



VSI-X PACKER

4-1/2" X 1.900"

Manual No:
DL-601-4500-722

Revision: C

Revision Date:
04/19/2023

Authored by: D.Barlow

Approved by: K.Riggs

A) DESCRIPTION

The VSI-X Single String Double-Grip Production Packer is one of the most versatile packers on the market. This packer is a modification of the ASI-X Packer with the advantage of being able to set on electric line or hydraulically.

An On-Off Tool Stinger with a Wireline Plug installed can be attached to the top of this packer. This packer can then be lubricated in the hole and set under pressure. Once set, casing pressure can be bled off, and the tubing with an On-Off Tool Overshot can be run and latched onto the packer. The Wireline Plug can then be removed.

This packer easily converts to a mechanically set ASI-X Packer – just remove the shear screws and install drag blocks and drag block springs. The ASI-X Packer sets with 1/4 right-hand rotation and releases with 1/4 right-hand rotation. The ASI-X Packer can be left in tension, compression or neutral.

NOTE₁: Stinger and setting equipment must be purchased separately.

NOTE₂: This packer requires at least a 30 second burn on the wireline setting tool to ensure a proper set. A burn time less than 30 seconds may shear the setting tool from the packer before fully setting the packer.

B) RELATED TOOLS (sold separately)

B-1) 4-1/2" X 1.900" Wireline Adapter Kit (WLAK) (PN 97140)—refer to technical manual *DL-971-4500-744*.

B-2) 1.900" On/Off Tool and Stinger—refer to applicable technical manual.

C) SPECIFICATION GUIDE

CASING			TOOL		THREAD CONNECTION BOX UP / PIN DOWN	PART NUMBER
SIZE (INCHES)	WEIGHT (LBS/FT)	RECOMMENDED HOLE SIZE (INCHES)	GAGE OD (INCHES)	ID (INCHES)		
4-1/2	18.8	3.640	3.437	1.50	1.900 EUE	60142 60142H ¹ 60142V ² 60142C ³ 60142HC ⁴ 60142VC ⁵

Tool Options: ¹HSN, ²Viton, ³Nitrile, Carbide, ⁴HSN, Carbide, ⁵Viton, Carbide

NOTE₃: Use of a Double Hook J-slot Packer is recommended when running with a pumpjack to help prevent the packer from unsetting during well production.

NOTE₄: Tools listed are right-hand set / right-hand release.

DIFFERENTIAL PRESSURE (MAX)	TENSILE LOAD THRU TOOL (MAX)
7,000 PSI	35,000 LBS

D & L OIL TOOLS
P.O. BOX 52220 TULSA, OK 74152
PHONE: (800) 441-3504 www.dloilttools.com



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D) PRE-INSTALLATION INSPECTION PROCEDURES

CAUTION1: D&L ships tool connections made-up **HAND TIGHT**—labeled with hand-tight tape on the tool (Fig. 1)—unless stated otherwise. Tighten/torque all connections properly before operating tool.



Fig. 1

GENERAL THREAD CONNECTION TORQUE RECOMMENDATIONS			
STUB ACME / ACME THREADS	INTERNAL TAPERED TUBING THREADS		PREMIUM THREADS
	UP TO 2-3/8"	GREATER THAN 2-3/8"	
600 – 800 FT-LBS	600 – 800 FT-LBS	800 – 1,200 FT-LBS	Consult thread manufacturer's recommendations.

GENERAL SCREW TORQUE RECOMMENDATIONS									
SCREW SIZE (INCHES)	#6	#8	#10	1/4	5/16	3/8	7/16	1/2	5/8 and larger
TORQUE RANGE (INCH-POUNDS)	5 – 8	10 – 15	18 – 25	25 – 40	50 – 80	90 – 135	160 – 210	250 – 330	450 – 650

Before first use, D&L recommends disassembly and inspection of the tool unless stated otherwise. Ensure parts have not been damaged during shipping. Replace damaged parts with D&L replacement parts. Contact D&L sales for replacement part information.

Re-assemble the tool after inspection. Install parts in the correct order and orientation. Properly tighten connections.

Before re-using the tool, D&L recommends disassembly and inspection of the tool. Clean parts and ensure parts are in good working condition. Replace worn or damaged parts with D&L replacement parts.

When redressing the tool, D&L recommends replacement of all seals, elements, o-rings, shear screws, etc. Contact D&L sales for redress kit and/or other part information.

E) RELEASING PROCEDURES

Set down weight on the packer and rotate the work string 1/4 turn to the right at the packer and pick up while holding right-hand torque. The internal by-pass will open, allowing pressure to equalize. After pressure is equalized, continue to pick up to release the upper slips, relax the elements and release the lower slips.

CAUTION2: High differential pressure below the VSI-X Packer may cause the upper slips to wedge in tighter, requiring an extra amount of tension to release the upper slips.

E-1) EMERGENCY RELEASE

In the event, the packer will not release in the normal manner, hard right-hand torque can be applied (800-1000 ft-lbs) which will break the tack weld on the J-pin ring. Continued rotation of approximately 15 turns will release the J-pin ring and allow the packer to be pulled. When released in this manner, the packer will reset when moved down the hole.

F) STORAGE RECOMMENDATIONS

When preparing the tool for storage, follow the Pre-Installation Inspection Procedures. Re-assemble the tool with connections hand-tight only and in running position if applicable. Elements should be in a relaxed state—free from tension, compression, and other stresses that could cause deformation.

Store the tool, if possible, in an enclosed, temperature and humidity controlled environment. Avoid excessively high temperatures over long periods of time. Shield elastomeric parts from ultraviolet light sources. Keep tool dry and protected from condensation. Do not store in contact with or near volatile or corrosive chemicals. Do not store near ozone generating equipment or operations such as welding.



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G) PRESSURE AFFECTED AREA GUIDE

When set downhole, the packer mandrel is subjected to a force created by differential pressure above or below the packer that acts on the pressure affected area (i.e., the piston effect). Depending on the tubing size and weight and the seal area of the packer the force created by differential pressure acts upwards or downwards on the packer mandrel. An upward force, designated as a negative (-) value, acts to push the packer mandrel up hole and must be accounted for to ensure that the packer remains set. A downward force, designated as a positive value, acts to push the packer mandrel down hole and must be accounted for when releasing the packer. Other factors (e.g., tubing movement due to temperature change) must be considered separately to determine all the forces acting on the packer.

PACKER SIZE (INCHES)	TUBING SIZE (INCHES)	PRESSURE AFFECTED AREA (SQ. INCHES)	
		ABOVE	BELOW
4-1/2	1.900	0.066 (DOWN)	-0.865 (UP)
	2.375	-1.529 (UP)	0.225 (DOWN)

Example: Consider a 4-1/2" X 1.900" VSI-X Packer set on 1.900" tubing with a differential pressure of 3,000 PSI in the annulus around the tubing above the packer. What is the force acting on the seal area of the mandrel?

To calculate the force (lbs) acting on the seal area of the mandrel, refer to the Pressure Affected Area Guide for a 4-1/2" X 1.900" VSI-X Packer run on 2.375" tubing. In this example, the differential pressure from above the packer acts on the seal area of the packer mandrel across a pressure affected area of 0.066 in². Multiplying the differential pressure (3,000 PSI) by the pressure affected area (0.066 in²) results in a force of 198 lbs. The piston effect on the packer mandrel is a downward force of 198 lbs.

H) ELASTOMER TRIM TEMPERATURE GUIDE

NITRILE (STD)			
TEMPERATURE RANGE (F°)	DUROMETER		
	END	MIDDLE	END
40° - 125°	80	70	80
125° - 250°	90	70	90
150° - 250°	90	80	90
250° +	Contact D&L Sales		

RUBBER TYPE	TEMPERATURE RANGE
NITRILE	40° - 250°F
HSN (HNBR)	70° - 300°F
VITON	100° - 350°F

I) RECOMMENDED TOOLS

I-1) HAND TOOLS

- VISE
- GLOVES
- ALLEN WRENCHES
- TAPE MEASURE
- O-RING PICK
- BAR
 - 1/2-INCH
 - 3/4-INCH
- PAINT BRUSH, 2-INCH
- PIPE WRENCH, 3-FT (2 EA)
- "CHEATER" PIPE, 4-FT LONG
- ADJUSTABLE WRENCH, 12-INCH
- CORDLESS DRILL, 18V
- SNAP RING SPREADER PLIERS
- ALIGNING PUNCH
- SCREWDRIVER SET, FLAT-TIPPED
- SOCKET SETS
 - 3/8-INCH DRIVE
 - 1/2-INCH DRIVE
- HAMMERS
 - SLEDGE
 - BALL PEEN
 - DEAD BLOW

I-2) SPECIAL TOOLS

ITEM	QTY	DESCRIPTION	PART NUMBER
T1	1	ASSEMBLY TOOL FOR 4-1/2" - 7-5/8" VSI-XW PACKERS	AT100



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J) DISASSEMBLY

J-1) Clamp spring cage (5) in vise.

J-1.1) Unscrew and remove shear screws (3) from J-body (20).

J-1.2) Unscrew and remove set screws (26) from J-pin bottom sub (23). Move J-body (20) as needed for access to set screws (26).

J-1.3) Unscrew and remove J-pin bottom sub (23) from inner mandrel (2).

NOTE5: Drag block body assembly must be free to rotate.

J-1.3.1) Remove o-ring (29) from J-pin bottom sub (23).

J-1.4) Unscrew and remove set screws (22) from J-body (20).

J-1.5) Unscrew and remove J-body (20) from drag block body (18) (**NOTE6:** Left-hand threads).

J-1.6) Remove drag block retainer (21) from drag block body (18).

J-1.7) Unscrew and remove rubber mandrel cap (19) from rubber mandrel (11).

NOTE7: For added leverage, insert a rod through rubber retainer (15) and rubber mandrel (11) as needed.

J-1.8) Wedge lower slips (17) outwards (if needed). Remove drag block assembly and disassemble:

J-1.8.1) Remove wedges (if needed). Remove lower slips (17) and lower slip springs (25) from drag block body (18).

J-1.9) Unscrew and remove lower cone (16) from rubber retainer (15).

J-1.10) Unscrew rubber mandrel (11) from center coupling (10).

NOTE8: For added leverage, insert a rod through upper cone (9) as needed.

J-1.11) Remove rubber mandrel assembly from inner mandrel (2) and disassemble:

J-1.11.1) Remove elements (13, 14), rubber spacers (12), and rubber retainer (15) from rubber mandrel (11).

J-1.12) Unscrew and remove center coupling (10) from upper cone (9).

J-1.12.1) Remove o-ring (30) and bonded seal (24) from center coupling (10).

J-1.12.1.1) Remove o-ring (28) from bonded seal (24).

J-1.13) Remove upper cone (9) from inner mandrel (2).

J-1.14) Wedge slips (7, 8) outwards (if needed). Unscrew and remove inner mandrel (2) from top sub (1).

J-1.15) Remove wedges (if needed) and remove releasing slip (7), upper slips (8) and upper slip springs (25) from spring cage (5).

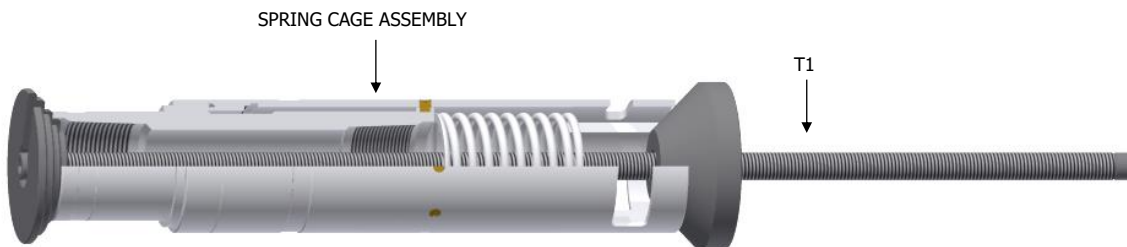


Fig. 2

J-1.16) Disassemble spring cage assembly:

J-1.16.1) Position assembly tool (T1) hand-tight against top sub (1) and spring cage (5) of spring cage assembly (Fig. 2).

CAUTION3: Compression spring (4) is compressed with tension against spring cage assembly.

J-1.16.2) Unscrew and remove shear screws (31) from spring cage (5).

J-1.16.3) Unscrew spring cage cap (27) from spring cage (5).



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J) DISASSEMBLY (cont'd)

J-1.16.4) Release compression spring (4) tension by loosening assembly tool (T1). Remove assembly tool (T1).

J-1.16.5) Remove spring cage cap (27), top sub (1), compression spring (4) and spring retaining ring (6) from spring cage (5).

J-2) Unclamp and remove spring cage (5) from vise.

K) ASSEMBLY

NOTE₉: Clean and inspect all parts. Replace all worn and damaged parts. Install parts in proper order, and orientation and tighten/torque all connections properly.

CAUTION₄: To ensure tool operates properly, install o-rings in o-ring grooves **NOT** thread reliefs (Fig. 3).

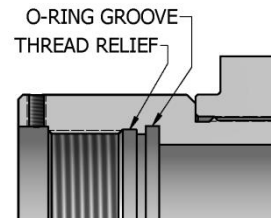


Fig. 3

K-1) Clamp spring cage (5) in vise.

CAUTION₅: Do **NOT** wrench or clamp on seal surface.

K-1.1) Assemble spring cage assembly:

K-1.1.1) Install spring retaining ring (6), compression spring (4), and top sub (1) into spring cage (5).

K-1.1.2) Screw spring cage cap (27) into spring cage (5).

NOTE₁₀: Press down top sub (1) to compress compression spring (4) as necessary.

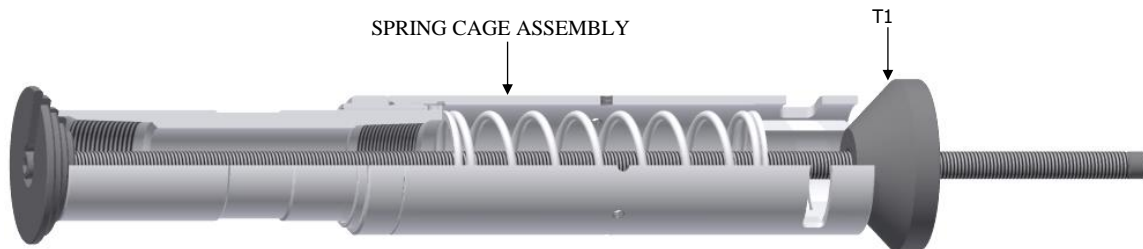


Fig. 4

K-1.1.3) Compress compression spring (4) with assembly tool (T1) (Fig. 4).

K-1.1.4) Align threaded holes in spring cage (5) with pocket holes in top sub (1). Screw shear screws (31) into spring cage (5). Tighten until shear screws (31) contact top sub (1). Back out 1/4 turn.

K-1.1.5) Remove assembly tool (T-1) from spring cage assembly.

CAUTION₃: Compression spring (4) is compressed with tension against spring cage assembly.

K-1.1.6) Install upper slips (8), releasing slip (7) and upper slip springs (25) into spring cage (5). Wedge releasing slip (7) and upper slips (8) outwards.

NOTE₁₁: Install one (1 ea) spring per slip (Fig. 5).

K-1.2) Screw inner mandrel (2) into top sub (1). Remove wedges.

K-1.3) Install upper cone (9) onto inner mandrel (2).

K-1.4) Install o-ring (30) in groove in center coupling (10).

K-1.5) Install o-ring (28) in groove in bonded seal (24).

K-1.6) Install bonded seal (24) in center coupling (10).

CAUTION₆: Do not rip or tear o-ring during installation.

K-1.7) Screw center coupling (10) onto upper cone (9).

NOTE₈: For added leverage, insert a rod through upper cone (9) as needed.

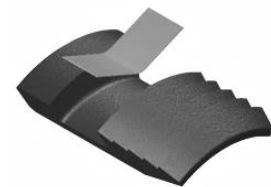


Fig. 5



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K) ASSEMBLY (cont'd)

K-1.8) Assemble rubber mandrel assembly:

K-1.8.1) Install rubber retainer (15), elements (13, 14), and rubber spacers (12) onto rubber mandrel (11).

K-1.8.2) Install rubber mandrel assembly onto inner mandrel (2) and screw rubber mandrel (11) into center coupling (10).

CAUTION₆: Do not rip or tear o-ring during installation.

K-1.9) Screw lower cone (16) into rubber retainer (15).

K-1.10) Assemble drag block body assembly and install:

K-1.10.1) Install lower slips (17) and lower slip springs (25) into drag block body (18).

NOTE₁₂: Install one (1ea) spring per slip (Fig. 6).

K-1.10.2) Wedge lower slips (17) outwards. Install drag block body assembly onto rubber mandrel (11) and remove wedges.

K-1.11) Screw rubber mandrel cap (19) onto rubber mandrel (11).

NOTE₈: For added leverage, insert a rod through rubber retainer (15) and rubber mandrel (11) as needed.

K-1.12) Install drag block retainer (21) on drag block body (18).

K-1.13) Screw J-body (20) onto drag block body (18) (**NOTE₆:** Left-hand threads).

K-1.14) Align threaded holes in J-body (20) with groove in drag block body (18). Screw set screws (22) into J-body (20).

K-1.15) Install o-ring (29) into groove in J-pin bottom sub (23).

K-1.16) Screw J-pin bottom sub (23) onto inner mandrel (2).

CAUTION₆: Do not rip or tear o-ring during installation.

NOTE₅: Drag block body assembly must be free to rotate.

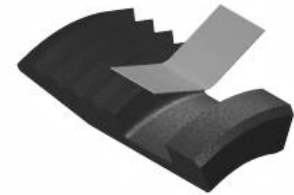


Fig. 6



Fig. 7

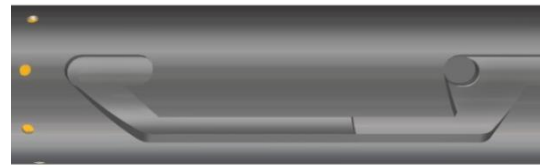


Fig. 8

K-1.17) Rotate J-body (20) as needed to position J-pin of J-pin bottom sub (23) along J-slot to access threaded holes (Fig. 7). Screw set screws (26) into J-pin bottom sub (23).

K-1.18) Position J-pin of J-pin bottom sub (23) on tension shoulder in J-slot of J-body (20) (Fig. 8).

K-1.19) Align threaded holes in J-body (20) with pocket holes in rubber mandrel cap (19). For added leverage, wrench on rubber retainer (15) as needed to properly align threaded holes.

K-1.20) Screw shear screws (3) into J-body (20). Tighten until shear screws (3) contact rubber mandrel cap (19). Back shear screws (3) out 1/4 turn.

K-2) Unclamp spring cage (5) from vise and remove assembled tool.



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L) PARTS LIST

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60142
1	1	TOP SUB	DLMS60	60140610
2	1	INNER MANDREL	DLMS80	60142210
3	6	SHEAR SCREW (2375#)	DLM360BRS	60100990
4	1	COMPRESSION SPRING	DLMCRSP	60340920
5	1	SPRING CAGE	DLMS60	60142326
6	1	SPRING RETAINING RING	DLMS60	60040820
7	1	RELEASING SLIP	DLMS110	60042125
8	2	UPPER SLIP	DLMS35	60042115
9	1	UPPER CONE	DLMS60	60040410
10	1	CENTER COUPLING	DLMS60	60242620
11	1	RUBBER MANDREL	DLMS60	60340220
12	2	RUBBER SPACER	DLMS60	60242840
13	1	ELEMENT	70 DURO NITRILE	60242511
14	2	ELEMENT	90 DURO NITRILE	60242513
15	1	RUBBER RETAINER	DLMS60	60242850
16	1	LOWER CONE	DLMS60	60040420
17	4	LOWER SLIP	DLMS35	60042135
18	1	DRAG BLOCK BODY	DLMS60	60042336
19	1	RUBBER MANDREL CAP	DLMS60	60140230
20	1	J-BODY	DLMS60	60142340
21	1	DRAG BLOCK RETAINER	DLMS60	60042910
22	4	1/4-20 UNC X 1/4 SOCKET SET SCREW	STEEL	SSS025C025
23	1	J-PIN SUB	DLMS110 / DLMS60	60340650
24	1	BONDED SEAL	DLMS60 / 90 DURO NITRILE	60040520
25	7	SLIP SPRING	-	7145900
26	2	1/4-20 UNC X 5/16 SOCKET SET SCREW	STEEL	SSS025C031
27	1	SPRING CAGE CAP	DLMS60	60140810
28	1	140-90 O-RING	90 DURO NITRILE	90140
29	1	224-90 O-RING	90 DURO NITRILE	90224
30	1	227-90 O-RING	90 DURO NITRILE	90227
31	6	SHEAR SCREW (2375#)	DLM360BRS	90555990
32	6	7/16-20 UNF X 1/2 SLOTTED SHEAR SCREW (5000#)	DLM360BRS	BSSSLT043F050*

*Refer to WLAK technical illustration for placement

REDRESS KIT (RDK)		60142050
ASSEMBLED WEIGHT		85 LBS



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L-1) ELASTOMER TRIM OPTIONS

NOTE₁₃: For temperature range, refer to Elastomer Trim Temperature Guide.

L-1.1) HSN

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60142H
13	1	ELEMENT	70 DURO HSN	60242511H
14	2	ELEMENT	90 DURO HSN	602422513H
24	1	BONDED SEAL	90 DURO HSN	60040520H
28	1	140 O-RING	90 DURO HSN	90140H
29	1	224 O-RING	90 DURO HSN	90224H
30	1	227 O-RING	90 DURO HSN	90227H

REDRESS KIT (RDK)		60142050H
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L-1.2) VITON

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60142V
13	1	ELEMENT	70 DURO VITON	60240511V
14	2	ELEMENT	90 DURO VITON	60240513V
24	1	BONDED SEAL	90 DURO VITON	60040520V
28	1	140 O-RING	90 DURO VITON	90140V
29	1	224 O-RING	90 DURO VITON	90224V
30	1	227 O-RING	90 DURO VITON	90227V

REDRESS KIT (RDK)		60142050V
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L-2) CARBIDE OPTIONS

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60142C
8	2	CARBIDE UPPER SLIP	DLMS110	60042115C
17	4	CARBIDE LOWER SLIP	DLMS110	60042135C



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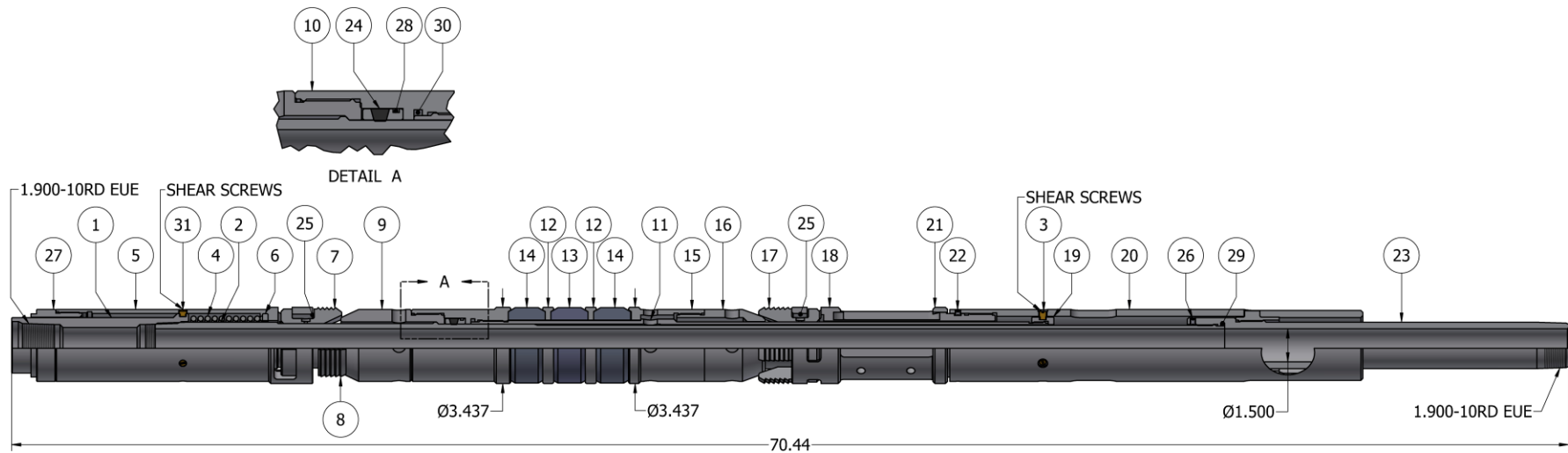
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M) TECHNICAL ILLUSTRATION



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N) REVISION HISTORY

DATE	REVISION	DESCRIPTION OF CHANGES	REVISED BY	APPROVED BY
04/19/2023	C	Added carbide options; Revised pressure affected area, 60142326 was 60145325, 60042336 was 60042335, 7145900 was 7045900	J.Anderson	E.Visaez
12/14/2018	B	Added General Screw Torque Recommendations; Revised P/N BSSSLT043F050 shear value was 4,300 lbs, Elastomer Trim Temp. Guide nitrile temp. rating	J.Anderson	J.Johnson
07/30/14	A	Created manual	-	-