A) DESCRIPTION

The LC Hydraulic Setting Tool (HST) is used to set packers and plugs on tubing that are normally set on wireline. This allows setting in high-angle wells or deviated wells where it is difficult to use wireline equipment. The LC HST allows for packers and plugs to be set with a combination of hydraulic and mechanical forces. This can reduce the setting pressure needed by supplementing the set with tubing tension. A single size LC HST may be used to set a multitude of packer sizes by simply attaching the proper size LC Hydraulic Adapter Kit.

NOTE$_1$: The Setting Kit with tripping ball is sold separately. Contact D&L with your requirements.

B) SPECIFICATION GUIDE

SIZE	**TOOL OD** (INCHES)	**TOOL ID** (INCHES)	**THREAD CONNECTION** BOX UP / PIN DOWN	**PART NUMBER**
#20	4.75	2.00	3-1/2 IF TOOL JOINT / 2-3/4 STUB ACME	39420 39420H[1] 39420V[2]

Elastomer Trim Options: [1]HSN, [2]Viton

NOTE$_2$: Other thread connections available. Contact D&L Sales for more information**.**

DIFFERENTIAL PRESSURE (MAX)	**TENSILE LOAD THRU TOOL** (MAX)
10,000 PSI	180,000 LBS

C) PRE-INSTALLATION INSPECTION PROCEDURES

CAUTION$_1$: 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

C) PRE-INSTALLATION INSPECTION PROCEDURES (cont'd)

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.

D) SETTING PROCEDURES

CAUTION[2]: Do not run the tool without properly tightening connections. Running the tool with loose connections may damage the tool and cause malfunction.

D-1) Run the packer on tubing at a uniform rate. Slowly stop tubing with brake without jerking, and the drop slips in place. If using a solid setting nut, DO NOT ROTATE THE TUBING TO THE RIGHT.

D-2) To remove the tubing slips: slowly pick up - without jerking – the desired amount.

D-3) When the desired depth is reached, drop the tripping ball into the running-in string. Allow approximately 5 minutes per 1,000 ft for the ball to gravitate to the ball seat in water.

NOTE[3]: The ball size varies depending on the setting equipment used.

D-4) Determine the setting force requirement for the packer by referring to the tech manual for the specific packer being run.

D-5) Calculate the required setting pressure required to obtain the recommended packer setting force (see Force Table).

D-6) Once the full setting force has been applied, bleed off the tubing pressure and set down as much weight as possible without damaging the running-in string, but DO NOT EXCEED THE SETTING FORCE REQUIREMENTS.

D-7) Pressure test the annulus while monitoring tubing. If the well has not been perforated below the packer, or a solid setting nut is used, pressure testing can be accomplished by pressuring tubing and monitoring the annulus.

D-8) If using a solid setting nut, the tool may now be rotated out of the packer with right-hand rotation.

E) FORCE TABLE

PRESSURE (PSI)	**FORCE APPLIED TO PACKER** (LBS - BASED ON 5 CYLINDERS)
1,000	23,000
1,500	34,500
2,000	46,000
2,500	57,500
3,000	69,000
3,500	80,500
4,000	92,000

F) ELASTOMER TRIM TEMPERATURE GUIDE

RUBBER TYPE	TEMPERATURE RANGE
NITRILE	40° - 250°F
HSN (HNBR)	70° - 300°F
VITON	100° - 350°F

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.

H) RECOMMENDED 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
- STRAP WRENCH
- 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) DISASSEMBLY

NOTE$_4$: Support tool during disassembly with jack stands as necessary.

I-1) Clamp top sub (1) in vise.

I-1.1) From lower end of tool, unscrew and remove set screws (17) from adapter sub (7).

I-1.2) Unscrew and remove adapter sub (7) from coupling (6).

I-1.3) Disassemble cylinder assembly:

I-1.3.1) Unscrew and remove coupling (6) from sleeve (5).

I-1.3.1.1) Remove o-rings (10, 12) from coupling (6).

I-1.3.2) Unscrew and remove set screws (17) from sleeve (5).

I-1.3.3) Unscrew and remove sleeve (5) from coupling (6).

I-1.3.4) Unscrew and remove set screws (15) from body extension (4).

I-1.3.5) Unscrew and remove body extension (4) from body extension (4).

I-1.3.5.1) Remove o-rings (9, 11) from body extension (4).

I-1.3.6) Repeat steps for disassembly of each cylinder as needed for each cylinder assembly.

I-1.4) Unscrew uppermost coupling (6) from sleeve (5) and remove from mandrel (2).

I-1.4.1) Remove o-rings (10, 12) from coupling (6).

I-1.5) Unscrew and remove shear screws (16) from sleeve (5).

I-1.6) Unscrew sleeve (5) from adjusting head (3) and remove from mandrel (2).

I-1.7) Unscrew and remove set screws (13) from top sub (1).

I-1.8) Unscrew and remove mandrel (2) from top sub (1).

I-1.8.1) Remove o-ring (11) from mandrel (2).

I-1.8.2) Unscrew and remove set screws (14) from adjusting head (3).

I-1.8.3) Unscrew and remove adjusting head (3) from mandrel (2).

I-2) Remove top sub (1) from vise.

I-2.1) Remove o-ring (8) from top sub (1).

J) ASSEMBLY

NOTE5: Clean and inspect all parts. Replace all worn and damaged parts. Install parts in proper order, and orientation and tighten/torque all connections properly.

CAUTION3: To ensure tool operates properly, install o-rings in o-ring grooves **NOT** thread reliefs (Fig. 2).

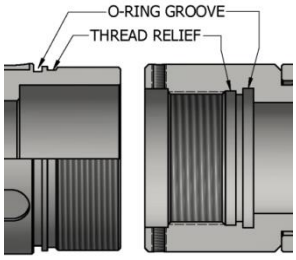


Fig. 2

NOTE4: Support tool during assembly with jack stands as necessary.

J-1) Install o-ring (8) in o-ring groove in top sub (1).

J-2) Clamp top sub (1) in vise.

J-2.1) Assemble mandrel assembly and install:

J-2.1.1) Install o-ring (11) in o-ring groove in mandrel (2).

J-2.1.2) Screw adjusting head (3) onto mandrel (2).

J-2.1.3) Screw set screws (6) into adjusting head (3).

J-2.1.4) Screw mandrel (2) into top sub (1).

CAUTION4: Do not rip or tear o-ring during installation.

J-2.1.5) Screw set screws (8) into top sub (1).

J-2.2) Install sleeve (5) onto mandrel (2) and onto adjusting head (3). Shear screws (16) will be installed in later step.

CAUTION4: Do not rip or tear o-ring during installation.

J-2.3) Install o-rings (10, 12) in o-ring grooves in coupling (6).

J-2.4) Install coupling (6) onto mandrel (2) and screw into sleeve (5).

CAUTION4: Do not rip or tear o-rings during installation.

J-2.5) Install cylinder assemblies:

J-2.5.1) Install o-rings (9, 11) in o-ring grooves in body extension (4).

J-2.5.2) Screw body extension (4) onto mandrel (2).

CAUTION4: Do not rip or tear o-ring during installation.

J-2.5.3) Screw set screws (15) into body extension (4).

J-2.5.4) Install sleeve (5) onto body extension (4) and screw onto coupling (6).

CAUTION4: Do not rip or tear o-ring during installation.

J-2.5.5) Screw set screws (7) into sleeve (5).

J-2.5.6) Install o-rings (10, 12) in o-ring grooves in coupling (6).

J-2.5.7) Install coupling (6) onto body extension (4) and screw into sleeve (5).

CAUTION4: Do not rip or tear o-rings during installation.

J-2.5.8) Repeat steps for installation of each cylinder assembly as needed. After first cylinder assembly is installed, body extension (4) installed in step J-2.5.2 will be screwed onto previously installed body extension (4).

J-2.6) Screw adapter sub (7) onto coupling (6).

J-2.7) Screw set screws (17) into adapter sub (7)

J-2.8) Moving to upper end of tool, screw shear screws (16) into uppermost sleeve (5). Tighten until shear screws (16) contact adjusting head (3). Back shear screws (16) out 1/4 turn.

J-3) Unclamp top sub (1) from vise and remove assembled tool.

K) PARTS LIST

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 39420
1	1	TOP SUB	P-110	39420610
2	1	MANDREL	P-110	39420210
3	1	ADJUSTING HEAD	P-110	NCB220HST-005
4	4	BODY EXTENSION	P-110	39420211
5	5	SLEEVE	P-110	NCB220HST-004
6	5	COUPLING	P-110	NCB220HST-012
7	1	ADAPTER SUB - BUSHING THREAD	P-110	NCB220HST-010
8	1	231 O-RING	90 DURO NITRILE	90231
9	4	230 O-RING	90 DURO NITRILE	90230
10	5	336 O-RING	90 DURO NITRILE	90336
11	5	340 O-RING	90 DURO NITRILE	90340
12	5	238 O-RING	90 DURO NITRILE	90238
13	4	SET SCREW 1/4-20 UNC X 1/2	STEEL	SSS025C050
14	2	SET SCREW 5/16-18 UNC X 5/8	STEEL	SSS031C062
15	16	SET SCREW 1/4-20 UNC X 3/8	STEEL	SSS025C037
16	12	SHEAR SCREW (2000#) 5/16-18 UNC X 5/16	BRASS	BSSSLT031C031
17	51	SET SCREW 5/16-18 UNC X 5/16	STEEL	SSS031C031

REDRESS KIT (RDK)		39420050
ASSEMBLED WEIGHT		334 LBS

K) PARTS LIST (cont'd)

K-1) ELASTOMER TRIM OPTIONS

NOTE$_5$: For temperature range, refer to Elastomer Trim Temperature Guide.

K-1.1) HSN

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 39420H
8	1	231 O-RING	90 DURO HSN	90231H
9	4	230 O-RING	90 DURO HSN	90230H
10	5	336 O-RING	90 DURO HSN	90336H
11	5	340 O-RING	90 DURO HSN	90340H
12	5	238 O-RING	90 DURO HSN	90238H

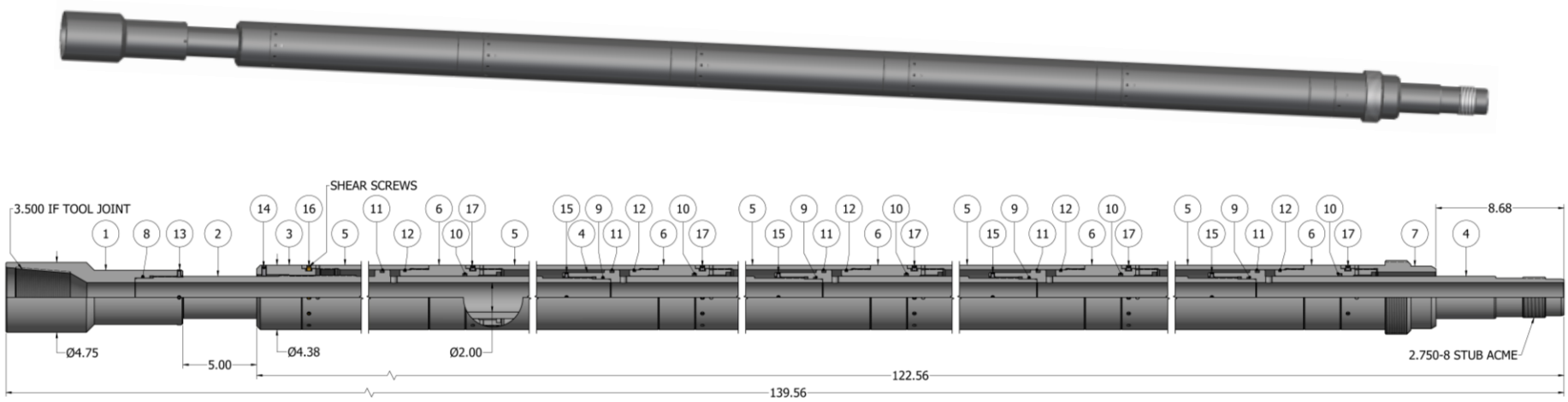
REDRESS KIT (RDK)		39420050H

K-1.2) VITON

ITEM	QTY	DESCRIPTION	MATERIAL	P/N 39420V
8	1	231 O-RING	90 DURO VITON	90231V
9	4	230 O-RING	90 DURO VITON	90230V
10	5	336 O-RING	90 DURO VITON	90336V
11	5	340 O-RING	90 DURO VITON	90340V
12	5	238 O-RING	90 DURO VITON	90238V

REDRESS KIT (RDK)		39420050V

L) TECHNICAL ILLUSTRATION



M) REVISION HISTORY

DATE	REVISION	DESCRIPTION OF CHANGES	REVISED BY	APPROVED BY
11/01/2019	C	Added General Screw Torque Recommendations; Revised Elastomer Trim Temp. Guide ratings	J.Anderson	E.Visaez
10/02/2015	B	Revised P/N 39420 was 39420-CBEE; Added HSN and Viton options, Pre-Installation Inspection Procedures, Storage Recommendations, Elastomer Trim Temperature Guide, Recommended Hand Tools, Assembly	J.Anderson	K.Riggs