



VSI-X HT PACKER

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

Manual No:
DL-601-4500-151

Revision: **J**

Revision Date:
12/27/2018

Authored by: B.Mathis

Approved by: B.Oligschlaeger

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 Wireline Adapter Kit (WLAK) sold 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 off of the packer before fully setting the packer.

B) RELATED TOOLS (sold separately)

B-1) 4-1/2" X 2-3/8" Wireline Adapter Kit (WLAK) (P/N's 97144, 97145)—refer to technical manual *DL-971-4500-542*.

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

B-3) 2-3/8" Stinger—actual P/N varies depending on customer requirements.

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	60145HT 60145HTH ¹ 60145HTV ²
	13.5 – 15.1	3.826 – 3.920	3.650	1.94	2-3/8 EUE	60144HT 60144HTH ¹ 60144HTV ²

Elastomer Trim Options: ¹HSN, ²Viton

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)
10,000 PSI	55,000 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

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 HT Packer may cause the upper slips to wedge in tighter, requiring an extra amount of tension to release the upper slips.

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" X 2-3/8"	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 0.97 in². Multiplying the differential pressure (3,000 PSI) by the pressure affected area (0.97 in²) results in a force of 2,910 lbs. The piston effect on the packer mandrel is an upward force of 2,910 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 FOR 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 (3 or 21) from J-body (20).

J-1.2) Unscrew and remove bottom nipple (22) from J-pin bottom sub (23).

J-1.3) Move J-body assembly as needed to unscrew and remove set screws (6) from J-pin bottom sub (23).

J-1.4) Unscrew and remove J-pin bottom sub (23) from inner mandrel (2).

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

J-1.4.1) Remove o-ring (29) from J-pin bottom sub (23).

J-1.5) Unscrew and remove set screws (6) from J-body (20).

J-1.6) Unscrew and remove J-body (20) from drag block body (18) (**NOTE₆:** Left-hand threads).

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 body assembly and disassemble:

J-1.8.1) Remove wedges. 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 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 bonded seal (24) and o-ring (30) 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 upper slips outward (if needed). Unscrew and remove inner mandrel (2) from top sub (1).

J-1.15) Remove wedges (if needed). Remove releasing slip (7), upper slips (8) and upper slip springs (26) from spring cage (5).

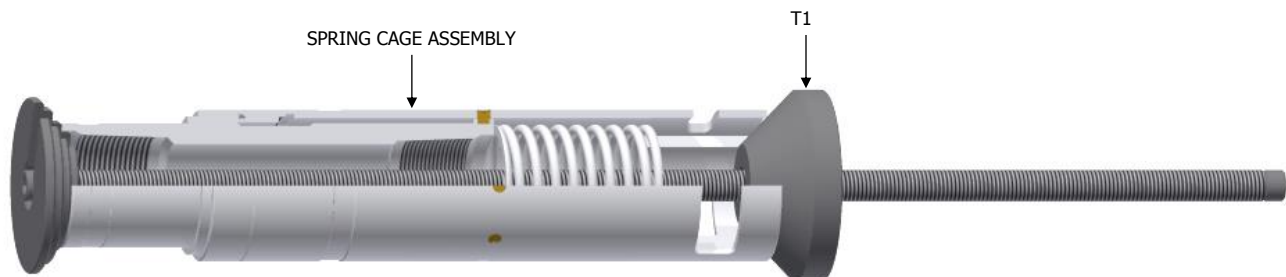


Fig. 2



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J) DISASSEMBLY (cont'd)

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 (21) from spring cage (5).

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

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

J-1.16.5) 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.

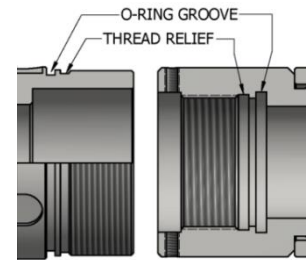


Fig. 3

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).

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).

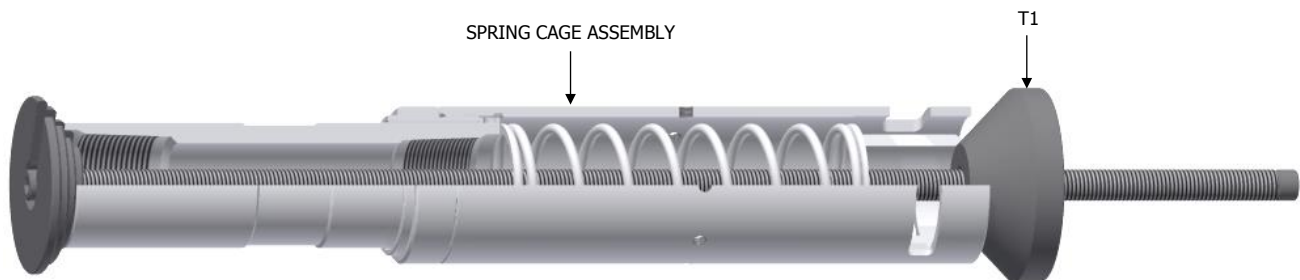


Fig. 4

K-1.1.2) Compress compression spring (4) with assembly tool (T1) (Fig. 4).

K-1.1.3) Align threaded holes of spring cage (5) with recessed holes of top sub (1). Screw shear screws (21) into spring cage (5). Tighten until shear screws (21) contact top sub (1). Back shear screws (21) out 1/4 turn.

K-1.1.4) Remove assembly tool (T1) from spring cage assembly.

K-1.1.5) Screw spring cage cap (27) into spring cage (5).

K-1.1.6) Install upper slips (8), releasing slip (7) and upper slip springs (26) into spring cage (5). Wedge slips outward.

NOTE₁₀: Install one (1ea) spring per slip (Fig. 5).

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

K-1.3) Install upper cone (9) onto lower end of inner mandrel (2). Slide upper cone (9) until the flange of upper cone contacts shoulder of inner mandrel (2). (Refer to Technical Illustration Detail A).

K-1.4) Install o-ring (28) into o-ring groove in bonded seal (24).

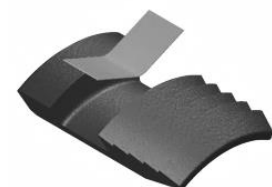


Fig. 5



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K) ASSEMBLY (cont'd)

K-1.5) Install bonded seal (24) into upper end of center coupling (10).

CAUTION₅: Do not rip or tear o-ring during installation.

K-1.6) Install o-ring (30) into o-ring groove in center coupling (10).

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

K-1.8) Assemble rubber mandrel assembly and install:

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

NOTE₁₁: Do not damage threads - use plastic or rubber hammer as needed.

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

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

CAUTION₅: 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 slips outward.

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

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

K-1.11) 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-1.12) Screw J-body (20) onto drag block body (18) (**NOTE₆:** Left-hand threads).

K-1.13) Screw set screws (6) into J-body (20).

K-1.14) Install o-ring (29) into o-ring groove in J-pin bottom sub (23).

K-1.15) Screw J-pin bottom sub (23) onto inner mandrel (2).

CAUTION₅: Do not rip or tear o-ring during installation.

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

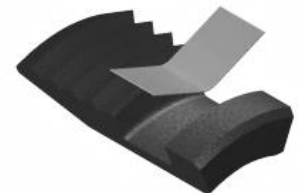


Fig. 6

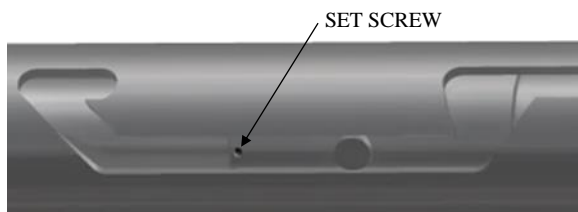


Fig. 7

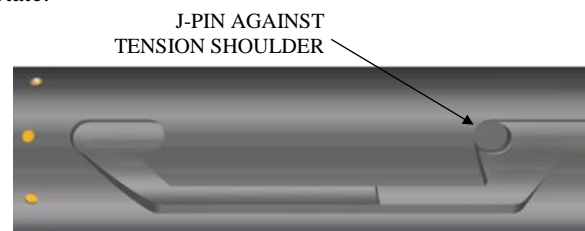


Fig. 8

K-1.16) 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 (6) into J-pin bottom sub (23).

K-1.17) Position J-pin of J-pin bottom sub (23) against tension shoulder in J-slot of J-body (20) (Fig. 8).

K-1.18) Screw bottom nipple (22) into J-pin bottom sub (23).

K-1.19) Align threaded holes in J-body (20) with pocket holes in rubber mandrel cap (19).

K-1.20) Screw shear screws (3 or 21) into J-body (20). Tighten until shear screws (3 or 21) make contact with rubber mandrel cap (19). Back shear screws (3 or 21) out 1/4 turn.

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



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L) PARTS LIST

ITEM	QTY	DESCRIPTION	MATERIAL	13.5 - 15.1# P/N 60144HT	9.5 - 13.5# P/N 60145HT
1	1	TOP SUB	DLMS110	60145610HT	
2	1	INNER MANDREL	DLMS110	60044210HT	60045210HT
3	-	SHEAR SCREW (2375#)	DLM360BRS	60100990 8 EA	16 EA
4	1	COMPRESSION SPRING	DLCRSP	60345920	
5	1	SPRING CAGE	DLMS110 / DLMS60	60144325HT	60145325HT
6	6	SET SCREW 1/4-20 UNC X 3/8	STEEL	SSS025C037	
7	1	RELEASING SLIP	DLMS110	60045125	
8	2	UPPER SLIP	DLMS60	60045115	
9	1	UPPER CONE	DLMS110	60044410HT	60045410HT
10	1	CENTER COUPLING	DLMS60	60244620	60245620
11	1	RUBBER MANDREL	DLMS110	60044220	60045220
12	2	RUBBER SPACER	DLMS60	60244840	60245840
13	1	ELEMENT	80 DURO NITRILE	60244512	60245512
14	2	ELEMENT	90 DURO NITRILE	60244513	60245513
15	1	RUBBER RETAINER	DLMS60	60244850	60245850
16	1	LOWER CONE	DLMS110	60044420HT	60045420HT
17	4	LOWER SLIP	DLMS60	60045135	
18	1	DRAG BLOCK BODY	DLMS60	60044335	60045335
19	1	RUBBER MANDREL CAP	DLMS60	60145230	
20	1	J-BODY	DLMS110	60144340HT	60145340HT
21	8	SHEAR SCREW (2375#)	BRASS	90555990	-
22	1	BOTTOM NIPPLE	DLMS60	60355636	
23	1	J-PIN BOTTOM SUB	DLMS110	60045634HT	
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	-	60144810	60145810
28	1	145 O-RING	90 DURO NITRILE	90145	
29	1	228 O-RING	90 DURO NITRILE	90228	



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L) PARTS LIST (cont'd)

ITEM	QTY	DESCRIPTION	MATERIAL	13.5 - 15.1# P/N 60144HT	9.5 - 13.5# P/N 60145HT
30	1	232 O-RING	90 DURO NITRILE	90232	
31	8	SHEAR SCREW (5000#) 7/16-20 UNF X 7/16	DLM360BRS	BSSSLT043F043*	

* Refer to WLAK technical illustration for placement.

REDRESS KIT (RDK)		60144050HT	60145050HT
ASSEMBLED WEIGHT		105 LBS	114 LBS

L-1) ELASTOMER TRIM OPTIONS

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

L-1.1) HSN

ITEM	QTY	DESCRIPTION	MATERIAL	13.5 - 15.1# P/N 60144HTH	9.5 - 13.5# P/N 60145HTH
13	1	ELEMENT	80 DURO HSN	60244512H	60245512H
14	2	ELEMENT	90 DURO HSN	60244513H	60245513H
24	1	BONDED SEAL	90 DURO HSN	60045520H	
28	1	145 O-RING	90 DURO HSN	90145H	
29	1	228 O-RING	90 DURO HSN	90228H	
30	1	232 O-RING	90 DURO HSN	90232H	

REDRESS KIT (RDK)		60144050HTH	60145050HTH
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L-1.2) VITON

ITEM	QTY	DESCRIPTION	MATERIAL	13.5 - 15.1# P/N 60144HTV	9.5 - 13.5# P/N 60145HTV
13	1	ELEMENT	80 DURO VITON	60244512V	60245512V
14	2	ELEMENT	90 DURO VITON	60244513V	60245513V
24	1	BONDED SEAL	90 DURO VITON	60045520V	
28	1	145 O-RING	90 DURO VITON	90145V	
29	1	228 O-RING	90 DURO VITON	90228V	
30	1	232 O-RING	90 DURO VITON	90232V	

REDRESS KIT (RDK)		60144050HTV	60145050HTV
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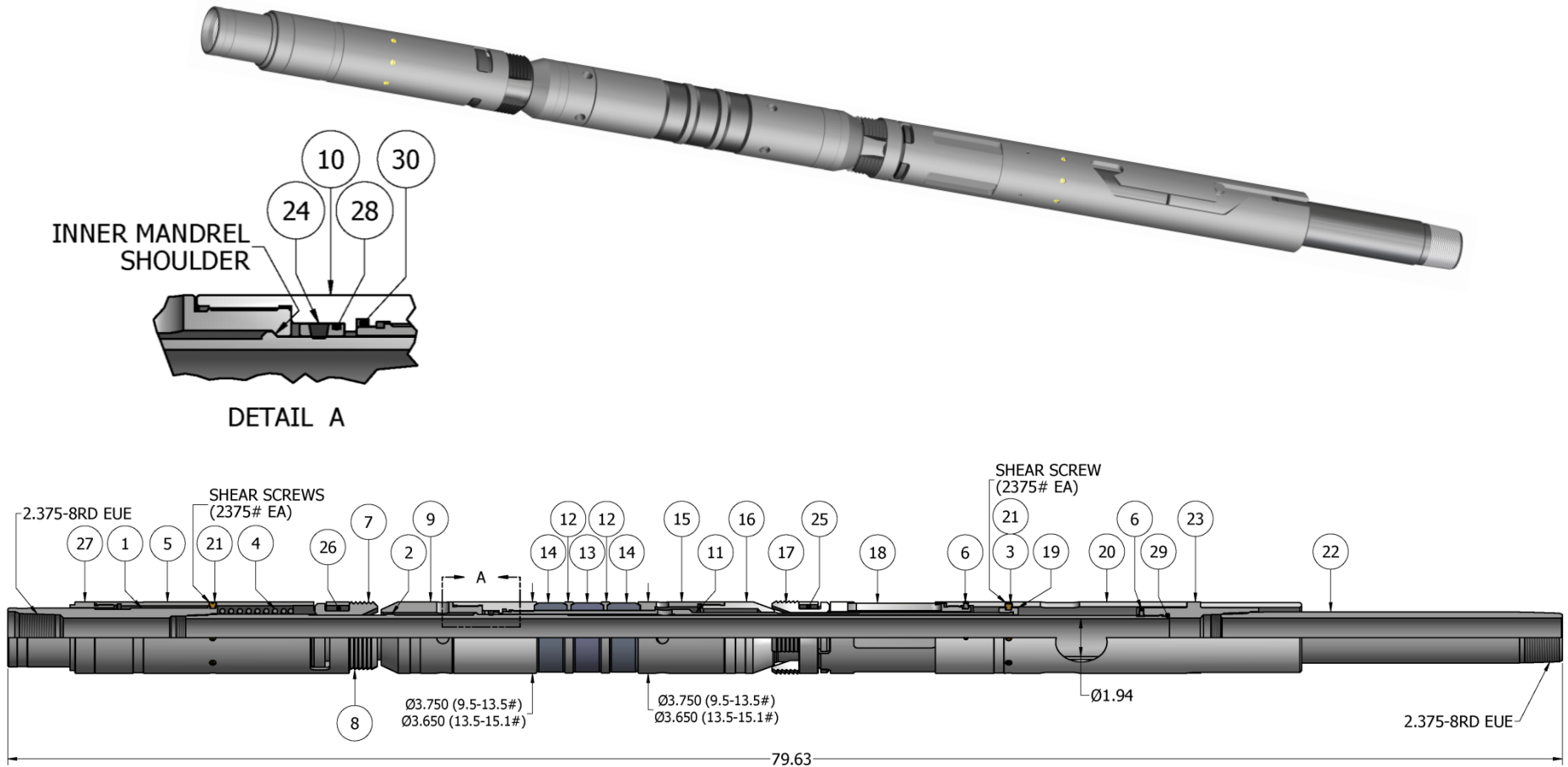
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M) TECHNICAL ILLUSTRATION



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N) REVISION HISTORY

DATE	REVISION	DESCRIPTION OF CHANGES	REVISED BY	APPROVED BY
12/27/2018	J	Revised P/N BSSSLT043F043 shear rating was 4,600, Elastomer Trim Temp. Guide Nitrile temp. rating; Added General Screw Torque Recommendations	J.Anderson	N.Banker
01/19/2016	H	Revised Elastomer Durometer Temperatures – Nitrile (90/80/90 Duro) was 250° - 300°F, Nitrile (Contact D&L Sales) was 300°F +, Rubber Type Temperature Ranges – Nitrile was 70° - 300°F, HSN was 70° - 325°F, P/N BSSSLT043F043 shear value 4,600 was 4,300 lbs; Removed tool drift ID	J.Anderson	B.Bishop
10/28/14	G	Revised P/N 60145810 material 1026 was L-80; Added Related Tools, drift ID to Specification Guide, note for use of a double hook j slot Packer, max tensile load, Pre-Installation Inspection Procedures, Storage Procedures and Figures 3,5,6,7 & 8 to assembly instructions.	D.Barlow	J.McArthur
03/14/13	F	Revised P/N 60145810 material was L-80, BSSSLT043F043 shear value was 5500#; Added references to tech manual 971-4500-542; Removed setting kit section	J.Anderson	K.Plunkett
01/15/13	E	Revised 60144HT 3.650" OD was 3.656", assembly instructions, technical illustration; Removed emergency release procedures from releasing procedures, AFLAS from element selection guide; Added HSN and Viton assembly options (P/Ns 60144HTH, 60144HTV, 60145HTH, and 60145HTV), BSSSLT043F043 to parts list, recommended hand tools, setting kit, options parts lists and revision history sections	J.Anderson	B.Oligschlaeger