



VSI-X PACKER

5-1/2" X 2-7/8" W/ ECNER, CARBIDE

Manual No:
DL-601-5500-851

Revision: **E**

Revision Date:
08/16/2019

Authored by: J.Anderson

Approved by: J.McArthur

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: 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.

NOTE2: Stinger and Wireline Adapter Kit (WLAK) sold separately.

B) RELATED TOOLS (sold separately)

B-1) 5-1/2 X 2-7/8" Wireline Adapter Kit (WLAK) (PN 97151)—refer to technical manual *DL-971-5500-631*.

B-2) 2-7/8" DT-2 On/Off Tool and Stinger—refer to technical manual *DL-512-2875-146*.

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)	NOMINAL ID (INCHES)		
5-1/2	23.0 – 26.0	4.548 – 4.670	4.406	2.38	2-7/8 EUE	60151BHC

NOTE3: Tools listed are right-hand set / right-hand release.

NOTE4: 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.

DIFFERENTIAL PRESSURE (MAX)	TENSILE LOAD THRU TOOL (MAX)
7,000 PSI	84,000 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 replacement part information.

E) RELEASING PROCEDURES

CAUTION₆: Packers with ECNER packing elements are single-use tools and must be redressed following initial set.

Set down weight on the packer. 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.

CAUTION₃: 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

If the packer will not release in the normal manner, apply hard right-hand torque (800-1,000 ft-lbs) to break the tack weld on the J-pin ring. Rotate the work string to the right approximately 15 turns to release the J-pin ring and retrieve the packer. 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 or other 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 when releasing the packer. 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 (IN ²)	
		ABOVE	BELOW
5-1/2	2.375	2.06 (DOWN)	-3.37 (UP)
	2.875	0 (DOWN)	-1.81 (UP)

Example: Consider a 5-1/2" VSI-X Packer set on 2.375" 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 5-1/2" 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 2.06 in². Multiplying the differential pressure (3,000 PSI) by the pressure affected area (2.06 in²) results in a force of 6,180 lbs. The piston effect on the packer mandrel is a downward force of 6,180 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



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I) RECOMMENDED TOOLS (cont'd)

I-2) SPECIAL TOOLS

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

J) DISASSEMBLY

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

J-1.1) Unscrew and remove shear screws (12) from J-body (20).

J-1.2) Unscrew and remove set screws (6) from bottom sub (28). Move J-body (20) as needed for access to set screws (6).

J-1.3) Unscrew and remove bottom sub (28) from inner mandrel (2).

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

J-1.3.1) Remove o-ring (30) from bottom sub (28).

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) 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-1.7) Remove drag block retainer (21) from drag block body (18).

J-1.8) Wedge lower slips (17) outwards (if needed). Remove drag block body 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).

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

J-1.11.1) Remove element (13) 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 seal (24) and o-ring (31) from center coupling (10).

J-1.13) Remove bearing bushing (14) and upper cone (9) from inner mandrel (2).

J-1.14) Unscrew and remove cap screws (29) from spring cage (5).

J-1.15) Wedge slips (7, 8) outwards (if needed). Unscrew and remove inner mandrel (2) from top sub (1).

J-1.16) Remove wedges (if needed). Remove releasing slip (7), upper slips (8) and upper slip springs (26) from spring cage (5).



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J) DISASSEMBLY (cont'd)

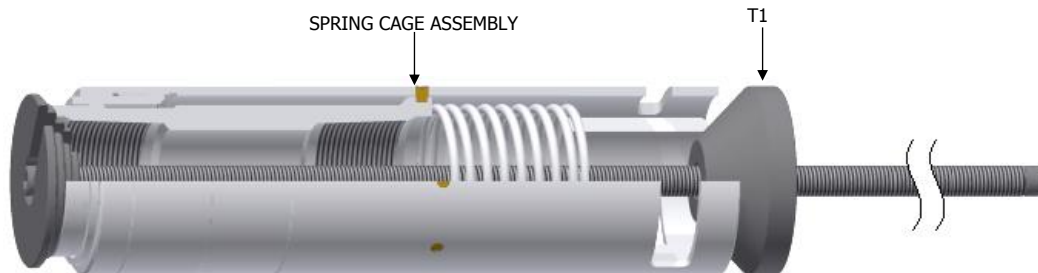


Fig. 2

J-1.17) Disassemble spring cage assembly:

J-1.17.1) Position assembly tool (T1) hand-tight against top sub (1) and spring cage (5) of spring cage assembly (Fig. 2).

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

J-1.17.2) Unscrew and remove shear screws (3) from spring cage (5).

J-1.17.3) Release compression spring (4) tension by loosening assembly tool (T1) until enough space exists between stepped cone of assembly tool (T1) and spring cage cap (27) for spring cage cap (27) to be unscrewed from spring cage (5).

J-1.17.4) Unscrew spring cage cap (27) from spring cage (5).

J-1.17.5) Release remaining compression spring (4) tension by loosening assembly tool (T1). Remove tool from assembly.

J-1.17.6) Remove spring cage cap (27), top sub (1), and compression spring (4) from spring cage (5).

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

K) ASSEMBLY

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

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

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

K-1.1) Assemble spring cage assembly:

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

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

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

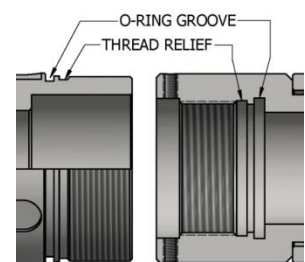


Fig. 3



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K) ASSEMBLY (cont'd)

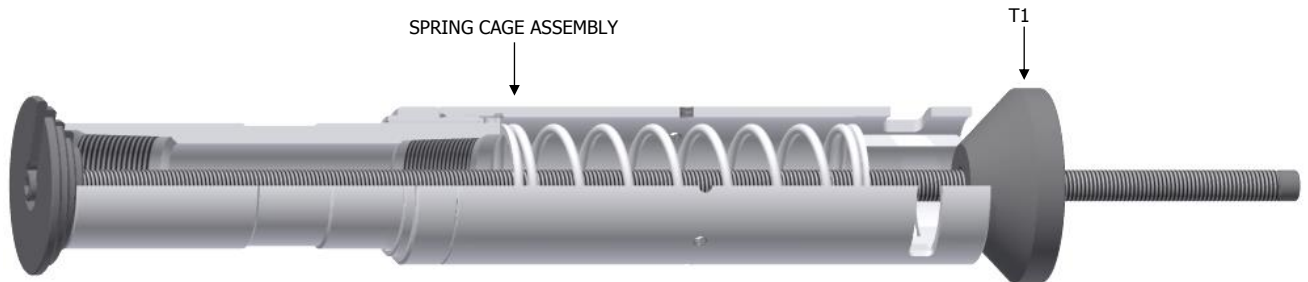


Fig. 4

K-1.1.3) Compress spring cage assembly 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 (3) into spring cage (5). Tighten until shear screws contact top sub. Back shear screws out 1/4 turn.

K-1.1.5) Remove assembly tool (T1) from spring cage assembly.

CAUTION₂: 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 (26) into spring cage (5). Wedge releasing slip (7) and upper slips (8) outwards.

NOTE₁₀: Install two (2ea) springs per slip (Fig. 5).

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

K-1.3) Screw cap screws (29) into spring cage (5).

K-1.4) Install upper cone (9) and bearing bushing (14) onto lower end of inner mandrel (2). Slide upper cone and bearing bushing together up inner mandrel until the flange of bearing bushing contacts shoulder of inner mandrel.

K-1.5) Install seal (24) into center coupling (10).

CAUTION₄: Do not rip or tear o-ring during installation.

K-1.6) Install o-ring (31) into center coupling (10).

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

NOTE₁₁: Do NOT tighten center coupling (10) onto upper cone (9). Leave connection loose until tool is pinned.

K-1.8) Assemble rubber mandrel assembly and install:

K-1.8.1) Install rubber retainer (15) and element (13) onto rubber mandrel (11).

K-1.8.2) Install rubber mandrel assembly onto inner mandrel (2).

K-1.8.3) Screw rubber mandrel (11) into center coupling (10).

CAUTION₄: 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). Wedge lower slips (17) outwards.

NOTE₁₀: Install two (2ea) springs per slip (Fig. 6).

K-1.10.2) Install drag block body assembly onto rubber mandrel (11). Remove wedges.

K-1.11) Install drag block retainer (21) onto drag block body (18).

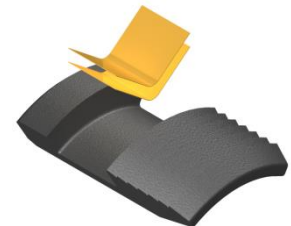


Fig. 5

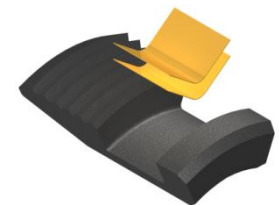


Fig. 6



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K) ASSEMBLY (cont'd)

K-1.12) Screw rubber mandrel cap (19) onto rubber mandrel (11).

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

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 (30) in o-ring groove in bottom sub (28).

K-1.16) Screw bottom sub (28) onto inner mandrel (2).

CAUTION4: Do not rip or tear o-ring during installation.

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

K-1.17) Align threaded holes in bottom sub (28) with groove in inner mandrel (2). Screw set screws (6) into bottom sub (28). Move J-body (20) as needed to access bottom sub (28) threaded holes.

Fig. 7



K-1.18) Position J-pin of bottom sub (28) on tension shoulder in J-slot of J-body (20). Rotate J-body (20) as necessary (Fig. 7).

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

K-1.19) Align threaded holes in J-body (20) with pocket holes in rubber mandrel cap (19). Screw shear screws (12) into J-body (20). Tighten until shear screws contact rubber mandrel cap. Back shear screws out 1/4 turn.

K-1.20) Tighten center coupling (10) upper cone (9) connection.

K-2) Unclamp top sub (1) from vise and remove assembled tool.

L) PARTS LIST

ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER
1	1	TOP SUB	DLMS80	60156610
2	1	INNER MANDREL	DLMS41X80	60351210HT
3	8	SHEAR SCREW (2375#)	DLM360BRS	90555990
4	1	COMPRESSION SPRING	DLMCRSP	60356920
5	1	SPRING CAGE BODY	DLMS110	60151325
6	2	SOCKET SET SCREW 1/4-20 UNC X 3/8	STEEL	SSS025C037
7	1	RELEASING SLIP	DLMS110	60056125
8	2	UPPER SLIP W/ CARBIDE	DLMS110	60056115C
9	1	UPPER CONE	DLMS110	60351410
10	1	CENTER COUPLING	DLMS80	60051620B
11	1	RUBBER MANDREL	DLMS110	60051220ECNER
12	8	SHEAR SCREW (2375#)	DLM360BRS	60100990



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L) PARTS LIST (cont'd)

ITEM	QTY	DESCRIPTION	MATERIAL	PART NUMBER
13	1	5-1/2" (17-23#) ECNER ELEMENT ARRAY	80 DURO HSN	OEM56BH
14	1	BEARING BUSHING	DLMS60	60056224
15	1	RUBBER RETAINER	DLMS60	60251850B
16	1	LOWER CONE	DLMS110	60051420
17	4	LOWER SLIP W/ CARBIDE	DLMS110	60056135C
18	1	DRAG BLOCK BODY	DLMS60	60051335
19	1	RUBBER MANDREL CAP	DLMS60	60156230
20	1	J-BODY	DLMS60	60151340
21	1	DRAG BLOCK RETAINER	DLMS60	60051910
22	3	SOCKET SET SCREW 5/16-18 UNC X 5/16	STEEL	SSS031C031
23	8	SLOTTED SHEAR SCREW (5500#) 1/2-13 UNC X 7/16	DLM360BRS	BSSSLT050C043*
24	1	DUAL PACK SEAL	90 DURO HSN	60056520BH
25	8	LOWER SLIP SPRING	-	7155901
26	6	UPPER SLIP SPRING	-	7155902
27	1	SPRING CAGE CAP	DLMS60	60151810
28	1	BOTTOM SUB	DLMS110 / DLMS60	60051650
29	3	SOCKET CAP SCREW 1/4-20 UNC X 1/2	STEEL	SCS025C050
30	1	231 O-RING	90 DURO HSN	90231H
31	1	235 O-RING	90 DURO HSN	90235H

*Refer to WLAK technical manual for placement.

REDRESS KIT (RDK)		60151050BH
ASSEMBLED WEIGHT		160 LBS



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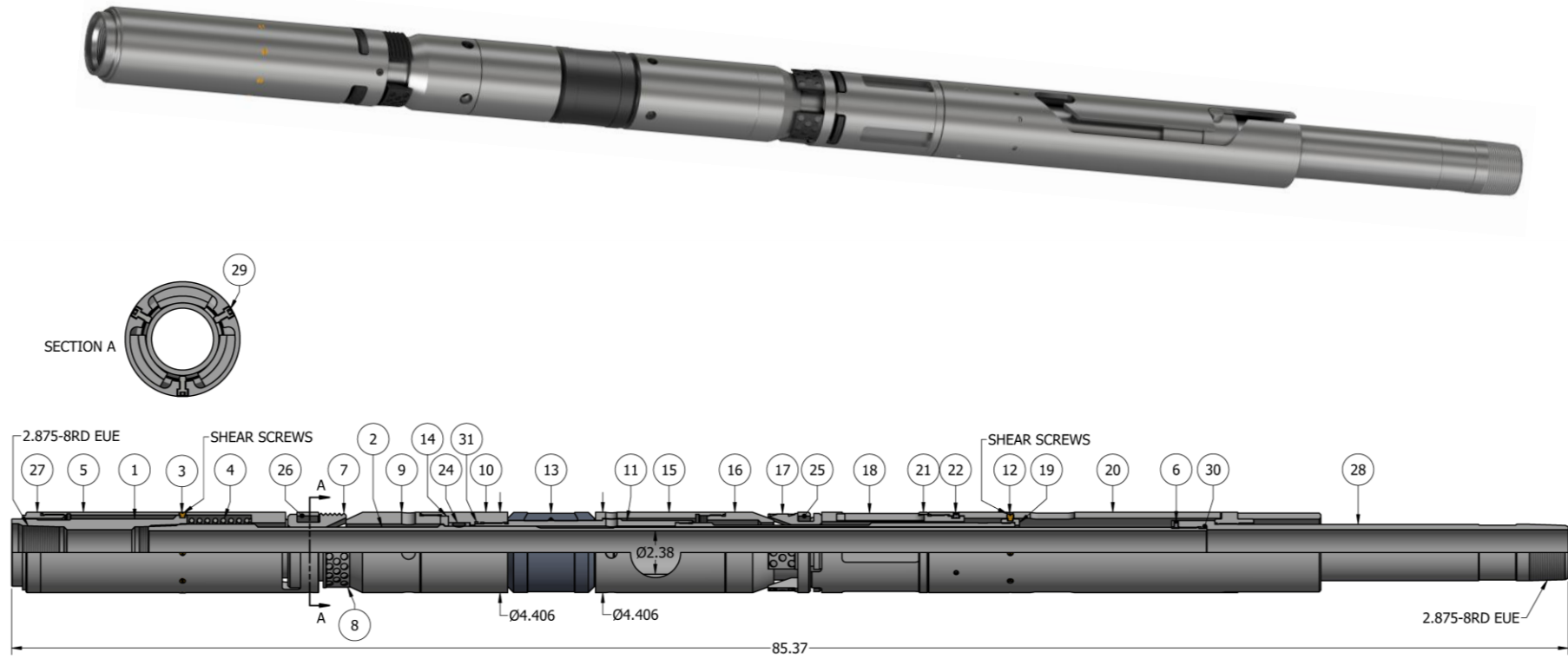
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M) TECHNICAL ILLUSTRATION



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N) REVISION HISTORY

DATE	REVISION	DESCRIPTION OF CHANGES	REVISED BY	APPROVED BY
08/16/2109	E	OEM56BH was OEM54BH, 60351210HT was 60351210, Removed 60370636, Added 60051650	J.Anderson	K.Plunkett
04/01/2019	D	Revised WLAK P/N 97151 was 97156 in Related Tools	J.Anderson	Z.Speer
05/18/2018	C	Added Caution6; Revised Elastomer Trim Temperature Guide nitrile temp. rating	J.Anderson	J.Johnson
07/01/2016	B	Removed tool drift ID; Add General Screw Torque Recommendations; Revised Elastomer Trim Temperature Guide Nitrile and HSN temp. ranges, P/N OEM54BH was OEM56BH	J.Anderson	N.Banker
04/21/15	A	Created new manual	-	-