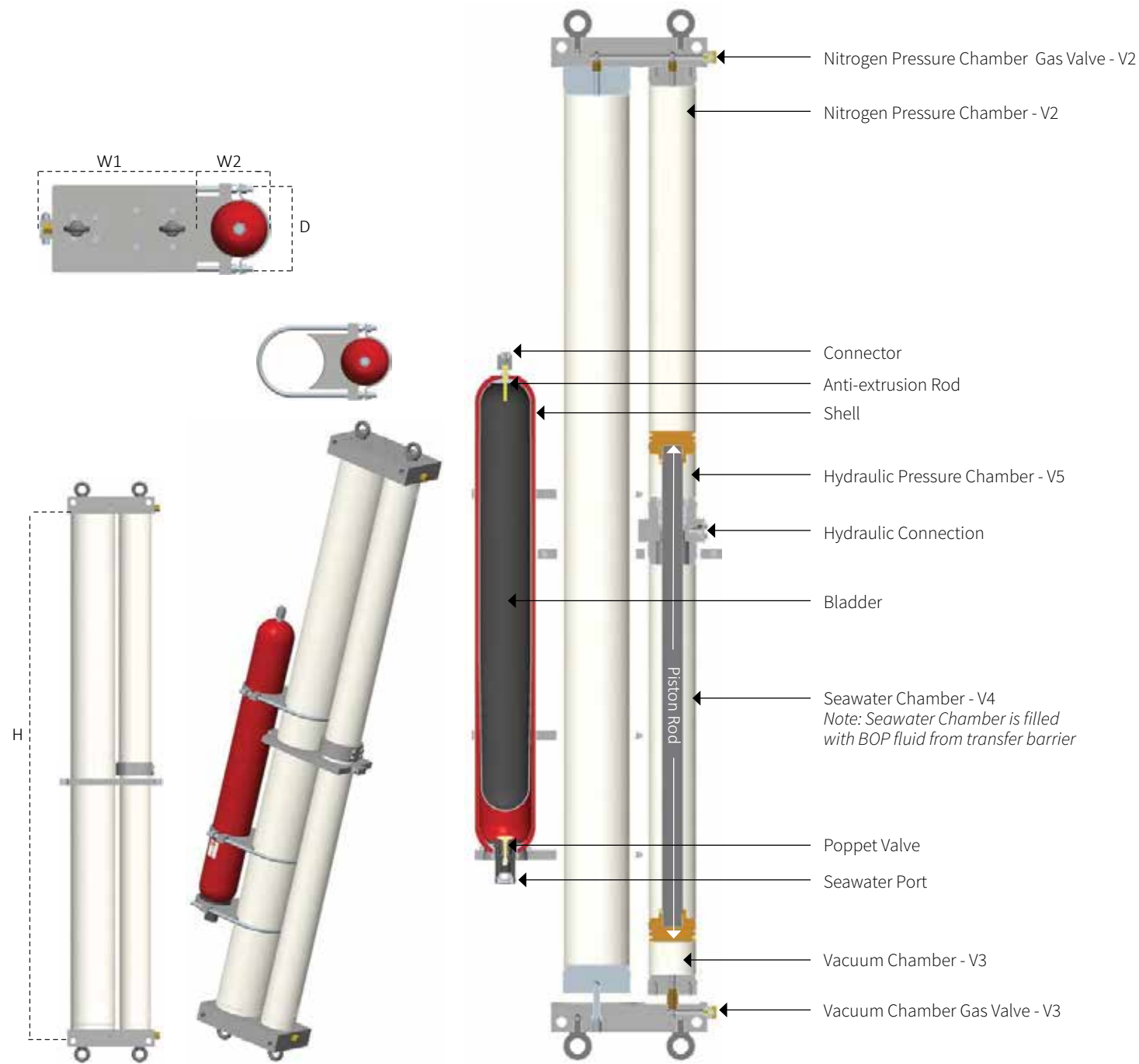
$$\frac{\text{Required Operational Volume} \times 1.1}{\text{Volume Used Per Bottle}} = \text{Number of Bottles Required (Round Up)}$$

Note: This is only an estimate. Contact NOV Pressure Control Engineering for certified calculations.

DCB Bottles - Shear Pressure vs Usable Volume



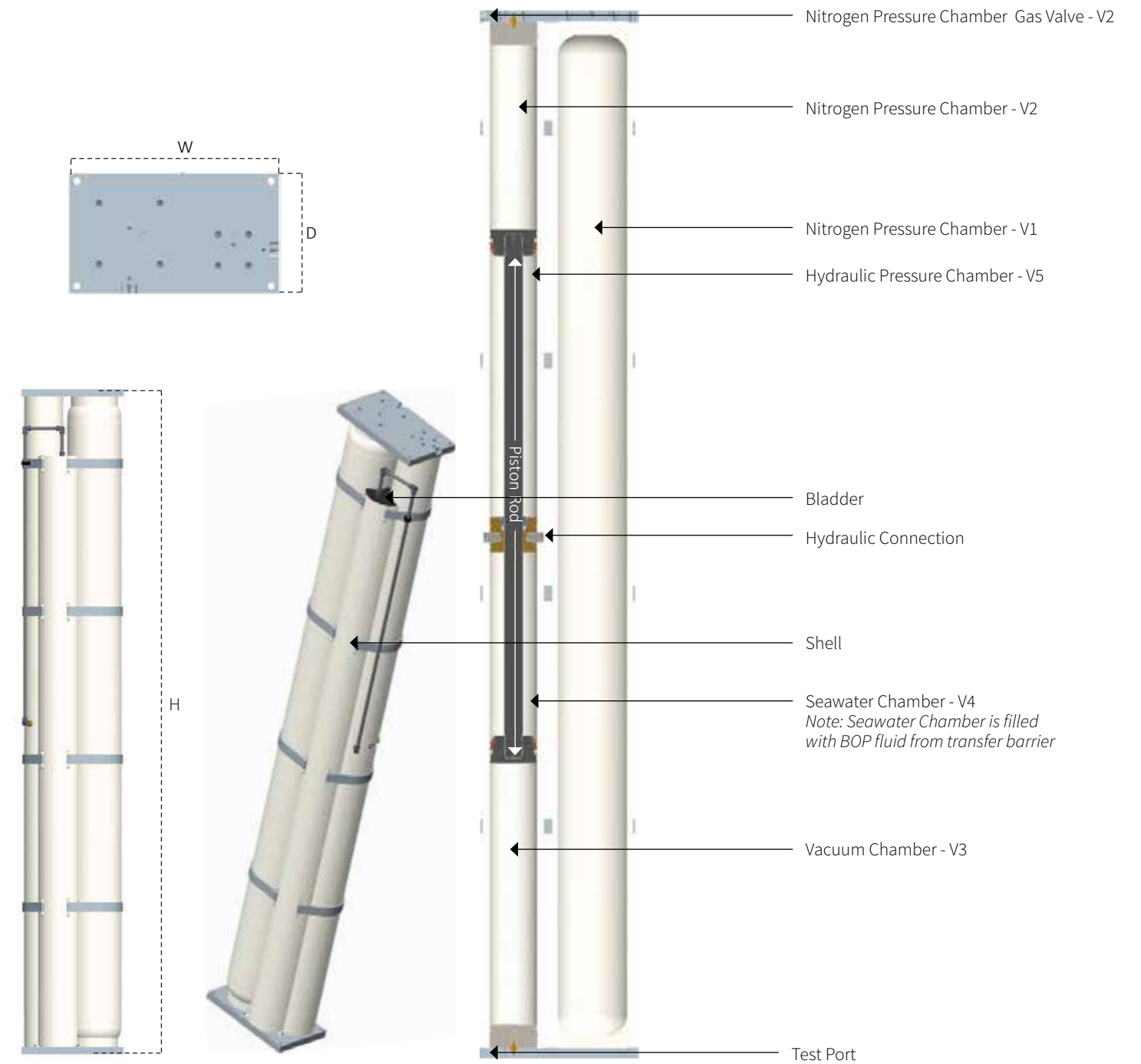
P/N 20090035 configuration



Specifications							
P/N	V5 VOLUME	V1 VOLUME	V2 VOLUME (MAX)	HEIGHT	WIDTH	DEPTH	WEIGHT
20090035	7.9 Gal (30 liters)	43.8 Gal (166 liters)	10 Gal (38 liters)	150.24" (3,816.1 mm)	25.5" (647.7 mm) 11.9" (302.3mm)	14.12" (358.6 mm)	3,995 lb (1,812 kg)

(Transfer barrier can be mounted separately if desired)

P/N 10641709-003 configuration



Specifications							
P/N	V5 VOLUME	V1 VOLUME	V2 VOLUME (MAX)	HEIGHT	WIDTH	DEPTH	WEIGHT
10641709-001	17 Gal (64.35 liters)	116.9 Gal (442.5 liters)	19.95 (75.5 liters)	150" (3,811 mm)	34" (863.6 mm)	19.5" (495.3 mm)	7,208 lb (3,269 kg)
10641709-002	20.6 Gal (77.98 liters)	138.1 Gal (522.8 liters)	24.2 Gal (91.6 liters)	175" (4,445 mm)	34" (863.6 mm)	19.5" (495.3 mm)	7,984 lb (3,621 kg)
10641709-004	25.8 Gal (97.66 liters)	167.9 Gal (635.6 liters)	30.3 Gal (114.7 liters)	210" (5,334 mm)	34" (863.6 mm)	19.5" (495.3 mm)	9,077 lb (4,117 kg)
10641709-003	28 Gal (105.99 liters)	180.8 Gal (684.4 liters)	32.8 Gal (124.2 liters)	225" (5,715 mm)	34" (863.6 mm)	19.5" (495.3 mm)	9,545 lb (4,329 kg)

Hands Free Gooseneck Overview

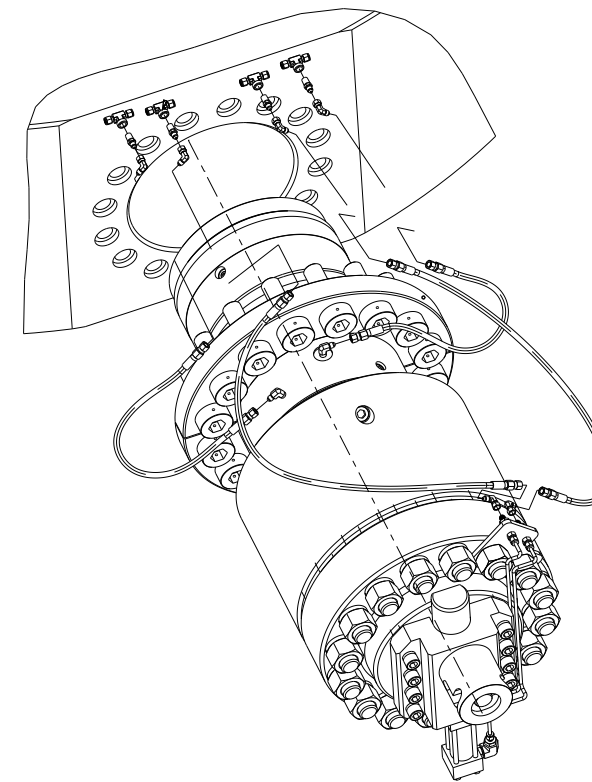
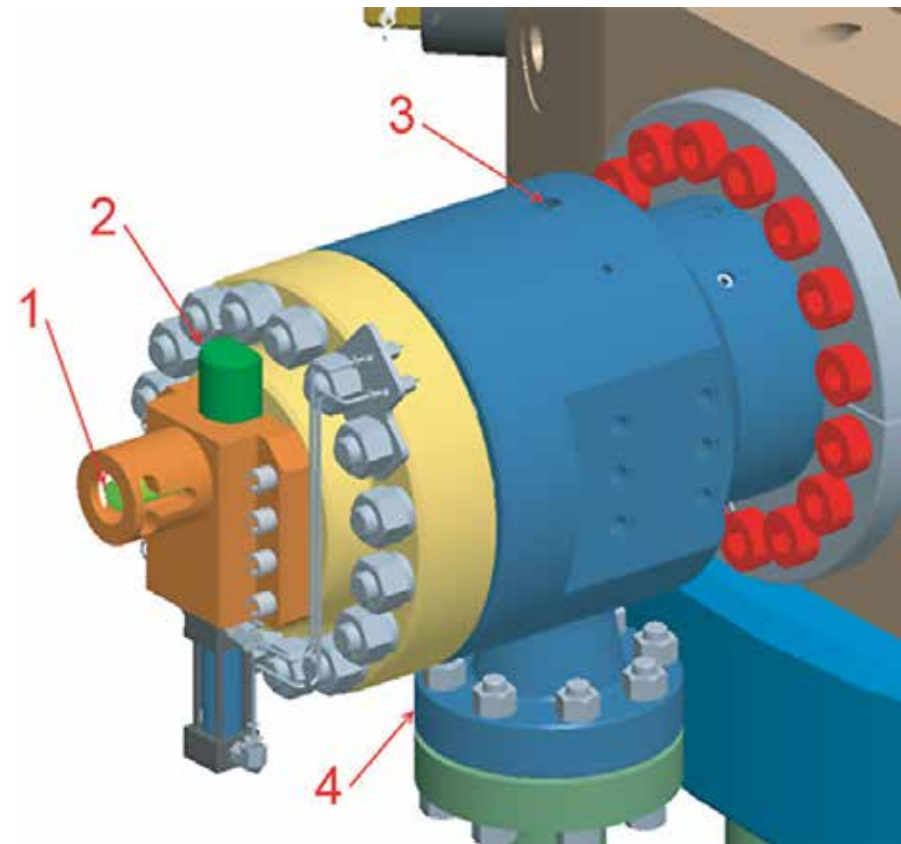
NOV understands the oil and gas industry, and with it, the inherent dangers of rig personnel working inside the moon pool area. Manual goosenecks have a tendency to have a long connection times and are difficult to manage; leaving an opportunity for both equipment damage as well as exposing rig personal to potentially harmful situations.

With an eye ever towards the needs of our customer, NOV is proud to introduce the Hands Free Gooseneck System (HFGN). NOV's HFGN eliminates the need to have rig personnel in potentially hazardous environments and with the addition of rotating stabs, the BOP stack has easy access beneath the drill floor.

Manual Swivel Gooseneck

The hands free gooseneck stabs are designed such that they may swivel in the clockwise and counterclockwise directions by manually pulling the hose in the desired plane of rotation, making way for any equipment which must find its way to well center. The unit is available in 75 1/2" and 60 1/2" diverter sizes.

1. Visual Position Rod to verify successful stab with the telescopic joint
2. Secondary locking to prevent unintentional un-stabbing of the gooseneck with the telescopic joint.
3. Emergency packing element to temporarily seal potential leaks.
4. API Flange or Hub moon pool hose connections, customizable to customer preference.



5X CARTRIDGE HOSE DETAIL

Features

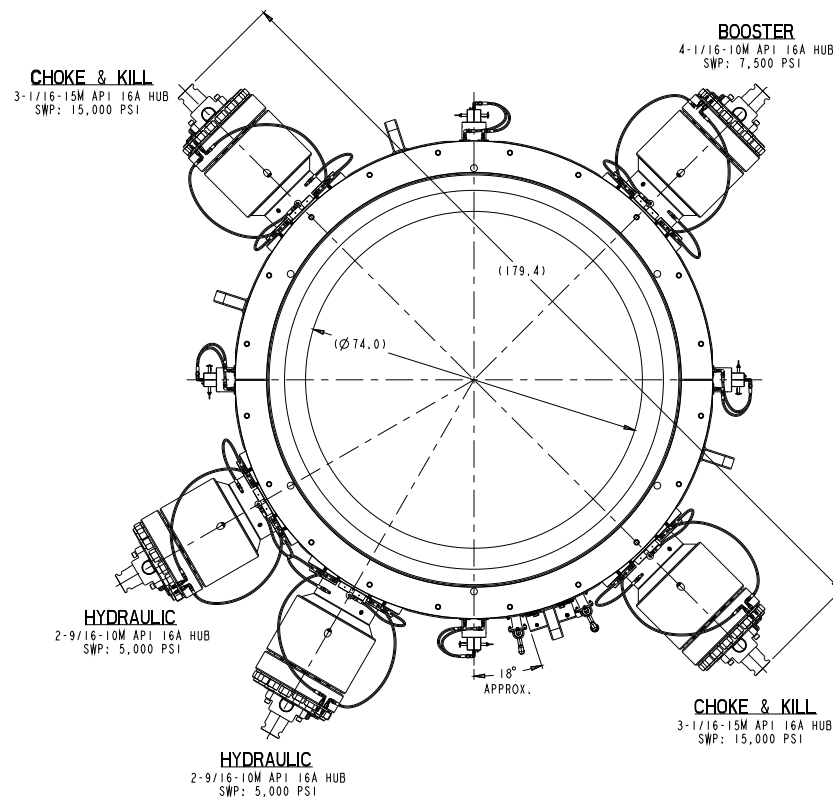
- Simple connection process
- Improved Safety
- No manual intervention required
- Rotating cartridge assemblies
- Modular Components
- Quick disconnects to facilitate connection of control hoses
- Emergency packing element in each cartridge
- Safety interlocks to prevent unintended operation of HFGN functions

Benefits

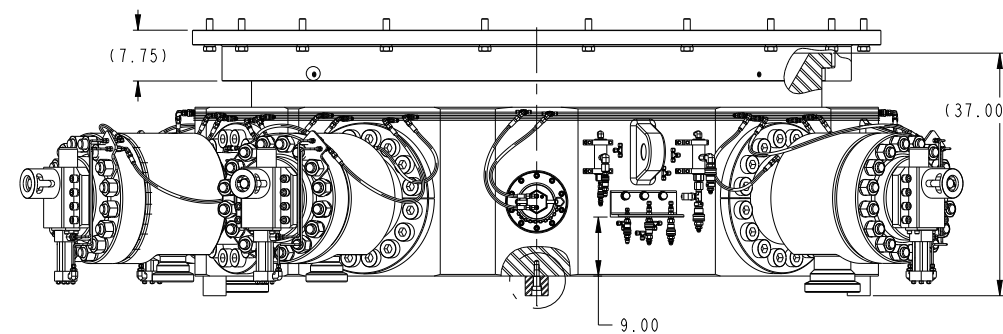
- Removes personnel from working over water in a riding belt
- Connection process is reduced from hours to minutes
- Can be retrofitted to existing NOV riser systems with minimal modifications
- Eliminates damage from manually stabbing individual goosenecks using snatch blocks and tuggers
- Modular configuration provides for common spare parts

Testing

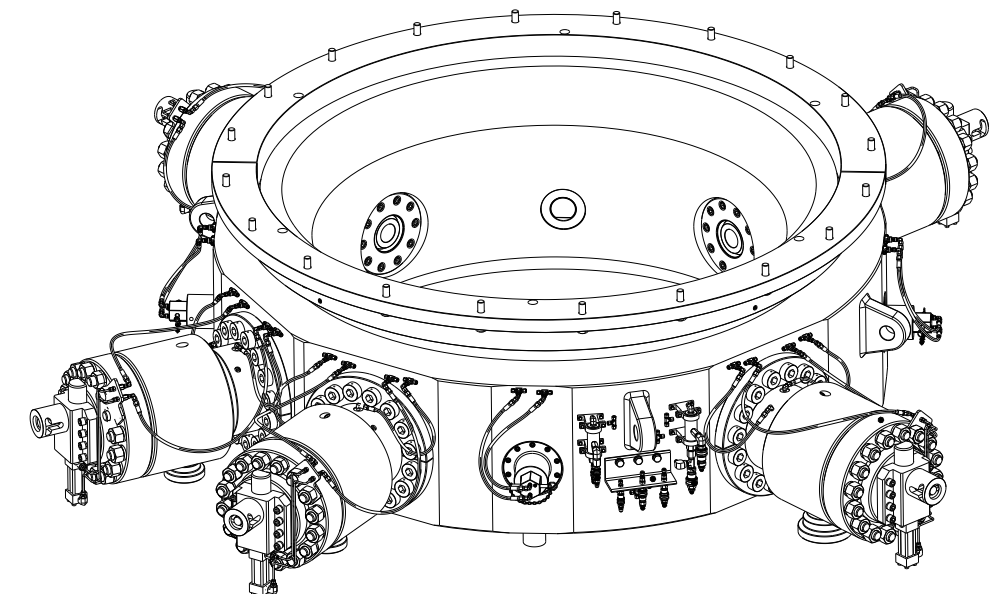
- Designed and tested to API 16F Specifications
- Each Hands Free Gooseneck is stab tested with a Telescoping Joint prior to shipment



Top View

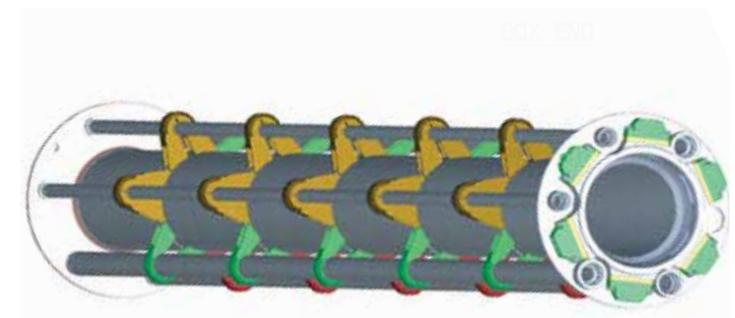
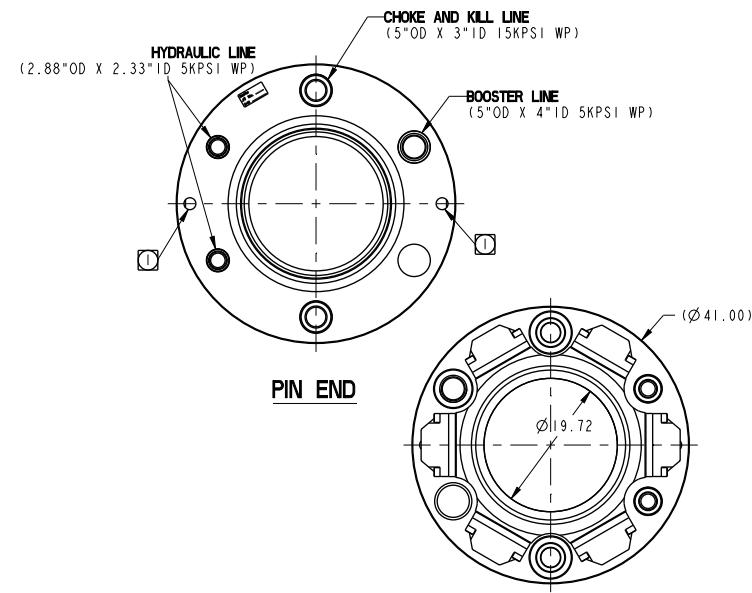


Front View



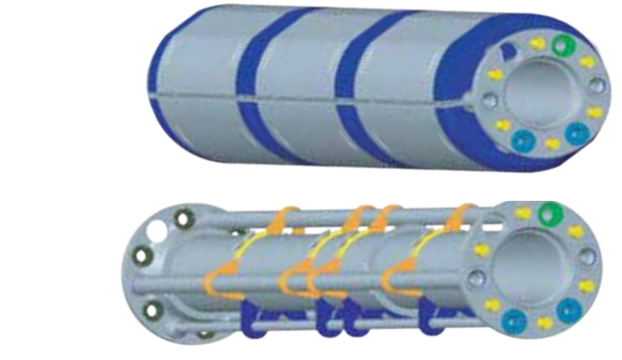
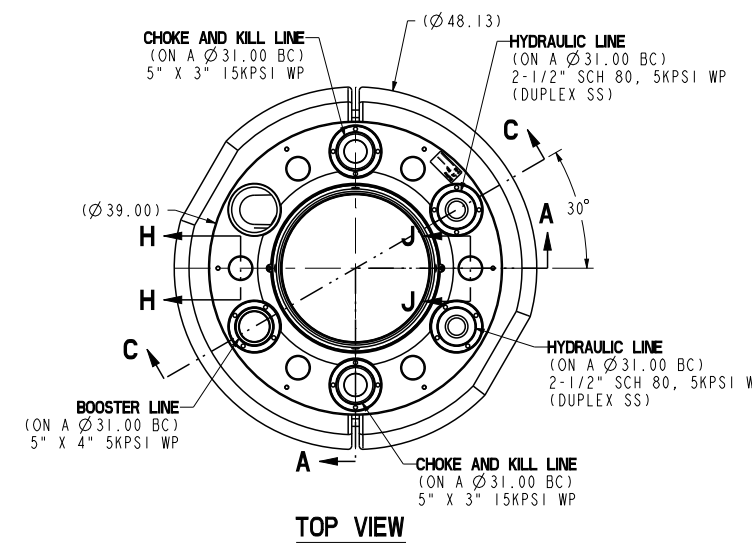
Perspective View

Dog Type 2™



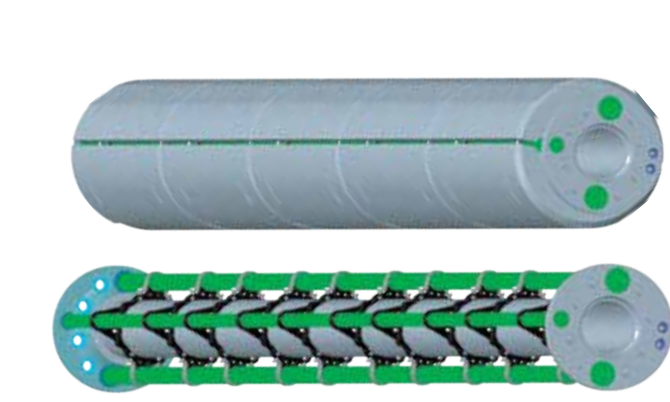
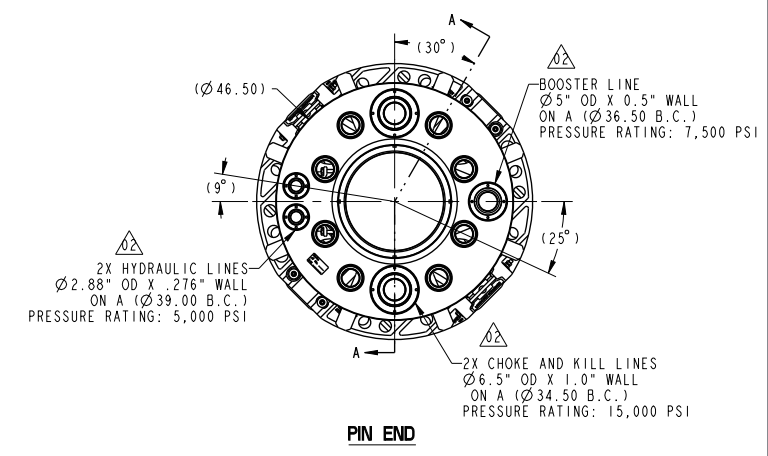
Technical Specifications	Dog Type-2 (shown above)	Dog Type-1
Tension Load	2,000,000 lb.	1,125,000 lb.
Lengths	50 ft, 75 ft	50 ft, 75ft
OD Pipe	21"	21"
Unique Configurations	5	8
Foot Lengths	5, 10, 15, 20, 25, 30, 40, 50, 60, 75	10, 20, 25, 31.25, 35, 40, 50, 65, 75
Wall Thickness	5/8", 11/16", 3/4", 13/16"	5/8"
Flange Diameter(s)	48.0", 41.0"	41.50", 41", 35.625"
Line Configurations	2 Line (Choke, Kill) 4 Line (Choke, Kill, Booster, 1x Hydraulic) 5 Line (Choke, Kill, Booster, 2x Hydraulic)	2 Line (Choke, Kill) 3 Line (Choke, Kill, Booster) 3 Line (Choke, Kill, 1x Hydraulic) 4 Line (Choke, Kill, Booster, 1x Hydraulic) 4 Line (Choke, Kill, 2x Hydraulic)
Line Pressures and Sizes	Choke/Kill: 15K and 10K / 6.5"x4.5", 5"x3 Booster: 5K / 5"x4", 5.5"x4.75" Hydraulic: 5K and 3K / 2.5" Sch80 (316 Stainless and Duplex SS)	Choke/Kill: 15K and 10K/5"x3", 4.375"x2.575", 4"x2.75" Booster - 5K and 3K / 3.5" Sch80, 4" Sch80, 4.5" Sch80, 5"x4", 4"x3" Hydraulic - 5K and 3K / 2.5" Sch80 (316 Stainless and Duplex SS)
Other	All lines are 60 degrees apart. Some styles may not have extra holes for lines.	All lines are 60 degrees apart. Some styles may not have extra holes for lines.

Flange Type-E™



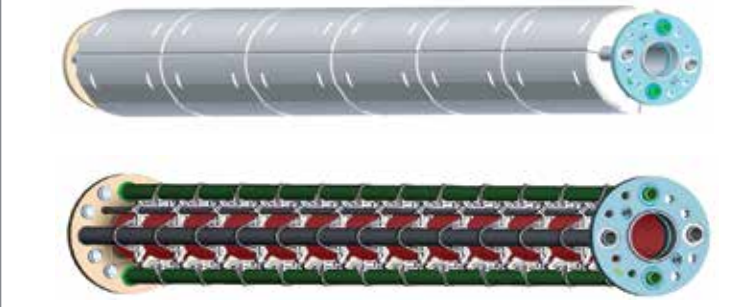
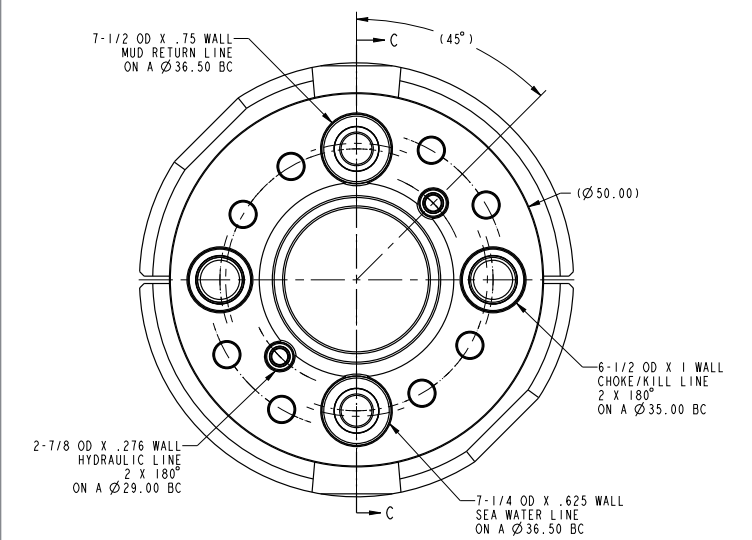
Technical Specifications	Flange Type-E (shown)	Flange Type-GB
Tension Load	2,000,000 lb.	3,000,000 lb.
Lengths	50 ft, 75ft	51 ft, 75ft
OD Pipe	21"	42"
Unique Configurations	4	4
Foot Lengths	5, 10, 15, 20, 25, 30, 35, 40, 50	5, 10, 20, 25, 30, 40, 75
Wall Thickness	5/8" and 11/16"	13/16", 7/8" and 15/16"
Line Configurations	3 Line (Choke, Kill, Booster) 4 Line (Choke, Kill, Booster, 1x Hydraulic) 5 Line (Choke, Kill, Booster (Upper), 2x Hydraulic) 5 Line (Choke, Kill, Booster (Lower), 2x Hydraulic)	4 Line (Choke, Kill, Booster, 1x Hydraulic) 5 Line (Choke, Kill, Booster, 2x Hydraulic)
Line Pressures and Sizes	Choke/Kill - 15K / 5"x3" Booster - 5K and 3K / 5"x4" (AISI Gr 4130 and ASTM A106 Gr C) Hydraulic - 5K and 3K / 2.5" Sch80 (316 Stainless and Duplex SS)"	Choke/Kill - 15K / 6.5"x4.5" Booster - 5K / 5"x4" Hydraulic - 5K / 2.5" Sch80 (Duplex SS)
Other	All lines are 60 degrees apart. All Flanges should have extra holes for lines.	All lines are 60 degrees apart. All Flanges should have extra holes for lines.

Flange Type-H™



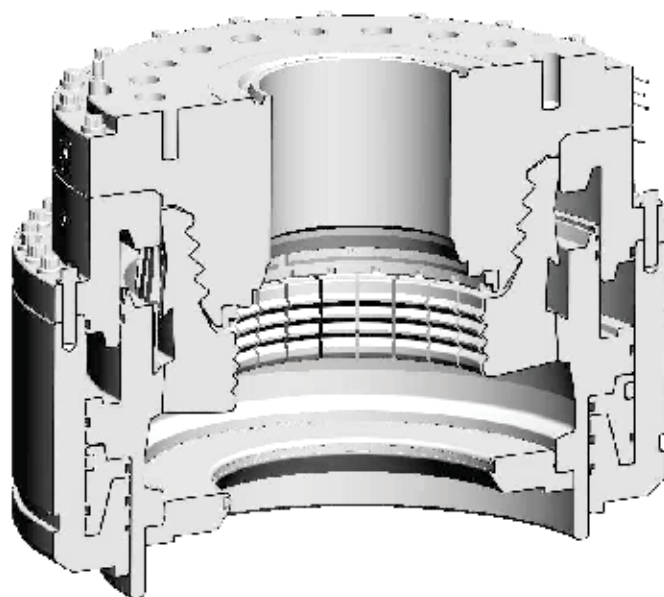
Technical Specifications	Flange Type-H (shown)	Flange Type-G	Flange Type-I
Tension Load	3,500,000 lb.	3,000,000 lb.	4,000,000 lb.
Lengths	75ft, 90ft	75ft, 90ft	75ft, 90ft
OD Pipe	21"	21"	21"
Unique Configurations	4	4	4
Foot Lengths	5, 10, 20, 25, 30, 40, 75, 90	5, 10, 20, 25, 30, 40, 75, 90	5, 10, 20, 25, 40, 90
Wall Thickness	3/4", 7/8" and 15/16"	13/16", 7/8" and 15/16"	13/16" and 15/16"
Flange Diameter(s)	46.50, same as FT-G *Some Flanges have a Glycol pocket between Hyds	46.5	47.13 All Flanges have a Glycol pocket between Hyds
Line Configurations	5 Line (Choke, Kill, Booster, 2x Hydraulic)	4 Line (Choke, Kill, Booster, 1x Hydraulic)	6 Line (Choke, Kill, Booster, 2x Hydraulic, Glycol)
Line Pressures and Sizes	Choke/Kill - 15K / 6.5"x4.5" Booster - 7.5K / 5"x4" Hydraulic - 5K / 2.5" Sch80 (Duplex SS)	Choke/Kill: 15K / 6.5"x4.5" Booster - 5K / 5"x4" Hydraulic - 5K / 2.5" Sch80 (Duplex SS)	Choke/Kill - 15K / 6.5"x4.5" Booster - 7.5K / 5"x4" Hydraulic - 5K / 2.5" Sch80 (Duplex SS) Glycol - 15K / 3"x2"
Other	All lines are 90 degrees apart. NO extra holes for extra lines in flange except hydraulic hole.	All lines are 90 degrees apart. NO extra holes for extra lines in flange except hydraulic hole.	All lines are 90 degrees apart. NO extra holes for extra lines in flange.

Flange Type-H DG™



Technical Specifications	FT-H DG (shown above)
Tension Load	3,500,000 lb.
Lengths	50ft, 75 ft
OD Pipe	21"
Unique Configurations	5
Foot Lengths	5, 10, 20, 25, 40, 90
Wall Thickness	7/8" and 15/16"
Flange Diameter(s)	50
Line Configurations	6 Line (Choke, Kill, Mud Return, Seawater, 2x Hydraulic)
Line Pressures and Sizes	Choke/Kill - 15K / 6.5"x4.5" Mud Return - 7.5K / 7.5"x6.0" Seawater Line - 7.5K / 7.25"x6.0" Hydraulic - 5K / 2.5" Sch80 (Duplex SS)
Other	All lines are 90 degrees apart with split hydraulic lines. NO extra holes for extra lines in flange

CHX WLHD Connector Overview



The CHX model connector is an industry leader in bending load capacity. Mechanical engagement of the unlocking piston to the finger segments, a 27% higher unlocking force to locking force, and a secondary unlocking piston ensures full release of the connector segments from the wellhead.

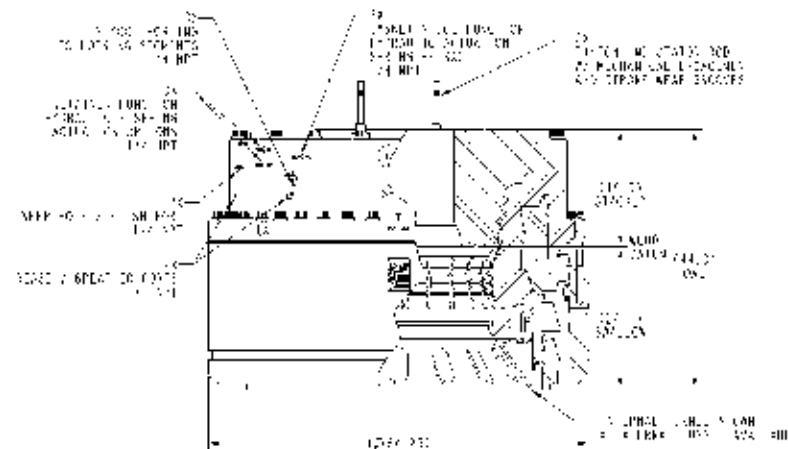
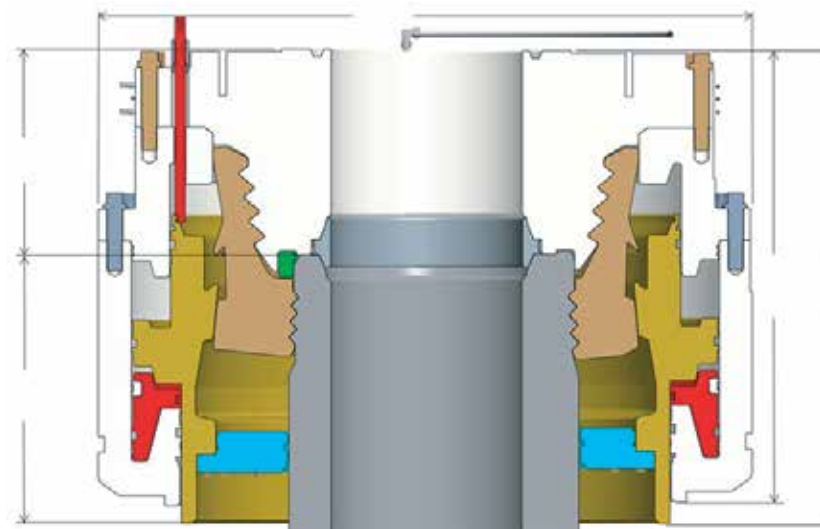
A wide variety of option features including top connection, gasket control features, porting types, and corrosion prevention measures, provide flexibility to meet customer satisfaction.

Standard Features

- Industry leading bending and tension capacity
- Unlock force 27% greater than locking force
- Load path directly through self locking segments
- Secondary unlocking piston for increased detachment reliability
- Two visual piston position indicator rods that engage with the annular piston to ensure an accurate reading. Both with life cycle grooves for easy connector life wear inspections
- Hydraulic and spring operated gasket retention pins
- Hydraulic gasket nudge pins
- Inconel inlay on all sealing surfaces
- Weep hole porting for quick testing validation
- ID running tool alignment slot
- Molded, bi-directional T seals with dual polyurethane back up extrusion protection
- Wear band protection against piston cylinder galling

Available Options

- CREP level packages
- Detachable WLHD funnel down assembly
- Various API top flange connections
- Multiple gasket control feature configurations
- Various hydraulic porting connection types
- Adapter kit which allows for a 27" H4 locking profile



Other Benefits

- 92% Surface coverage on locking profile allows for higher pre-load without damaging wellhead / mandrel
- Lead in alignment that eliminates potential gasket contact when landing on the wellhead
- Design flexibility with integrated stack controls

Design Validation Testing

- Sealing Mechanism (Wellbore Shell)
- Tension / Bending Capacity
- Seal Life Cycle Fatigue
- Piston Displacement
- Hub Separation
- Stack Pull (Gimbal) Simulation
- Vibration Simulation
- Locking Relationship Validation
- High & Low Temperature Testing
- Function Life Cycle Fatigue
- Friction Validation



Technical Specifications

Pure Bending Load Capacity	17.0 MM ft-lbs
Pure Tension Load Capacity	16.5 MM lbs
Preload	4.64MM lbs
Locking Volume	14.9 Gal
Unlocking Volume	18.9 Gal
Max Service Pressure	15,000 psi
Max Hydraulic Operating Pressure	3,000 psi
Stack Up Height	19.88 in
Swallow Height	26.37 in
Weight	24.700 lbs

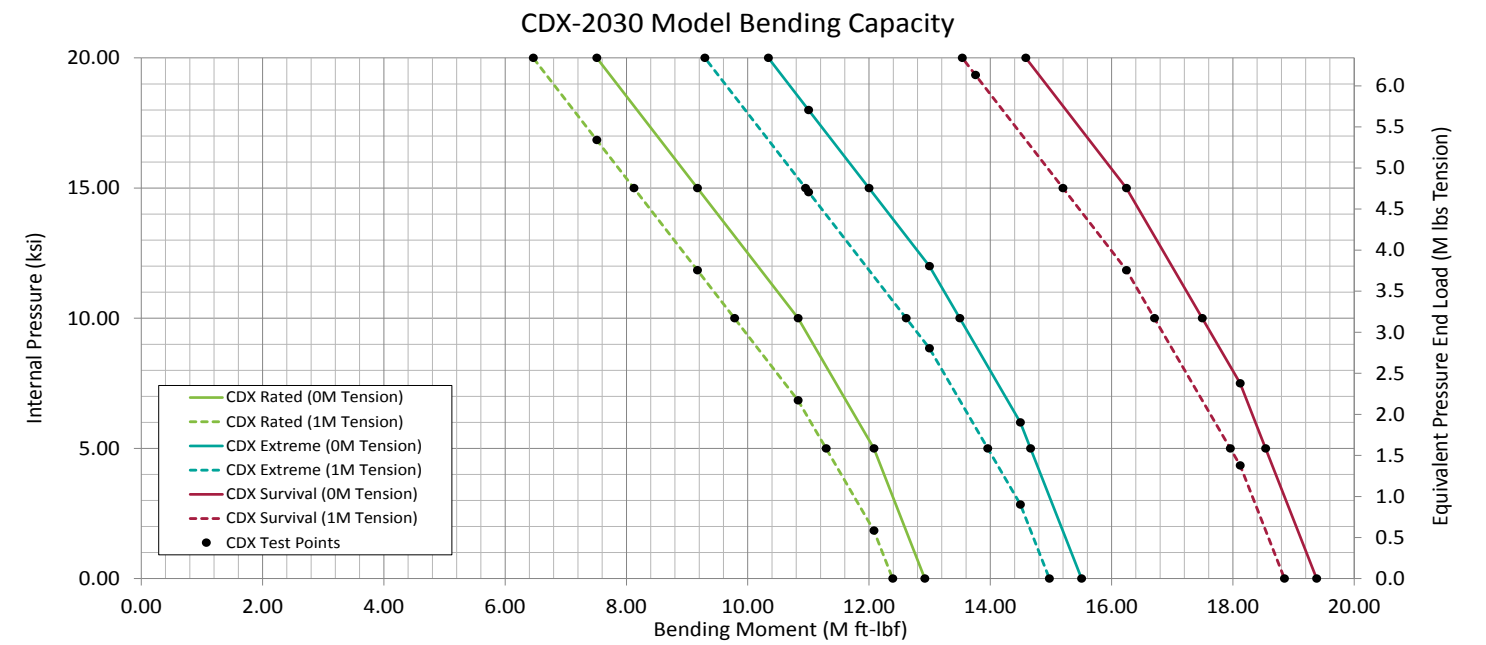
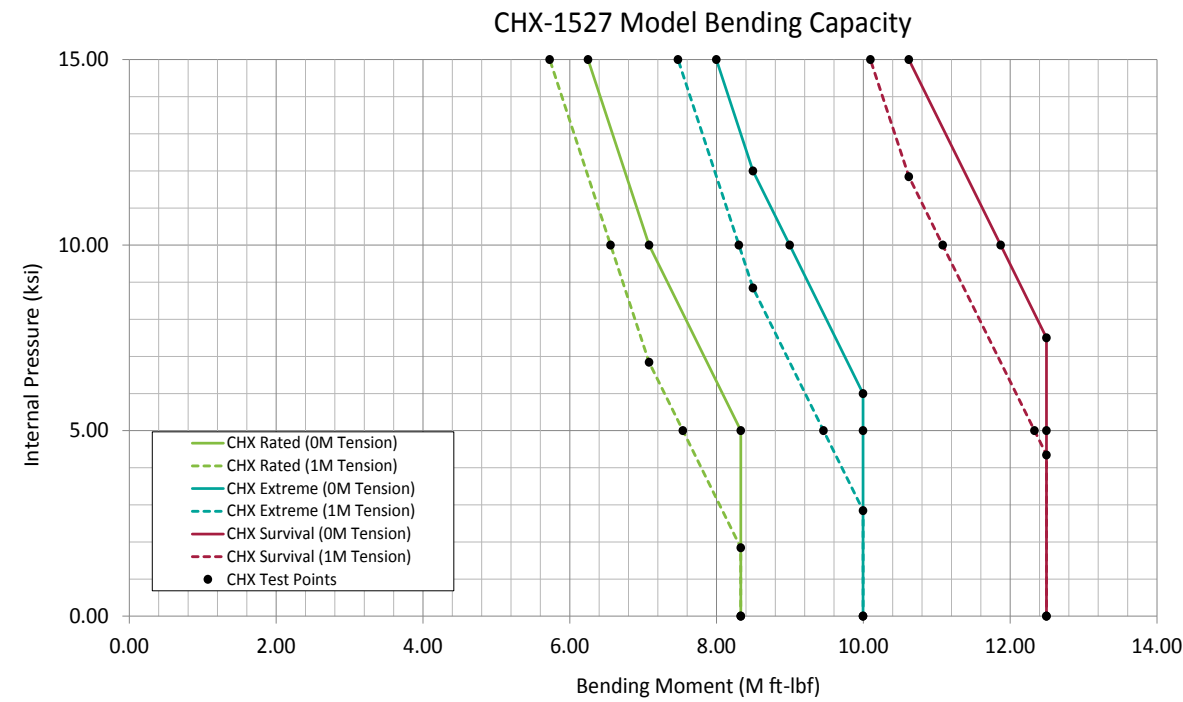
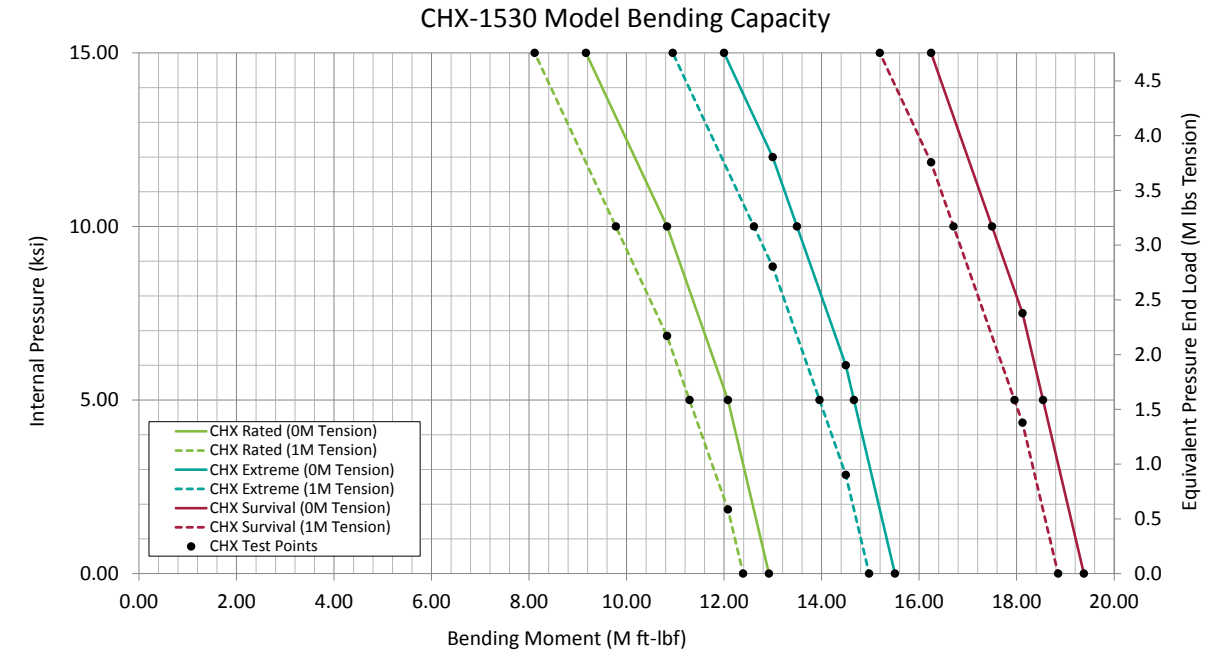
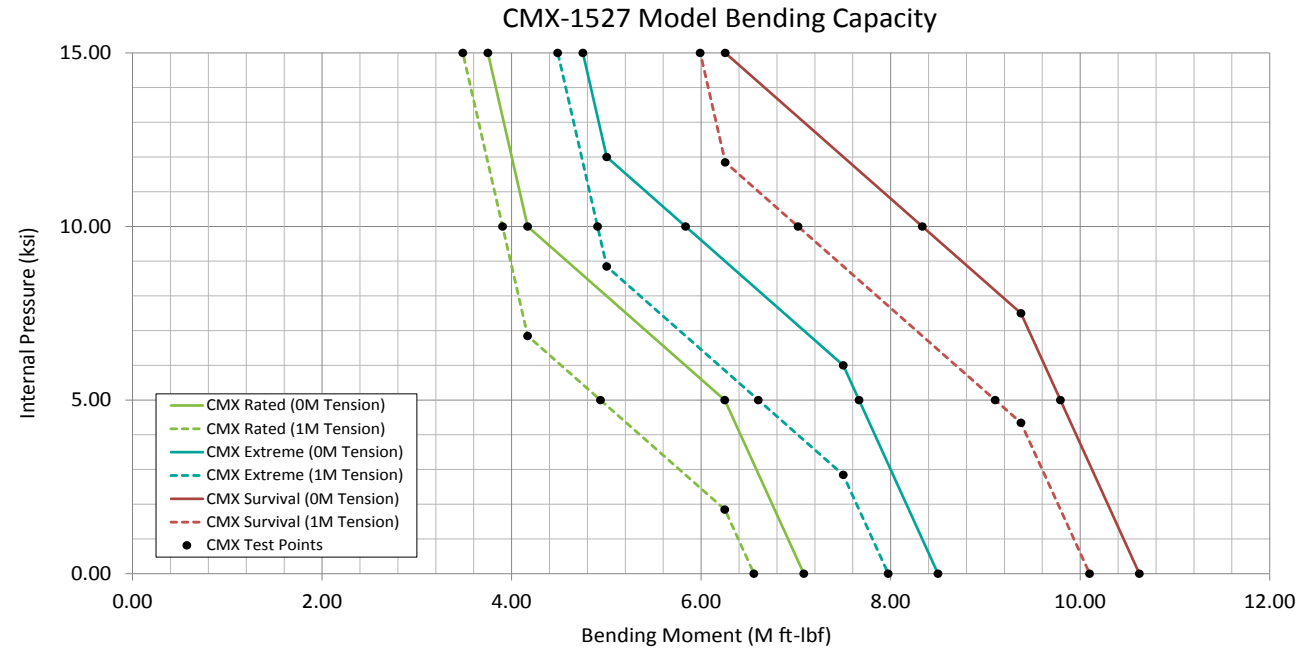
All values are preliminary and are subject to change. Full capacity values are based on FEA and will be confirmed with testing.



Low Temperature Test



Bending Test Fixture





The CMX-1527 connector includes a patent pending floating hydrate seal that allows for extreme angle lift off, while maintaining hydrate prevention during operation.

Mechanical engagement of the unlocking piston to the finger segments, a 43% higher unlocking force to locking force, and a secondary unlocking piston ensures full release of the connector segments from the mandrel or wellhead.

A wide variety of option features including top connection, gasket control features, porting types, and corrosion prevention measures, provide flexibility to meet customer satisfaction.

Standard Features:

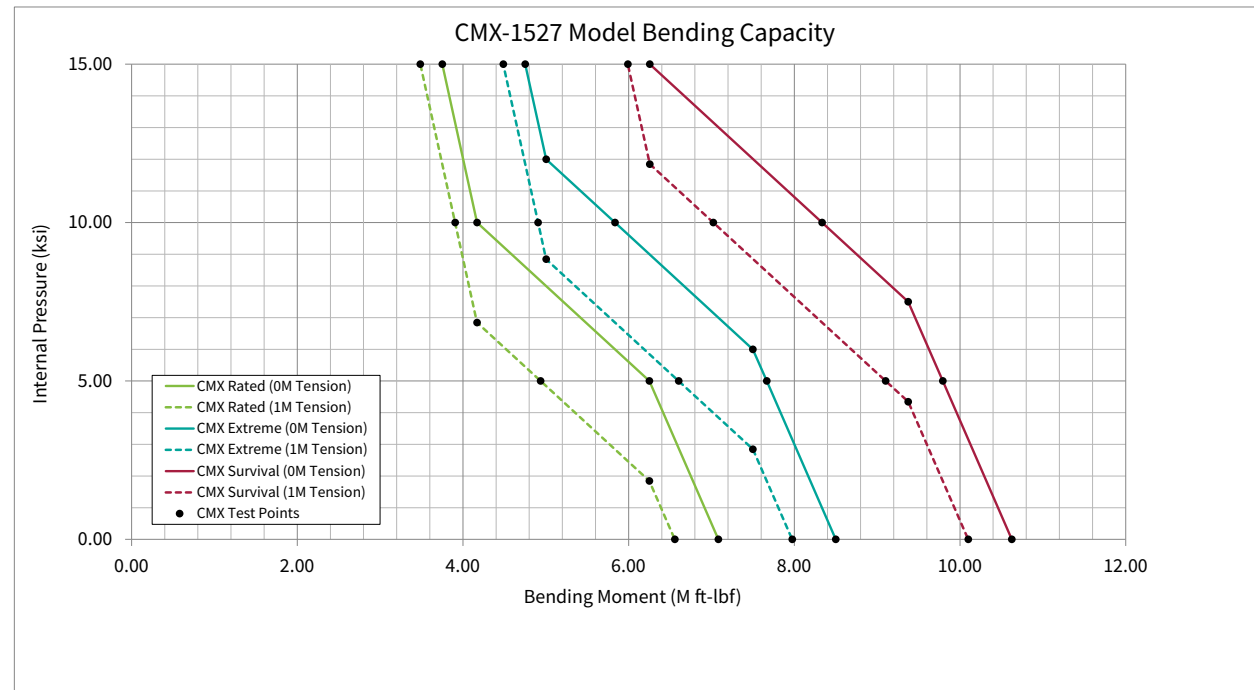
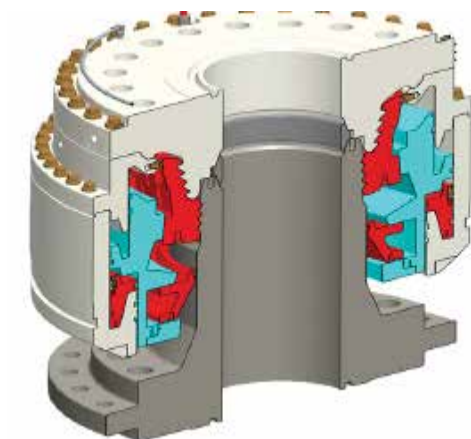
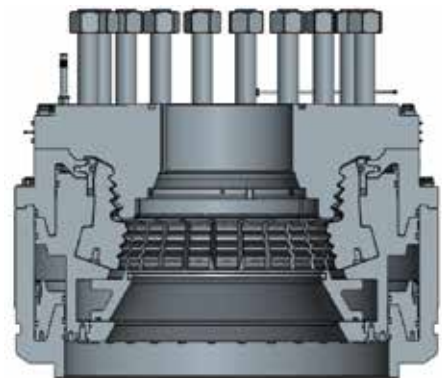
- High angle release capability:
 - Stationary upper support (patent pending)
 - Floating hydrate seal (patent pending)
- Competitive bending and tension capacity
- Unlock force 43% greater than locking force
- Load path directly through sel locking segments
- Two visual piston position indicator rods that engage with the annular piston to ensure an accurate rading. Both with life cycle grooves for easy connector life wear inspections.
- Hydraulic and spring operated gasket retention pins
- Weep hole porting for quick testing validation
- ID running tool alignment slot

Available Options:

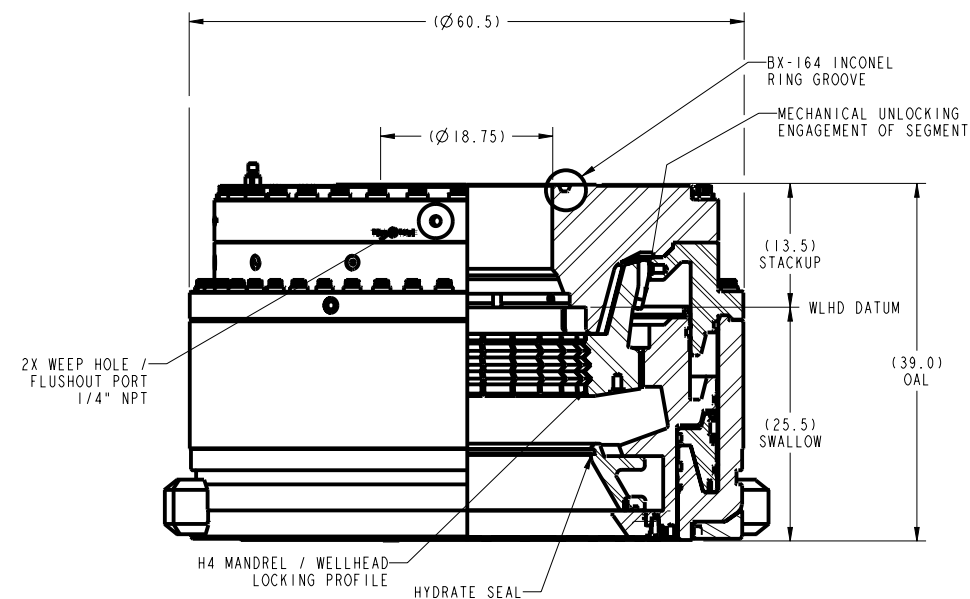
- CREP level packages
- Detachable LMRP alignment / WLHD funnel down assembly
- Various API top flange connections
- Multiple gasket control feature configurations
- Various hydraulic porting connection types

Benefits:

- Added HAR capability with floating hydrate seal design
- 92% Surface coverage on locking profile allows for higher pre-load without damaging wellhead/mandrel
- Lead in alignment that eliminates potential gasket contact when landing
- Design flexibility with integrated stack controls
- Improved delivery times



Technical Specifications	
Pure Bending Load Capacity	7.0 mm ft-lbs
Pure Tension Load Capacity	6.75 mm lbs
Preload	4.9mm lbs
Locking Volume	10.6 Gal
Unlocking Volume	15.4 Gal
Max Service Pressure	15,000 psi
Max Hydraulic Operating Pressure	3,000 psi
Stack Up Height	13.5 in.
Swallow Height	25.50 in.
Weight	20,300 lbs



Design Validation Testing:

- Sealing Mechanism (Wellbore Shell)
- Tension/Bending Capacity
- Seal Life Cycle Fatigue
- Piston Displacement
- Hub Separation
- Stack Pull (Gimbal) Simulation
- Vibration Simulation
- Locking Relationship Validation
- High & Low Temperature Testing
- Function Life Cycle Fatigue
- High Angle Release



Bending Test Fixture



Low Temperature Test



Locking Segment Coverage Shown in Unlocked Position

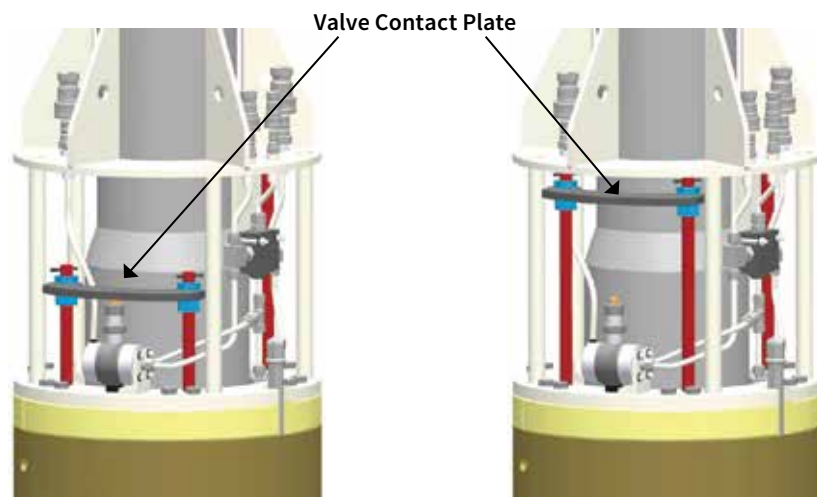
Type FT-H/FT-HB

The shuttle stack tool is used as a lifting tool for the riser string and BOP stack when the vessel needs to move a short distance. The shuttle stack tool is comprised of two main parts, the riser shuttle joint and the shuttle tool assembly. The riser shuttle joint is installed beneath the telescopic joint and functions as another joint of riser during normal operations. However, the riser shuttle joint has a large locking area in which the shuttle tool assembly's six lock dogs can engage.

Hydraulic Locking System

The Shuttle Tool hydraulic circuit is equipped with a pilot operated check valve. This allows the operator to first activate the pilot operated check valve before functioning the tool to the unlock position. This procedure prevents the Shuttle Tool from being inadvertently unlocked.

- Stab the shuttle tool pin into the riser shuttle joint box connection
- Apply 1500 psi hydraulic pressure to the shuttle tool's lock side hydraulic circuit



(Shown in Locked Position)

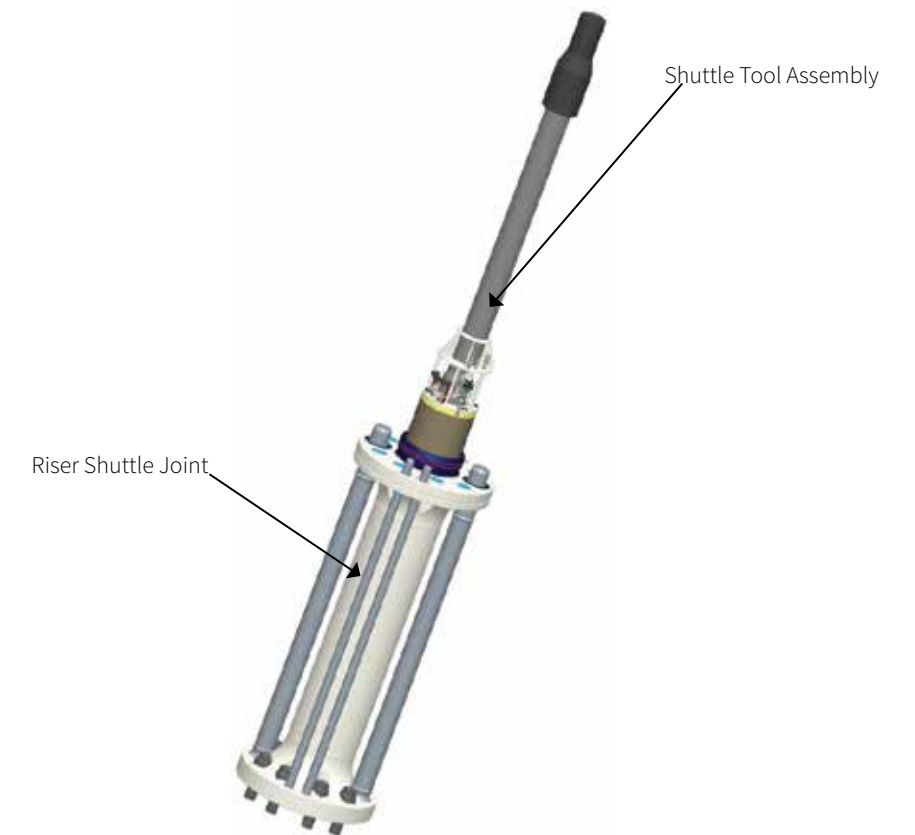
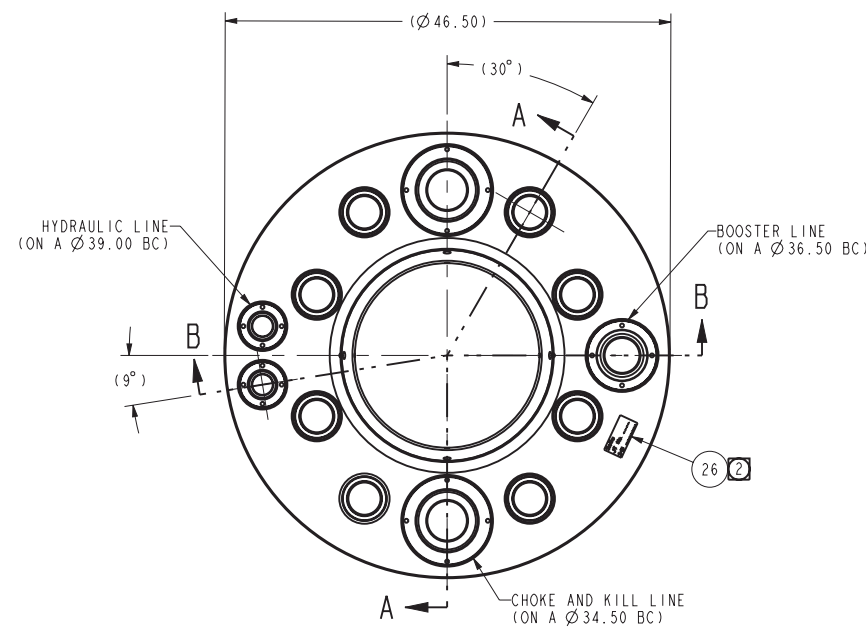
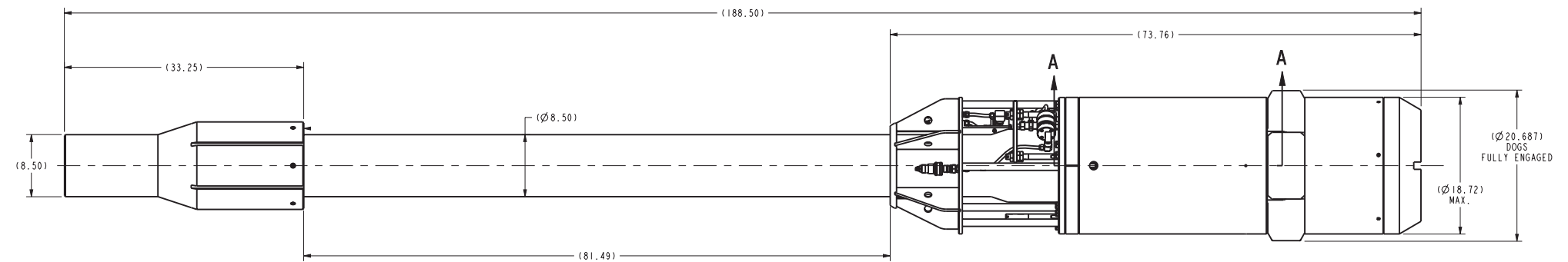
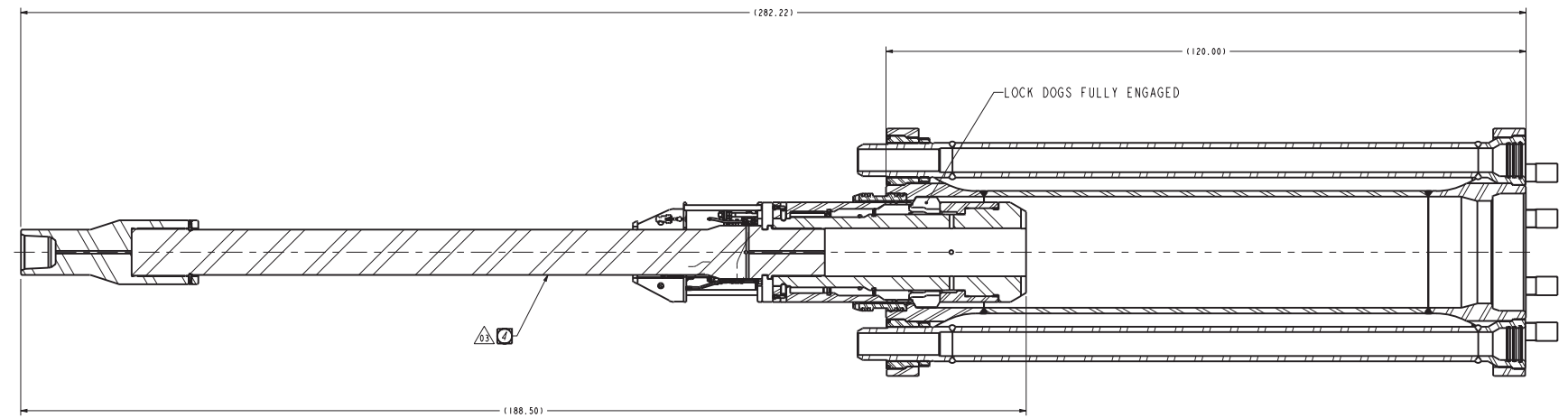
(Shown in Unlocked Position)

Shuttle Tool Uses

The Shuttle Tool does not carry over 500T.

- Re-landing the LMRP/BOP
- Move or reorient the BOP Stack
- Location Hopping for Short Distances
- Perhaps fully utilizing the Dual Activity Rigs

Technical Specifications	
Safe Working Load	500 Tons (454 Tonne)
Estimated Weight	15,034 lb. (6,819 kg.)
Weight: Riser Shuttle Joint Only	9,118 lb. (4,1365 Kg.)
Weight: Riser Shuttle Tool Only	5,916 lb. (2,683 Kg.)
Length: (whole Assembly)	23.42 ft. (7.14 m)
Length: Riser Shuttle Joint Only	10.5 ft. (3.2 m)
Length: Shuttle Tool Only	9.83 ft. (3 m)
Hydraulic Lock/Unlock:	1500 psi WP (103 Bar)
Operating Fluid	BOP Fluid or Hydraulic Oil



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