



# VSI-X PACKER WITH YO-YO

## 4-1/2" X 2-3/8"

Manual No:  
**DL-601-4500-671**

Revision: **F**

Revision Date:  
**05/22/2018**

Authored by : J.Anderson

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.

The VSI-X Packer with Yo-Yo design allows the packer to be set and unset without rotation of the tubing.

**NOTE<sub>1</sub>:** Stinger and setting equipment sold separately.

**NOTE<sub>2</sub>:** 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 off of the packer before fully setting the packer.

### B) RELATED TOOLS (sold separately)

B-1) 4-1/2" Wireline Adapter Kit (WLAK) (PN 97145)—refer to technical manual *DL-971-4500-542*.

**NOTE<sub>3</sub>:** This packer uses **four (4 qty)** shear screws with WLAK.

B-2) 2-3/8" DT-2 On/Off Tool and Stinger—refer to technical manual *DL-512-2375-360*.

### 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)		
4-1/2	9.5 – 13.5	3.920 – 4.090	3.750	1.94	2-3/8 EUE	60145Y 60145YV <sup>1</sup>

<sup>1</sup>Viton Option

DIFFERENTIAL PRESSURE (MAX)	TENSILE LOAD THRU TOOL (MAX)
7,000 PSI	40,000 LBS

### D) PRE-INSTALLATION INSPECTION PROCEDURES

**CAUTION<sub>1</sub>:** 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.

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



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### D) PRE-INSTALLATION INSPECTION PROCEDURES (cont'd)

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) SETTING PROCEDURES

Follow the wireline setting tool manufacturer's setting instructions.

**CAUTION<sub>2</sub>:** Packer must be pinned with **four (4 qty)** shear screws in spring cage (5) and **four (4 qty)** in J-body (20).

### F) RELEASING AND RESETTING PROCEDURES

Set down weight on the packer and pick up. 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.

**CAUTION<sub>3</sub>:** High differential pressure below the VSI-X may cause the upper slips to wedge in tighter, requiring an extra amount of tension to release the upper slips.

After releasing the packer, reset the packer by setting weight down on the packer, picking up on the packer, then setting weight back down on the packer, and finally picking back up on the packer to return the J-pin to the run in position (Refer to Technical Illustration, Fig. 7).

### G) 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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### H) 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	1.48 (DOWN)	-2.28 (UP)
	2.063	0.97 (DOWN)	-1.91 (UP)
	2.375	-0.11 (UP)	-1.19 (UP)

**Example:** Consider a 4-1/2" X 2-3/8" 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 4-1/2" X 2-3/8" 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 -0.11 in<sup>2</sup>. Multiplying the differential pressure (3,000 PSI) by the pressure affected area (-0.11 in<sup>2</sup>) results in a force of -330 lbs. The piston effect on the packer mandrel is an upward force of 330 lbs.

### I) 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

### J) RECOMMENDED TOOLS

#### J-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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### J) RECOMMENDED TOOLS (cont'd)

#### J-2) SPECIAL TOOLS

ITEM	QTY	DESCRIPTION	PART NUMBER
T1	1	SPRING CAGE ASSEMBLY TOOL 4-1/2" - 7-5/8" VSI-XW	AT100
T2	1	DRAG BLOCK ASSEMBLY TOOL	AT045110

### K) DISASSEMBLY

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

K-1.1) Unscrew and remove J-pin (30) from J-pin body (20).

K-1.2) Unscrew and remove J-slot mandrel (23) from inner mandrel (2).

K-1.2.1) Remove o-ring (32) from J-slot mandrel (23).

K-1.3) Unscrew and remove shear screws (6) from J-pin body (20).

K-1.4) Unscrew and remove set screws (21) from J-pin body (20).

K-1.5) Compress drag blocks (22) with drag block assembly tool (T2). Unscrew and remove J-pin body (20) from drag block body (18) (**NOTE6:** Left-hand threads).

K-1.6) Unscrew and remove rubber mandrel cap (19) from rubber mandrel (11).

**NOTE5:** For added leverage, insert a rod through rubber retainer (15) and rubber mandrel (11) as needed.

K-1.7) Release drag blocks (22) from drag block assembly tool (T2). Unscrew and remove button head screws (28) from rubber mandrel (11).

K-1.8) Remove drag blocks (22) and drag block springs (3) from drag block body (18)

K-1.9) Wedge lower slips (17) outwards (if needed). Remove drag block body assembly and disassemble:

K-1.9.1) Remove wedges (if needed). Remove lower slips (17) and lower slip springs (25) from drag block body (18).

K-1.10) Unscrew and remove lower cone (16) from rubber retainer (15).

K-1.11) Unscrew rubber mandrel (11) from center coupling (10).

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

K-1.12) Remove rubber mandrel assembly from inner mandrel (2) and disassemble:

K-1.12.1) Remove elements (13, 14), rubber spacers (12), and rubber retainer (15) from rubber mandrel (11).

K-1.13) Unscrew and remove center coupling (10) from upper cone (9).

K-1.13.1) Remove bonded seal (24) and o-ring (33) from center coupling (10).

K-1.13.1.1) Remove o-ring (31) from bonded seal (24).

K-1.14) Remove upper cone (9) from inner mandrel (2).

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

K-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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### K) DISASSEMBLY (cont'd)

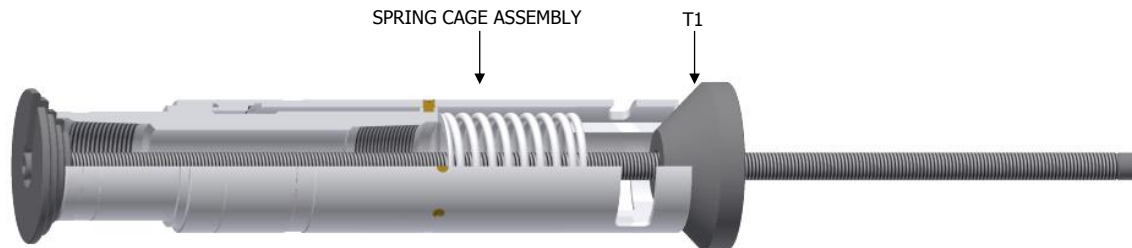


Fig. 2

#### K-1.17) Disassemble spring cage assembly:

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

**CAUTION4:** Compression spring (4) is compressed with tension against spring cage assembly.

K-1.17.2) Unscrew and remove shear screws (6) from spring cage (5).

K-1.17.3) Unscrew spring cage cap (27) from spring cage (5).

K-1.17.4) Release compression spring (4) tension by loosening spring cage assembly tool (T1). Remove spring cage assembly tool (T1).

K-1.17.5) Remove spring cage cap (3), top sub (1), and compression spring (4) from spring cage (5).

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

### L) 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.

**CAUTION5:** To ensure tool operates properly, install o-rings in o-ring grooves **NOT** thread reliefs unless stated otherwise (Fig. 3).

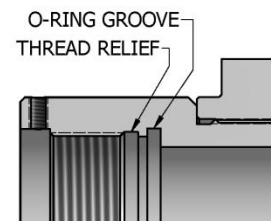


Fig. 3

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

#### L-1.1) Assemble spring cage assembly:

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

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

**NOTE7:** Press down top sub (1) to compress compression spring (4) as necessary.

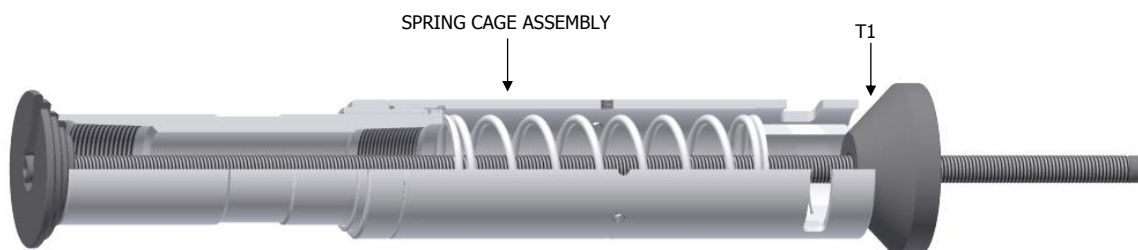


Fig. 4

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

L-1.1.4) Align threaded holes in spring cage (5) with recessed holes in top sub (1). Screw four (4 qty) shear screws (6) into spring cage (5). Tighten until shear screws (6) make contact with top sub (1). Back shear screws (6) out 1/4 turn.

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

**CAUTION4:** Compression spring (4) is compressed with tension against spring cage assembly.



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### L) ASSEMBLY (cont'd)

L-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.

**NOTE4:** Uses one (1ea) spring per slip (Fig. 5).

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

L-1.3) Install upper cone (9) from lower end of inner mandrel (2). Slide upper cone (9) up inner mandrel (2) until the flange of upper cone (9) comes in contact with shoulder of inner mandrel (2).

L-1.4) Install o-ring (31) into groove in bonded seal (24).

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

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

L-1.6) Install o-ring (33) into center coupling (10).

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

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

L-1.8) Assemble rubber mandrel assembly and install:

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

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

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

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

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

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

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

**NOTE4:** Uses one (1ea) spring per slip (Fig. 6).

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

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

**NOTE5:** For added leverage, insert a rod through rubber retainer (15) and rubber mandrel (11) as needed.

L-1.12) Align holes in drag block body (18) with threaded holes in rubber mandrel (11). Install drag block springs (3) and drag blocks (22). Compress drag blocks (22) with drag block assembly tool (T2).

**NOTE10:** Uses three (3ea) springs per block (Fig. 7).

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

L-1.14) Align threaded holes in J-pin body (20) with groove in drag block body (18). Screw set screws (21) into J-pin body (20).

L-1.15) Install o-ring (32) into groove in J-slot mandrel (23).

L-1.16) Screw J-slot mandrel (23) onto inner mandrel (2).

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

L-1.17) Align threaded hole in J-pin body (20) with run-in position landing in J-slot mandrel (23). Screw J-pin (30) into J-pin body (20) (Refer to Technical Illustration, Fig. 7).

L-1.18) Move rubber mandrel assembly as required to align threaded holes in J-pin body with recessed holes in rubber mandrel cap (19). Screw four (4 qty) shear screws (6) into J-pin body (20). Tighten until shear screws (6) make contact with rubber mandrel cap (19). Back shear screws (6) out 1/4 turn.

L-1.19) Screw button head screws (28) into rubber mandrel (11). Release drag blocks (22) from drag block assembly tool (T2).

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

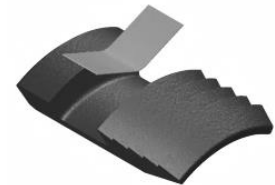


Fig. 5

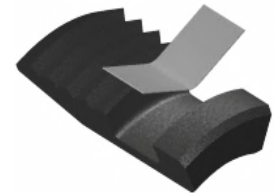


Fig. 6



Fig. 7



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### M) PARTS LIST

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60145Y
1	1	TOP SUB	DLMS80	60145610
2	1	INNER MANDREL	DLMS80	60045210
3	12	DRAG BLOCK SPRING	INCONEL	9100900-PINNED
4	1	COMPRESSION SPRING	DLMCRSP	60345920
5	1	SPRING CAGE	DLMS80 / DLMS35	60145325
6	8	SHEAR SCREW (2375#)	DLM360BRS	60100990
7	1	RELEASING SLIP	DLMS110	60045125
8	2	UPPER SLIP	DLMS35	60045115
9	1	UPPER CONE	DLMS60	60045410
10	1	CENTER COUPLING	DLMS60	60245620
11	1	RUBBER MANDREL	DLMS110	60045220-PINNED
12	2	RUBBER SPACER	DLMS60	60245840
13	1	ELEMENT	70 DURO NITRILE	60245511
14	2	ELEMENT	90 DURO NITRILE	60245513
15	1	RUBBER RETAINER	DLMS60	60245850
16	1	LOWER CONE	DLMS60	60045420
17	4	LOWER SLIP	DLMS60	60045135
18	1	DRAG BLOCK BODY	1026	60045335-PINNED
19	1	RUBBER MANDREL CAP	DLMS60	60145230
20	1	J-PIN BODY	L-80	60145340Y
21	4	SET SCREW 1/4-20 UNC X 3/8	STEEL	SSS025C037
22	4	DRAG BLOCK W/ CARBIDE	DLMSDB4	9045900C-PINNED
23	1	J-SLOT MANDREL	P-110	60045630Y
24	1	BONDED SEAL	90 DURO NITRILE	60045520
25	4	LOWER SLIP SPRING	ELGILOY	7145901
26	3	UPPER SLIP SPRING	ELGILOY	7145902
27	1	SPRING CAGE CAP	DLMS60	60145810
28	4	BUTTON HEAD SCREW #10-32 X 5/8	DLM360BRS	BMS01032F062R
29	4	SHEAR SCREW (4600#) 7/16-20 UNF X 7/16	DLM360BRS	BSSSLT043F043*





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### M) PARTS LIST (cont'd)

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60145Y
30	1	J-PIN	P-110	60035635Y
31	1	145 O-RING	90 DURO NITRILE	90145
32	1	228 O-RING	90 DURO NITRILE	90228
33	1	232 O-RING	90 DURO NITRILE	90232

\*Refer to WLAK technical manual for placement.

REDRESS KIT (RDK)		60145050
ASSEMBLED WEIGHT		118 LBS

#### M-1) ELASTOMER TRIM OPTIONS

**NOTE<sub>10</sub>:** For temperature range, refer to Elastomer Trim Temperature Guide.

##### M-1.1) HSN

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60145YH
13	1	ELEMENT	70 DURO HSN	60245511H
14	2	ELEMENT	90 DURO HSN	60245513H
24	1	BONDED SEAL	90 DURO HSN	60045520H
31	1	145 O-RING	90 DURO HSN	90145H
32	1	228 O-RING	90 DURO HSN	90228H
33	1	232 O-RING	90 DURO HSN	90232H

REDRESS KIT (RDK)		60145050H
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##### M-1.2) VITON

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60145YV
13	1	ELEMENT	70 DURO VITON	60245511V
14	2	ELEMENT	90 DURO VITON	60245513V
24	1	BONDED SEAL	90 DURO VITON	60045520V
31	1	145 O-RING	90 DURO VITON	90145V
32	1	228 O-RING	90 DURO VITON	90228V
33	1	232 O-RING	90 DURO VITON	90232V

REDRESS KIT (RDK)		60145050V
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## N) TECHNICAL ILLUSTRATION

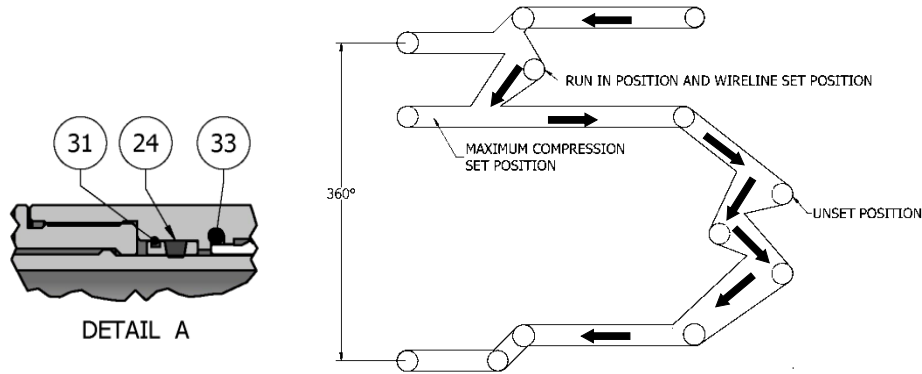
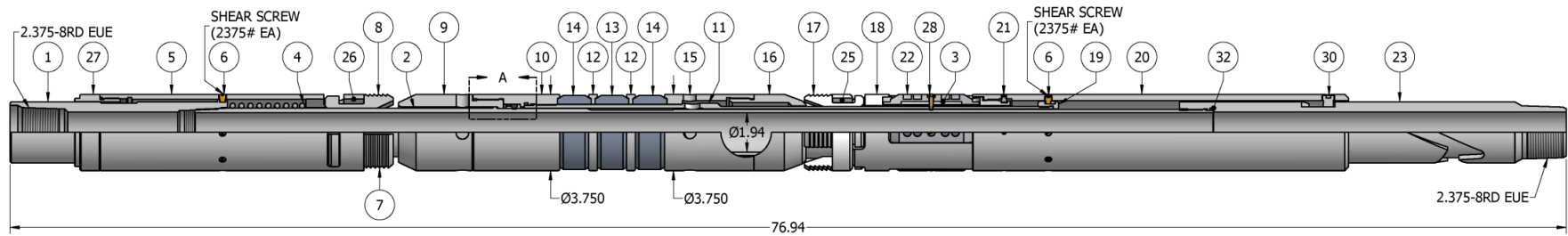


Fig. 7





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### O) REVISION HISTORY

DATE	REVISION	DESCRIPTION OF CHANGES	REVISED BY	APPROVED BY
05/22/2018	F	Added General Screw Torque Recommendations; Revised P/N BSSSLT043F043 shear value was 4,300 lbs, Elastomer Trim Temperature Guide Nitrile temp rating was 70-300, HSN was 70-325	J.Anderson	C.Colvin
08/22/14	E	Added setting procedures	J.Anderson	K.Riggs
05/22/14	D	Revised PN 60100990 qty was 16, Fig. 7	J.Anderson	K.Riggs
04/21/14	C	Added resetting procedures; Revised Fig. 7	J.Anderson	K.Riggs
04/09/14	B	Added notes for 4 shear screws to be used with WLAK; Revised PN BSSSLT043F043 qty was 8	J.Anderson	K.Riggs
04/04/14	A	Created new manual	-	-