



# VSI-X PACKER

## 5-1/2" X 2-7/8"

Manual No:  
**DL-601-5500-245**

Revision: **E**

Revision Date:  
**04/17/2014**

Authored by: B.Mathis

Approved by: D.Hushbeck

### 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 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 Wireline Plug installed can be attached to the top of the VSI-X Packer which 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 converts to a mechanically set ASI-X Packer by removing the shear screws and installing drag blocks and drag block springs. The VSI-X Packer sets with 1/4 right-hand rotation; and releases with 1/4 right-hand rotation and can be left in tension, compression or neutral.

**NOTE<sub>1</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.

**NOTE<sub>2</sub>:** Stinger and Wireline Adapter Kit (WLAK) sold separately.

### B) RELATED TOOLS

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

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

### C) SPECIFICATION GUIDE

CASING		RECOMMENDED HOLE SIZE (INCHES)	TOOL			THREAD CONNECTION BOX UP / PIN DOWN	PART NUMBER
SIZE (INCHES)	WEIGHT (LBS/FT)		OD (INCHES)	NOMINAL ID (INCHES)	DRIFT ID (INCHES)		
5-1/2	13.0 – 14.0#	5.012 – 5.044	4.813	2.38	2.347	2-7/8 EUE	60158 60158H <sup>1</sup> 60158V <sup>2</sup>
	14.0 – 20.0#	4.778 – 5.012	4.625	2.38	2.347	2-7/8 EUE	60156 60156H <sup>1</sup> 60156V <sup>2</sup>
	20.0 – 23.0#	4.670 – 4.778	4.500	2.38	2.347	2-7/8 EUE	60159 60159H <sup>1</sup> 60159V <sup>2</sup>

<sup>1</sup>HSN Option

<sup>2</sup>Viton Option

**NOTE<sub>3</sub>:** Tools listed are right-hand set / right-hand release.

**NOTE<sub>4</sub>:** 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	76,000 LBS

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



# VSI-X PACKER

## 5-1/2" X 2-7/8"

Manual No:  
**DL-601-5500-245**

Revision: **E**

Revision Date:  
**04/17/2014**

Authored by: B.Mathis

Approved by: D.Hushbeck

### 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—unless stated otherwise. Properly tighten connections before operating tool (Fig. 1).

STUB ACME/ACME THREADS	INTERNAL TAPERED TUBING THREADS	PREMIUM THREADS
	2-7/8" EUE	
600 – 800 FT-LBS	1,650 – 3,000 FT-LBS	Consult thread manufacturer's recommendations.

Fig. 1 – General Thread Connection Torque Recommendations

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 (Fig. 1).

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 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 (800-1,000 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<sub>3</sub>:** 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.

### F) STORAGE PROCEDURES

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.



# VSI-X PACKER

## 5-1/2" X 2-7/8"

Manual No:  
**DL-601-5500-245**

Revision: **E**

Revision Date:  
**04/17/2014**

Authored by: B.Mathis

Approved by: D.Hushbeck

### G) PRESSURE AFFECTED AREA GUIDE

PACKER SIZE (INCHES)	TUBING SIZE (INCHES)	PRESSURE (SQ. INCHES)	
		ABOVE	BELOW
5-1/2" X 2-7/8"	2.375	2.06 DOWN	3.37 UP
	2.875	0	1.81 UP

**Example:** Consider a 5-1/2 X 2-7/8" 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. 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 5-1/2 X 2-7/8" VSI-X Packer set on 2.375" 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 2.06 in<sup>2</sup>. Multiplying the differential pressure (3,000 PSI) by the pressure affected area (2.06 in<sup>2</sup>) results in a downward force of 6,180 lbs. 6,180 lbs is the force which needs to be overcome when releasing the packer.

### H) 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

### 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 4-1/2" - 7-5/8" VSI-XW	AT100



# VSI-X PACKER

## 5-1/2" X 2-7/8"

Manual No:  
**DL-601-5500-245**

Revision: **E**

Revision Date:  
**04/17/2014**

Authored by: B.Mathis

Approved by: D.Hushbeck

### 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 set screws (6) from J-pin bottom sub (23). Move J-body (20) as needed for access to set screws (6).

J-1.3) Unscrew and remove J-pin bottom sub (23) from inner mandrel (2).

**NOTE<sub>5</sub>:** Drag block body assembly must be free to rotate.

J-1.3.1) Remove o-ring (32) from J-pin bottom sub (23).

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) (**NOTE<sub>6</sub>:** Left-hand threads).

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

**NOTE<sub>7</sub>:** 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).

**NOTE<sub>8</sub>:** For added leverage, insert rod through upper cone (9) as needed.

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

J-1.11.1) Remove gage ring (29), 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 (33) from center coupling (10).

J-1.12.1.1) Remove o-ring (31) from bonded seal (24).

J-1.13) Remove bearing bushing (30) and upper cone (9) from inner mandrel (2).

J-1.14) Wedge slips (7, 8) outwards (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).

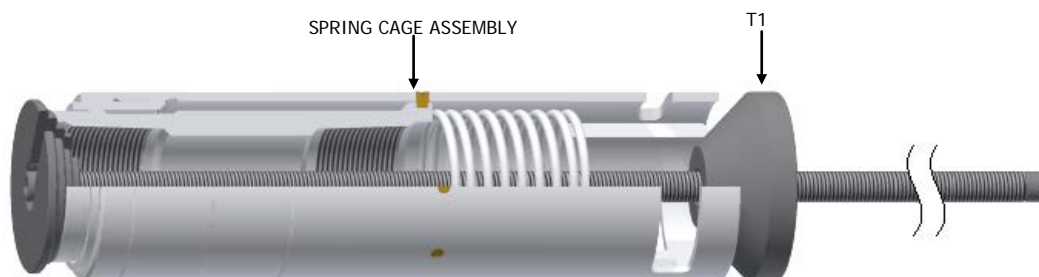


Fig. 2

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).

**CAUTION<sub>2</sub>:** Compression spring (4) is compressed with tension against spring cage assembly.

J-1.16.2) Unscrew and remove shear screws (3 or 28) from spring cage (5).



# VSI-X PACKER

## 5-1/2" X 2-7/8"

Manual No:  
**DL-601-5500-245**

Revision: **E**

Revision Date:  
**04/17/2014**

Authored by: B.Mathis

Approved by: D.Hushbeck

### J) DISASSEMBLY (cont'd)

J-1.16.3) 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-1.16.4) Unscrew spring cage cap (27) from spring cage (5).

J-1.16.5) Release remaining compression spring (4) tension by loosening assembly tool (T1). Remove tool from assembly.

J-1.16.6) 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<sub>9</sub>:** 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).

**NOTE<sub>10</sub>:** Press down top sub (1) to compress compression spring (4) as necessary.

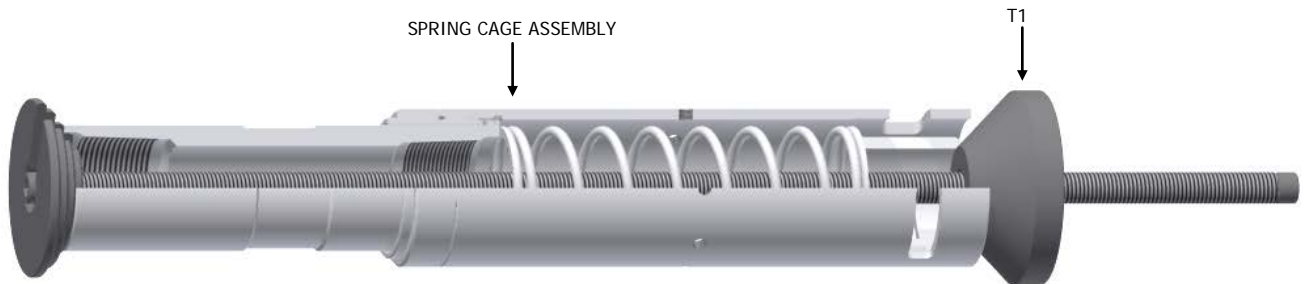


Fig. 3

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

K-1.1.4) Align threaded holes in spring cage (5) with recessed holes in top sub (1). Screw shear screws (3 or 28) into spring cage (5). Tighten until shear screws (3 or 28) make contact with top sub (1). Back shear screws (3 or 28) out 1/4 turn.

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

**CAUTION<sub>2</sub>:** 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<sub>11</sub>:** Install two (2ea) springs per slip (Fig. 4).

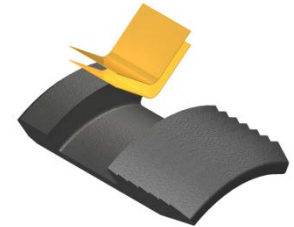


Fig. 4

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 lower end of inner mandrel (2). Slide upper cone (9) and bearing bushing (30) together up inner mandrel (2) until the flange of bearing bushing (30) comes in contact with shoulder of inner mandrel (2).

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

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

**CAUTION<sub>4</sub>:** Do not rip or tear o-ring during installation.

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



# VSI-X PACKER

## 5-1/2" X 2-7/8"

Manual No:  
**DL-601-5500-245**

Revision: **E**

Revision Date:  
**04/17/2014**

Authored by: B.Mathis

Approved by: D.Hushbeck

### K) ASSEMBLY (cont'd)

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

**NOTE<sub>8</sub>:** For added leverage, insert rod through upper cone (9) as needed.

**NOTE<sub>12</sub>:** If installing Ecnor element assembly, 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), 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).

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

**CAUTION<sub>4</sub>:** 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.

**NOTE<sub>11</sub>:** Install two (2ea) springs per slip (Fig. 5).

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

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

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

**NOTE<sub>7</sub>:** 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) (**NOTE<sub>6</sub>:** 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 (32) into groove in J-pin bottom sub (23).

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

**CAUTION<sub>4</sub>:** Do not rip or tear o-ring during installation.

**NOTE<sub>5</sub>:** Drag block body assembly must be free to rotate.

K-1.17) Align threaded holes in J-pin bottom sub (23) with groove in inner mandrel (2). Screw set screws (6) into J-pin bottom sub (23). Move J-body (20) as needed to access J-pin bottom sub (23) threaded holes.

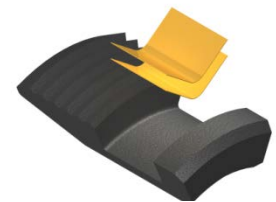


Fig. 5

Fig. 6




K-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. 6).

**NOTE<sub>5</sub>:** 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 (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) Unclamp top sub (1) from vise and remove assembled tool from vise.

	<b>VSI-X PACKER</b> <b>5-1/2” X 2-7/8”</b>	Manual No: <b>DL-601-5500-245</b>
		Revision: <b>E</b>
		Revision Date: <b>04/17/2014</b>
<i>Authored by: B.Mathis</i>		<i>Approved by: D.Hushbeck</i>

## L) PARTS LIST

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60156 (14.0 – 20.0#)	P/N 60158 (13.0 – 14.0#)	P/N 60159 (20.0 – 23.0#)
1	1	TOP SUB	L-80	60156610		
2	1	INNER MANDREL	L-80	60356210		60359210
3	-	SHEAR SCREW (2375#)	BRASS	60100990 16 EA		8 EA
4	1	COMPRESSION SPRING	CHROME VANADIUM	60356920		
5	1	SPRING CAGE	1026/L-80	60156325		60159325
6	2	SET SCREW 1/4-20 UNC	STEEL	SSS025C037 (3/8" LONG)		SSS025C043 (7/16" LONG)
7	1	RELEASING SLIP	P-110	60056125	60058125	60056125
8	2	UPPER SLIP	1026	60056115	60058115	60056115
9	1	UPPER CONE	1026	60356410		
10	1	CENTER COUPLING	1026	60056620		
11	1	RUBBER MANDREL	1026	60056220		60059220
12	2	RUBBER SPACER	1026	60256840	60258840	60259840
13	1	ELEMENT	DURO NITRILE	60256511	60258511	60259512
14	2	ELEMENT	DURO NITRILE	60256513	60258513	60259513
15	1	RUBBER RETAINER	1026	60256850	60258850	60259850
16	1	LOWER CONE	1026	60056420		60059420
17	4	LOWER SLIP	1026	60056135	60058135	60056135
18	1	DRAG BLOCK BODY	1026	60056335		60059335





# VSI-X PACKER

## 5-1/2" X 2-7/8"

Manual No:  
**DL-601-5500-245**

Revision: **E**

Revision Date:  
**04/17/2014**

Authored by: B.Mathis

Approved by: D.Hushbeck


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

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60156 (14.0 – 20.0#)	P/N 60158 (13.0 – 14.0#)	P/N 60159 (20.0 – 23.0#)
19	1	RUBBER MANDREL CAP	1026	60156230		
20	1	J-BODY	1026	60156340		
21	1	DRAG BLOCK RETAINER	1026	60056910	60058910	60059910
22	3	SET SCREW 5/16-20 UNC	STEEL	SSS031C037 (3/8" LONG)		SSS031C031 (5/16" LONG)
23	1	J-PIN BOTTOM SUB	P-110/1026	60056650		
24	1	BONDED SEAL	90 DURO NITRILE	60056520		
25	8	LOWER SLIP SPRING		7155901		
26	6	UPPER SLIP SPRING		7155902		
27	1	SPRING CAGE CAP	1018	60156810	60158810	60159810
28	8	SHEAR SCREW (2375#)	BRASS	-	-	90555990
29	1	GAGE RING	1026	60256830	60258830	60259830
30	1	BEARING BUSHING	1026	60056224		
31	1	151-90 O-RING		90151		
32	1	231-90 O-RING		90231		
33	1	235-90 O-RING		90235		
34	8	SHEAR SCREW (5500#) 1/2-13 UNC X 7/16	BRASS	BSSSLT050C043*		

\*Refer to WLAK technical manual for placement.

REDRESS KIT (RDK)		60156050	60158050	60159050
ASSEMBLED WEIGHT		177 LBS	179 LBS	166 LBS



	<b>VSI-X PACKER</b> 5-1/2" X 2-7/8"	Manual No: <b>DL-601-5500-245</b>
		Revision: <b>E</b>
		Revision Date: <b>04/17/2014</b>
Authored by: B.Mathis		Approved by: D.Hushbeck

## M) OPTIONS PARTS LIST

### M-1) HSN

**NOTE<sub>13</sub>:** For temperature range, refer to element selection guide.

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60156H (14.0 – 20.0#)	P/N 60158H (13.0 – 14.0#)	P/N 60159H (20.0 – 23.0#)
13	1	ELEMENT	DURO HSN	60256511H	60258511H	60259512H
14	2	ELEMENT	DURO HSN	60256513H	60258513H	60259513H
24	1	BONDED SEAL	90 DURO HSN	60056520H		
31	1	151-90 O-RING	90 DURO HSN	90151H		
32	1	231-90 O-RING	90 DURO HSN	90231H		
33	1	235-90 O-RING	90 DURO HSN	90235H		

REDRESS KIT (RDK)		60156050H	60158050H	60159050H
-------------------	--	-----------	-----------	-----------

### M-2) VITON

**NOTE<sub>13</sub>:** For temperature range, refer to element selection guide.

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 60156V (14.0 – 20.0#)	P/N 60158V (13.0 – 14.0#)	P/N 60159V (20.0 – 23.0#)
13	1	ELEMENT	DURO VITON	60256511V	60258511V	60259512V
14	2	ELEMENT	DURO VITON	60256513V	60258513V	60259513V
24	1	BONDED SEAL	90 DURO VITON	60056520V		
31	1	151-90 O-RING	90 DURO VITON	90151V		
32	1	231-90 O-RING	90 DURO VITON	90231V		
33	1	235-90 O-RING	90 DURO VITON	90235V		

REDRESS KIT (RDK)		60156050V	60158050V	60159050V
-------------------	--	-----------	-----------	-----------



# VSI-X PACKER

5-1/2" X 2-7/8"

Manual No:  
**DL-601-5500-245**

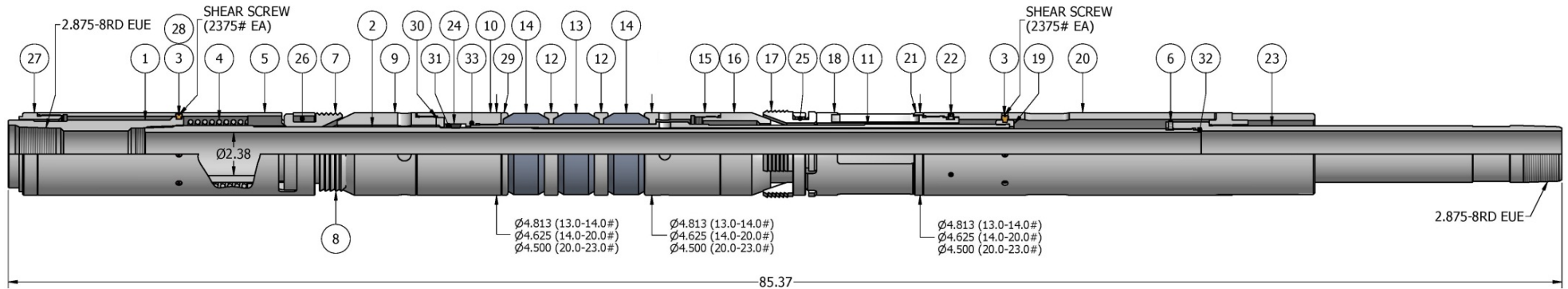
Revision: **E**


Revision Date:  
**04/17/2014**

Authored by: B.Mathis

Approved by: D.Hushbeck

## N) TECHNICAL ILLUSTRATION



	Manual No: <b>DL-601-5500-245</b>
	Revision: <b>E</b>
	Revision Date: <b>04/17/2014</b>
<div> <div> <b>VSI-X PACKER</b>  <b>5-1/2" X 2-7/8"</b> </div> <div> <i>Authored by: B.Mathis</i> </div> </div> <div> <i>Approved by: D.Hushbeck</i> </div>	

## O) REVISION HISTORY

DATE	REVISION	DESCRIPTION OF CHANGES	REVISED BY	APPROVED BY
04/17/14	E	Added related tools, tool drift ID, max. tensile load, note <sub>4</sub> for double hook j-slot packer, pre-installation inspection and storage procedures, note <sub>12</sub> for Ecner element assembly,	J.Anderson	J.McArthur
02/20/13	D	Revised disassembly and assembly instructions to include assembly tool, P/Ns 60156810, 60158810 and 60159810 material was 1026, P/N SSS031C031 was SSS025C031; Removed AFLAS from element selection guide; Added HSN and Viton assembly options (P/Ns 60156H, 60156V, 60158H, 60158V, 60159H, 60159V), recommended hand tools, options parts lists and revision history sections, references to Tech Manual 971-5500-440 for WLAK;	J.Anderson	K.Plunkett