A) DESCRIPTION

The VSI-X HT Packer, a 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 HT Packer is designed for differential pressures up to 10,000 PSI (unless noted otherwise). The HT version allows this packer to be utilized in completions where high pressure treating operations are performed and it is desirable to leave the tool in the well for production.

This packer easily converts to a mechanically set ASI-X HT Packer. To convert, remove the shear screws and install drag blocks and drag block springs. The ASI-X HT Packer sets with 1/4 right-hand rotation, and releases with 1/4 right-hand rotation. The ASI-X HT 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.

B) RELATED TOOLS (sold separately)

B-1) 5-1/2" X 2-7/8" Wireline Adapter Kit (WLAK) (P/N 97156) —refer to technical manual *DL-971-5500-440*

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

B-3) 2-7/8" 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)		
5-1/2	14.0 - 20.0	4.778 - 5.012	4.625	2.38	2-7/8 EUE	60156HT 60156HTH[1] 60156HTV[2] 60156HTC[3] 60156HTHC[4] 60156HTVC[5]
	20.0 - 23.0	4.670 - 4.778	4.500	2.38	2-7/8 EUE	60159HT 60159HTH[1] 60159HTV[2] 60159HTC[3] 60159HTHC[4] 60159HTVC[5]

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

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.

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

C) SPECIFICATION GUIDE (cont'd)

DIFFERENTIAL PRESSURE (MAX)	**TENSILE LOAD THRU TOOL** (MAX)
10,000 PSI	88,915 LBS

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 tools 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

The releasing procedures are the same whether the packer has been tension or compression set. Set down weight on the packer to unseat the J-pin from the tension shoulder of the J-slot. Refer to the Pressure Affected Area Guide to determine necessary set down weight on the packer. Rotate the work string 1/4 right-hand turn at the packer and pick up while holding right-hand torque. Weight in addition to pipe weight may be required to pick up on packer – refer to Pressure Affected Area Guide. 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 thus allowing the packer to be removed from the well.

CAUTION4: 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.

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** (SQ. INCHES)	
		ABOVE	**BELOW**
5-1/2"	2.375	2.06 (DOWN)	-3.37 (UP)
	2.875	0.00	-1.81 (UP)

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

I-2) SPECIAL TOOLS

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

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 bottom nipple (22) from J-pin bottom sub (23).

J-1.3) Unscrew and remove set screws (28) from J-pin bottom sub (23). Move J-body (20) as needed.

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 (33) from J-pin bottom sub (23).

J-1.5) Unscrew and remove set screws (31) 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) Remove drag block retainer (21) from drag block body (18).

J-1.8) 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-1.9) Wedge lower slips (17) outwards (if needed). Remove drag block body assembly and disassemble:

J-1.9.1) Remove lower slips (17) and lower slip springs (25) from drag block body (18).

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

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

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

J-1.12) Remove rubber mandrel assembly and disassemble:

J-1.12.1) Remove gage ring (29), elements (13, 14), rubber spacers (12), and rubber retainer (15) from rubber mandrel (11).

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

J-1.13.1) Remove bonded seal (24) and o-ring (34) from center coupling (10).

J-1.13.1.1) Remove o-ring (32) from bonded seal (24).

J-1.14) Remove bearing bushing (30) and upper cone (9) from inner mandrel (2).

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

J) DISASSEMBLY (cont'd)

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

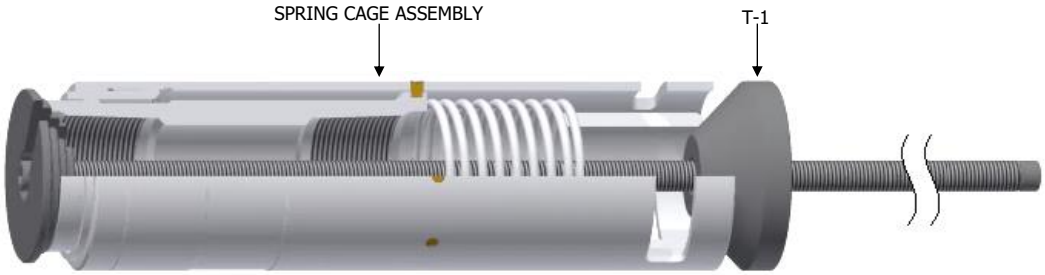


Fig. 1

J-1.17) Disassemble spring cage assembly:

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

CAUTION2: Compression spring (4) is compressed with tension against spring cage assembly.

J-1.17.2) Unscrew and remove shear screws (3 or 6) from spring cage (5).

J-1.17.3) Release compression spring (4) tension by loosening assembly tool (T-1) until enough space exists between stepped cone of assembly tool (5) 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 (T-1). 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) 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.

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).

NOTE2: Press down top sub (1) to compress compression spring (4) as necessary.

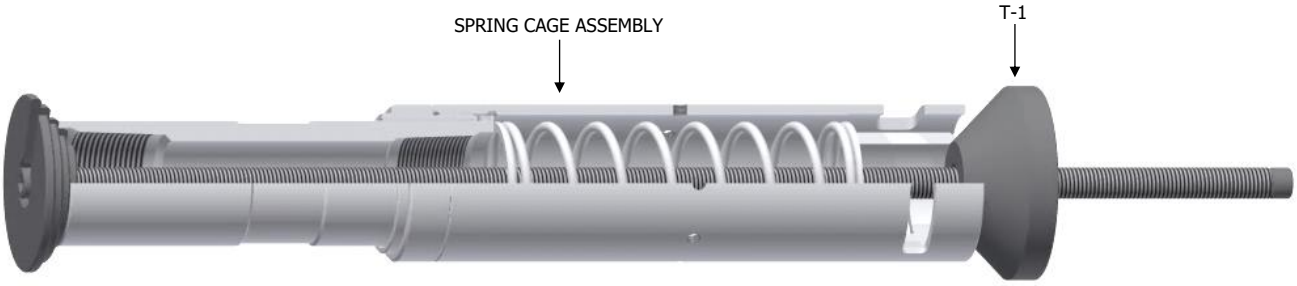


Fig. 2

K-1.1.3) Compress compression spring (4) with assembly tool (T-1) (Fig. 2).

K) ASSEMBLY (cont'd)

K-1.1.4) Align threaded holes in spring cage (5) with recessed holes in top sub (1). Screw shear screws (3 or 6) into spring cage (5). Tighten until shear screws (3 or 6) make contact with top sub (1). Back shear screws (3 or 6) out 1/4 turn.

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

CAUTION$_2$: 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.

NOTE$_{10}$: Install two (2ea) springs per slip (Fig. 3).

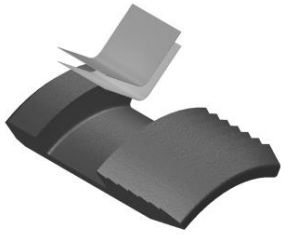


Fig. 3

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

K-1.3) Install upper cone (9) and bearing bushing (30) onto inner mandrel (2).

K-1.4) Install o-ring (32) into groove in bonded seal (24).

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

CAUTION$_3$: Do not rip or tear o-ring during installation.

K-1.6) Install o-ring (34) in groove in center coupling (10).

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

NOTE$_8$: For added leverage, insert a rod through upper cone (9) as needed.

K-1.8) Assemble rubber mandrel assembly and install:

K-1.8.1) Install rubber retainer (15), elements (13, 14), rubber spacers (12), and gage ring (29) 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).

CAUTION$_3$: 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).

NOTE$_{10}$: Install two (2ea) springs per slip (Fig. 4).

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

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

NOTE$_7$: For added leverage, insert a rod through rubber retainer (15) and rubber mandrel (11) as needed.

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

K-1.13) Screw J-body (20) onto drag block body (18) (**NOTE$_6$**: Left-hand threads).

K-1.14) Screw set screws (31) into J-body (20).

K-1.15) Install o-ring (33) into groove in J-pin bottom sub (23).

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

CAUTION$_3$: Do not rip or tear o-ring during installation.

NOTE$_5$: Drag block body assembly must be free to rotate.

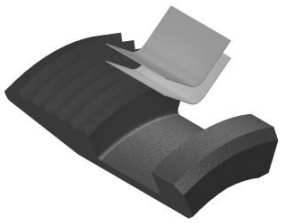


Fig. 4

K-1.17) Screw set screws (28) into J-pin bottom sub (23). Move J-body (20) as needed.

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

K-2) Remove assembled tool from vise.

L) PARTS LIST

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60156HT	P/N 60159HT
1	1	TOP SUB	DLMS110	60156610HT	
2	1	INNER MANDREL	DLMS110	60356210HT	60359210HT
3	-	SHEAR SCREW (2375#)	DLM360BRS	60100990 (16 EA)	60100990 (8 EA)
4	1	COMPRESSION SPRING	DLMCRSP	60356920	
5	1	SPRING CAGE	DLMS110	60156325HT	60159325HT
6	8	SHEAR SCREW (2375#)	DLMS110	-	90555990
7	1	RELEASING SLIP	DLMS35	60056125	
8	2	UPPER SLIP	DLMS110	60056115	
9	1	UPPER CONE	DLMS80	60356410HT	
10	1	CENTER COUPLING	DLMS110	60056620	
11	1	RUBBER MANDREL	DLMS60	60056220HT	60059220HT
12	2	RUBBER SPACER	80 DURO NITRILE	60256840	60259840
13	1	ELEMENT	90 DURO NITRILE	60256512	60259512
14	2	ELEMENT	DLMS60	60256513	60259513
15	1	RUBBER RETAINER	DLMS110	60256850	60259850
16	1	LOWER CONE	DLMS35	60056420HT	60059420HT
17	4	LOWER SLIP	DLMS80	60056135	
18	1	DRAG BLOCK BODY	DLMS60	60056335	60059335
19	1	RUBBER MANDREL CAP	DLMS60	60156230	
20	1	J-BODY	DLMS60	60156340	
21	1	DRAG BLOCK RETAINER	DLMS80	60056910	60059910
22	1	BOTTOM NIPPLE	DLMS110	60370636	
23	1	J-PIN BOTTOM SUB	90 DURO NITRILE	60356634HT	
24	1	BONDED SEAL	-	60056520	
25	8	LOWER SLIP SPRING	-	7155901	
26	6	UPPER SLIP SPRING	DLMS60	7155902	
27	1	SPRING CAGE CAP	STEEL	60156810	60159810
28	2	SET SCREW 1/4-20 UNC	DLMS60	SSS025C037 (3/8” LONG)	SSS025C050 (1/2” LONG)
29	1	GAGE RING	DLMS60	60256830	60259830
30	1	BEARING BUSHING	STEEL	60056224	
31	3	SET SCREW 5/16-18 UNC	DLMS110	SSS031C037 (3/8” LONG)	SSS031C031 (5/16” LONG)

L) PARTS LIST (cont'd)

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60156HT	P/N 60159HT
32	1	151 O-RING	90 DURO NITRILE	90151	
33	1	231 O-RING	90 DURO NITRILE	90231	
34	1	235 O-RING	90 DURO NITRILE	90235	
35	8	SHEAR SCREW (5500#) 1/2-13 UNC X 7/16 BRASS	DLM360BRS	BSSSLT050C043*	

*Refer to WLAK tech manual for placement.

REDRESS KIT (RDK)		60156050HT	60159050HT
ASSEMBLED WEIGHT		184 LBS	172 LBS

L-1) ELASTOMER TRIM OPTIONS

NOTE$_{11}$: For temperature range, refer to elastomer trim temperature guide.

L-1.1) HSN

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60156HTH	P/N 60159HTH
13	1	ELEMENT	80 DURO HSN	60256512H	60259512H
14	2	ELEMENT	90 DURO HSN	60256513H	60259513H
24	1	BONDED SEAL	90 DURO HSN	60056520H	
32	1	151 O-RING	90 DURO HSN	90151H	
33	1	231 O-RING	90 DURO HSN	90231H	
34	1	235 O-RING	90 DURO HSN	90235H	

REDRESS KIT (RDK)		60156050HTH	60156050HTH

L-1.2) VITON

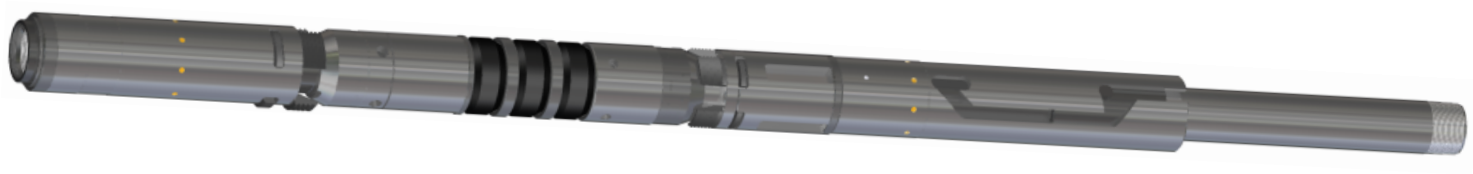
ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60156HTV	P/N 60159HTV
13	1	ELEMENT	80 DURO VITON	60256512V	60259512V
14	2	ELEMENT	90 DURO VITON	60256513V	60259513V
24	1	BONDED SEAL	90 DURO VITON	60056520V	
32	1	151 O-RING	90 DURO VITON	90151V	
33	1	231 O-RING	90 DURO VITON	90231V	
34	1	235 O-RING	90 DURO VITON	90235V	

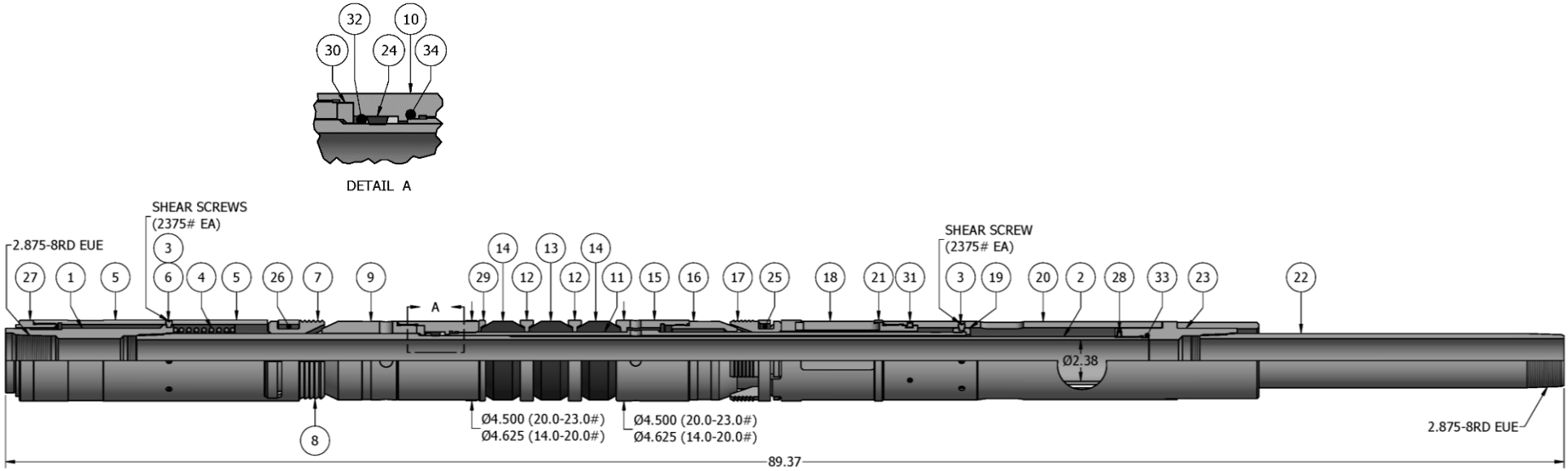
REDRESS KIT (RDK)		60156050HTV	60159050HTV

L-2) CARBIDE OPTIONS

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60156HT	P/N 60159HT
8	2	CARBIDE UPPER SLIP	DLMS110	60056115C	
17	4	CARBIDE LOWER SLIP	DLMS110	60056135C	

M) TECHNICAL ILLUSTRATION





N) REVISION HISTORY

DATE	REVISION	DESCRIPTION OF CHANGES	REVISED BY	APPROVED BY
09/01/2022	H	Added related tools, carbide options, inspection procedures, storage recommendations	J.Anderson	E.Visaez
06/04/13	G	Removed setting kit section; Added references to WLAK tech manual *DL-971-5500-440*;	J.Anderson	B.Oligschlaeger
01/09/13	F	Revised technical illustration; Removed emergency release instructions from releasing procedures section, AFLAS from element selection guide; Added recommended tools, setting kit and revision history sections, HSN and Viton options (P/Ns 60156HTH, 60156HTV and 60159HTH, 60159HTV); Rewrote disassembly and assembly instructions	J.Anderson	J.McArthur