A) DESCRIPTION

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

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

The VSI-X Packer can be easily converted to a mechanically set ASI-X Packer by removing the shear screws and installing drag blocks. The ASI-X packer is set with 1/4 right-hand rotation; and released with 1/4 right-hand rotation and can be left in tension, compression or neutral.

NOTE$_1$: Stinger, WLAK and pressure setting equipment sold separately.

NOTE$_2$: 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.

NOTE$_3$: Uses 7 and 7-5/8" X 3-1/2" WLAK (P/N 97174). Refer to Technical Manual *DL-971-7000-247* for technical info.

B) SPECIFICATION GUIDE

CASING		RECOMMENDED HOLE SIZE (INCHES)	TOOL OD (INCHES)	TOOL ID (INCHES)	THREAD CONNECTION BOX UP / PIN DOWN	PART NUMBER
SIZE (INCHES)	WEIGHT (LBS/FT)					
7-5/8	24.0 – 29.7#	6.875 – 7.025	6.672	3.00	3-1/2 EUE	60178 60178H[1] 60178V[2]
	33.7 – 39.0#	6.625 – 6.765	6.453	3.00	3-1/2 EUE	60177 60177H[1] 60177V[2]

[1]HSN Option [2]Viton Option

NOTE$_4$: Tools listed are right-hand set / right-hand release.

DIFFERENTIAL PRESSURE (MAX)	TENSILE LOAD THRU TOOL (MAX)
7,000 PSI	105,000 LBS

C) RELEASING PROCEDURES

Set down weight on the packer and rotate the tubing 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.

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.

CAUTION$_1$: 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.

D) PRESSURE AFFECTED AREA GUIDE

PACKER SIZE (INCHES)	**TUBING SIZE** (INCHES)	**PRESSURE** (SQ. INCHES)	
		ABOVE	**BELOW**
7-5/8" X 3-1/2"	2.375	6.43 DOWN	7.59 UP
	2.875	4.37 DOWN	6.19 UP
	3.500	1.24 DOWN	3.47 UP

Example: Consider a 7-5/8" X 3-1/2" VSI-X Packer set on 2.875" tubing with a differential pressure of 3,000 PSI in the annulus around the tubing above the packer. How much force is 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 7-5/8" X 3-1/2" VSI-X Packer run on 2.875" tubing. In this example, the differential pressure from above the packer acts down on the seal area of the mandrel area across a pressure affected area of 4.37 in^2. Multiplying the differential pressure (3,000 PSI) by the pressure affected area (4.37 in^2) results in a downward force of 13,110 lbs. 13,110 lbs is the force which needs to be neutralized when releasing the packer.

E) ELEMENT SELECTION GUIDE

NITRILE (STD)			
TEMPERATURE RANGE (F°)	**DUROMETER**		
	END	**MIDDLE**	**END**
70° - 125°	80	70	80
125° - 250°	90	70	90
250° - 300°	90	80	90
300° +	Contact D&L Sales		

RUBBER TYPE	**TEMPERATURE RANGE**
NITRILE	70° - 300°F
HSN (HNBR)	70° - 325°F
VITON	100° - 350°F

F) RECOMMENDED TOOLS

F-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

F-2) SPECIAL TOOLS

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

G) DISASSEMBLY

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

G-1.1) Unscrew and remove set screws (31) from drag block body (18).

G-1.2) Unscrew and separate drag block body (18) from J-body (20) (**NOTE$_5$**: Left-hand threads).

NOTE$_6$: Drag block body assembly must be free to rotate.

G-1.3) Unscrew and remove shear screws (3) from J-body (20).

G-1.4) Unscrew and remove set screws (30) from J-pin bottom sub (23). Move J-body (20) as needed to access screws.

G-1.5) Unscrew and remove J-pin bottom sub (23) from inner mandrel (2).

G-1.5.1) Remove o-ring (35) from J-pin bottom sub (23).

G-1.6) Remove J-body (20) from inner mandrel (2).

G-1.6.1) Remove retaining ring (31) from J-body (20).

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

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

G-1.8) Remove drag block retainer (21) from drag block body (18).

G-1.9) Remove drag block body assembly and disassemble:

G-1.9.1) Wedge lower slips (17) outwards (if needed). Unscrew and remove cap screws (22) from drag block body (18).

G-1.9.2) Remove lower slip support (32) from drag block body (18). Remove wedges (if needed).

G-1.9.3) Remove lower slips (17) and lower slip springs (25) from drag block body (18).

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

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

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

G-1.12) Remove rubber mandrel assembly and disassemble:

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

G-1.12.1.1) Unscrew and remove gage ring (29) from rubber retainer (15).

G) DISASSEMBLY (cont'd)

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

G-1.13.1) Unscrew and remove gage ring (29) from central coupling (10).

G-1.13.2) Remove bonded seal (24) and o-ring (36) from center coupling (10).

G-1.13.2.1) Remove o-ring (34) from bonded seal (24).

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

G-1.15) Unscrew and remove inner mandrel (2) from top sub (1).

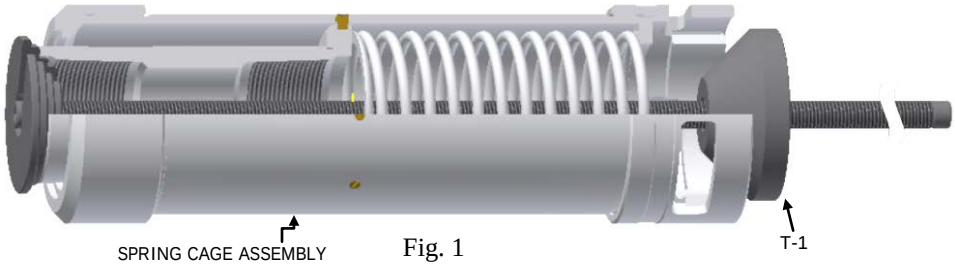


Fig. 1

G-1.16) Disassemble spring cage assembly:

G-1.16.1) Unscrew and remove spring cage cap (27) from spring cage (5).

G-1.16.2) Position assembly tool (T1) hand-tight against top sub (1) and upper slip body (6) of spring cage assembly (Fig. 1).

CAUTION$_2$: Compression spring (4) is compressed with tension against spring cage assembly.

G-1.16.3) Unscrew and remove shear screws (3) from spring cage (5).

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

G-1.16.5) Remove top sub (1), and compression spring (4) from spring cage (5).

G-1.16.6) Unscrew upper slip support (33) from spring cage (5).

G-1.16.7) Remove upper slip body assembly and disassemble:

G-1.16.7.1) Remove spring retainer ring (28) from upper slip support (33).

G-1.16.7.2) Wedge slips (7, 8) outwards (if needed). Unscrew and remove upper slip body (6) from upper slip support (33).

G-1.16.7.3) Remove wedges (if needed). Remove releasing slip (7), upper slips (8) and upper slip springs (26) from upper slip body (6).

G-2) Remove spring cage (5) from vise.

H) ASSEMBLY

NOTE$_9$: Clean and inspect all parts. Replace all worn and damaged parts. Install parts in proper order and orientation.

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

H-1.1) Assemble spring cage assembly:

H-1.1.1) Assemble upper slip body assembly and install:

H-1.1.1.1) Install spring retainer ring (28) into upper slip support (33).

H-1.1.1.2) Install releasing slip (7), upper slips (8) and upper slip springs (26) into upper slip body (6). Wedge slips (7, 8) outwards.

NOTE$_{13}$: Install two (2ea) springs per slip (Fig. 2).

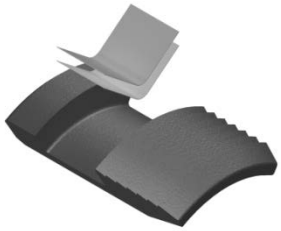


Fig. 2

H) ASSEMBLY (cont'd)

H-1.1.1.3) Screw upper slip body (6) onto upper slip support (33). Remove wedges.

H-1.1.1.4) Screw upper slip support (33) onto spring cage (5).

H-1.1.2) Install compression spring (4) and top sub (1) into spring cage (5).

NOTE$_{10}$: Press down top sub (1) to compress compression spring (4) as needed.

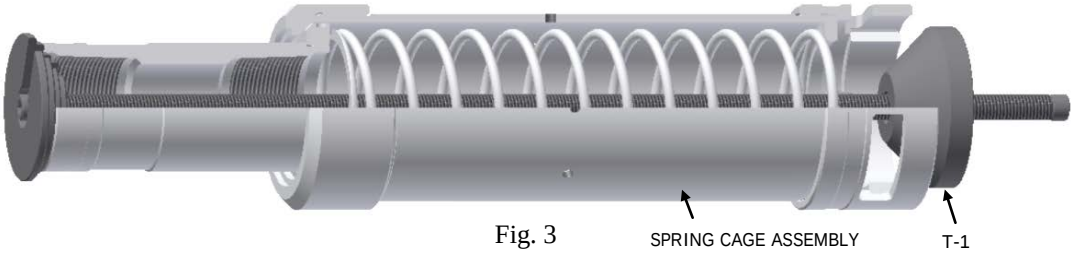


Fig. 3

H-1.1.3) Compress compression spring (4) with assembly tool (T1) (Fig. 3).

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

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

CAUTION$_2$: Compression spring (4) is compressed with tension against spring cage assembly.

H-1.1.6) Screw spring cage cap (27) onto spring cage (5).

H-1.2) Screw inner mandrel (2) into top sub (1).

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

H-1.4) Install o-ring (34) in groove in bonded seal (24).

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

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

H-1.6) Install o-ring (36) in groove in center coupling (10).

H-1.7) Screw gage ring (29) onto center coupling (10).

H-1.8) Screw center coupling (10) onto upper cone (9).

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

H-1.9) Assemble rubber mandrel assembly and install:

H-1.9.1) Screw gage ring (29) onto rubber retainer (15).

H-1.9.2) Install rubber retainer (15), elements (13, 14), and rubber spacers (12) onto rubber mandrel (11).

H-1.9.3) Install rubber mandrel assembly onto inner mandrel (2).

H-1.9.4) Screw rubber mandrel (11) into center coupling (10).

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

H-1.10) Screw lower cone (16) into rubber retainer (15).

H-1.11) Assemble drag block body assembly and install:

H-1.11.1) Install lower slips (17) and lower slip springs (25) into drag block body (18).

NOTE$_{13}$: Install two (2ea) springs per slip (Fig. 4).

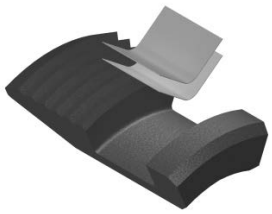


Fig. 4

H-1.11.2) Wedge lower slips (17) outwards. Install lower slip support (32) into drag block body (18).

H-1.11.3) Align pocket holes in lower slip support (32) with threaded holes in drag block body (18). Screw cap screws (22) into drag block body (18). Remove wedges.

H-1.11.4) Install drag block body assembly onto rubber mandrel (11).

H) ASSEMBLY (cont'd)

H-1.12) 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.

H-1.13) Install drag block retainer (21) onto drag block body (18).

H-1.14) Install J-body (20) onto inner mandrel (2) and over rubber mandrel cap (19). Do not screw J-body (20) at this time.

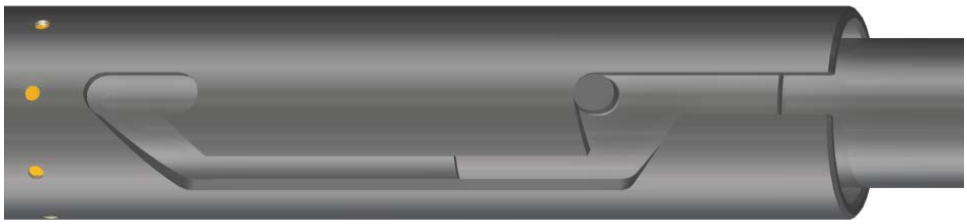
H-1.15) Install o-ring (35) in groove in J-pin bottom sub (23).

H-1.16) Install J-pin bottom sub (23) in J-slots in J-body (20). Screw J-pin bottom sub (23) onto inner mandrel (2).

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

H-1.17) Screw set screws (30) into J-pin bottom sub (23). Move J-body (20) as needed to access threaded holes in J-pin bottom sub (23).

Fig. 5



H-1.18) Position J-pin of J-pin bottom sub (23) on tension shoulder in J-slot of J-body (20). Rotate J-body (20) as necessary (Fig. 5).

H-1.19) Align threaded holes in J-body (20) with recessed holes in rubber mandrel cap (19). Screw shear screws (3) in J-body (20). Tighten until shear screws (3) make contact with rubber mandrel cap (19). Back shear screws (3) out 1/4 turn.

NOTE$_{11}$: If needed, back off J-pin bottom sub (23). No more than 1/8 turn (45°) should be needed.

H-1.20) Screw drag block body (18) onto J-body (20). (**NOTE$_5$**: Left-hand threads).

NOTE$_6$: Drag block body assembly must be free to rotate.

H-1.21) Screw set screws (31) into drag block body (18).

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

I) PARTS LIST

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60177 (33.7-39.0#)	P/N 60178 (24.0-29.7#)
1	1	TOP SUB	1026	60173610	
2	1	INNER MANDREL	1026	60373210	
3	16	SHEAR SCREW (2375#)	BRASS	60100990	
4	1	COMPRESSION SPRING	CHROME VANADIUM	60373920	
5	1	SPRING CAGE	1026	60174310	
6	1	UPPER SLIP BODY	1026	60377320	
7	1	RELEASING SLIP	P-110	60075125	
8	2	UPPER SLIP	1026	60075115	
9	1	UPPER CONE	1026	60377410	
10	1	CENTER COUPLING	1026	60273620	
11	1	RUBBER MANDREL	1026	60073220	
12	2	RUBBER SPACER	1026	60277840	60378840
13	1	ELEMENT	70 DURO NITRILE	60277511	60278511
14	2	ELEMENT	90 DURO NITRILE	60277513	60278513
15	1	RUBBER RETAINER	1026	60377850	
16	1	LOWER CONE	1026	60377421	
17	4	LOWER SLIP	1026	60075135	
18	1	DRAG BLOCK BODY	1026	60377335	
19	1	RUBBER MANDREL CAP	1026	60173230	
20	1	J-BODY	1026	60173340	
21	1	DRAG BLOCK RETAINER	1026	60377910	
22	2	CAP SCREW 3/8-16 UNC X 3/4	STEEL	SCS037C075	
23	1	BOTTOM SUB	P-110/1026	60373650	
24	1	BONDED SEAL	NITRILE	60073520	
25	8	LOWER SLIP SPRING	ELGILOY	7170901	
26	6	UPPER SLIP SPRING	ELGILOY	7170902	
27	1	SPRING CAGE CAP	1026	60174810	
28	1	SPRING RETAINER RING	1026	60073820	
29	2	GAGE RING	1026	60277830	60378830
30	2	SET SCREW 1/4-20 UNC X 3/8	STEEL	SSS025C037	
31	3	SET SCREW 3/8-16 UNC X 1/2	STEEL	SSS037C050	
32	1	LOWER SLIP SUPPORT	1026	60377912	
33	1	UPPER SLIP SUPPORT	1026	60377880	

I) PARTS LIST (cont'd)

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60177 (33.7-39.0#)	P/N 60178 (24.0-29.7#)
34	1	155 O-RING	90 DURO NITRILE	90155	
35	1	237 O-RING	90 DURO NITRILE	90237	
36	1	243 O-RING	90 DURO NITRILE	90243	
37	8	SHEAR SCREW (5500#) 1/2-13 UNC X 7/16	BRASS	BSSSLT050C043*	

*Refer to WLAK tech manual for placement.

REDRESS KIT (RDK)		60177050	60178050
ASSEMBLED WEIGHT		358 LBS	360 LBS

J) OPTIONS PARTS LIST

J-1) HSN

NOTE$_{12}$: For temperature range, refer to element selection guide.

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60177H (33.7-39.0#)	P/N 60178H (24.0-29.7#)
13	1	ELEMENT	70 DURO HSN	60277511H	60278511H
14	2	ELEMENT	90 DURO HSN	60277513H	60278513H
34	1	155 O-RING	90 DURO HSN	90155H	
35	1	237 O-RING	90 DURO HSN	90237H	
36	1	243 O-RING	90 DURO HSN	90243H	

REDRESS KIT (RDK)		60177050H	60178050H

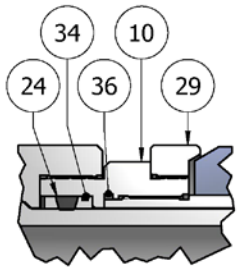
J-2) VITON

NOTE$_{12}$: For temperature range, refer to element selection guide.

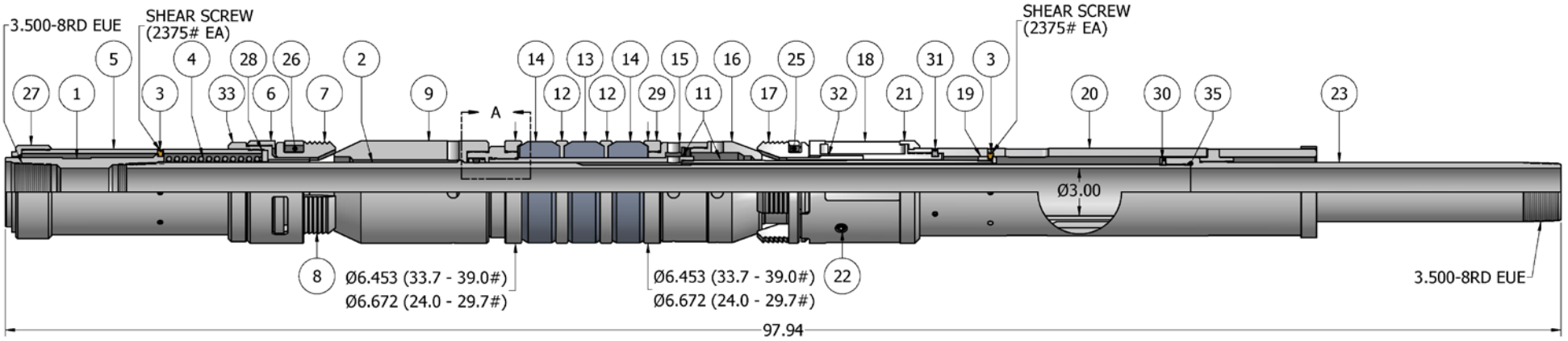
ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60177V (33.7-39.0#)	P/N 60178V (24.0-29.7#)
13	1	ELEMENT	70 DURO VITON	60277511V	60278511V
14	2	ELEMENT	90 DURO VITON	60277513V	60278513V
34	1	155 O-RING	90 DURO VITON	90155V	
35	1	237 O-RING	90 DURO VITON	90237V	
36	1	243 O-RING	90 DURO VITON	90243V	

REDRESS KIT (RDK)		60177050V	60178050V

K) TECHNICAL ILLUSTRATION



DETAIL A



L) REVISION HISTORY

DATE	REVISION	DESCRIPTION OF CHANGES	REVISED BY	APPROVED BY
01/17/14	A	Created new manual	-	-