A) DESCRIPTION

The HD Retrievable Packer is a heavy duty service packer ideally suited for all types of squeeze cementing, formation fracturing, high pressure acidizing, etc. It is a large opening compression set packer with hydraulic button-type hold down. This packer withstands high pressure from above or below and uses a 3-element packing system, J-slot, and a drag block mechanism for easy setting. The packer has a built-in unloader which circulates across the hold down buttons to improve retrievability and run in performance.

B) 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	2.00	2-3/8 EUE	61357RM 61357RMH[1] 61357RMV[2]
	20.0 – 23.0	4.670 – 4.778	4.500	2.00	2-3/8 EUE	61356RM 61356RMH[1] 61356RMV[2]

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

NOTE$_1$: Tools listed are right-hand set/ straight pick-up release. Additional configurations are available. Contact D&L Sales for more information.

DIFFERENTIAL PRESSURE (MAX)	TORQUE (MAX)	TENSILE LOAD THRU TOOL (MAX)	HANGING WEIGHT (MAX)
10,000 PSI	2,000 FT-LBS	70,500 LBS	70,500 LBS[†]

[†]Casing must be cemented for this load rating.

CAUTION$_1$: Before running the tool, check the pressure affected areas chart, and consider other effects to be certain that the unloader will remain closed during operation.

CAUTION$_2$: If the HD Packer is run with a retrievable bridge plug, make sure the bridge plug J-slot is compatible with the J-slot on the packer. Whichever direction you set the plug, the packer should set in the opposite direction.

C) PRE-INSTALLATION INSPECTION PROCEDURES

CAUTION$_3$: 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).

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.

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

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.

D) SETTING PROCEDURES

CAUTION$_4$: Do not run the tool without properly tightening connections. Running the tool with loose connections may damage the tool and cause malfunction.

Run to setting depth. The unloader remains open while running in. Pick up the work string and rotate to the right 1/4 turn at the packer. Slack off weight and set down on the packer to set the slips, close the unloader and compress the packing elements. A minimum weight of 14,000 lbs. at the packer is required to pack off the elements.

CAUTION$_5$: Run the tool slowly, as with any hold down type packer, to help prevent dulling of the hydraulic buttons.

E) RELEASING PROCEDURES

Pick up on the work string to open the unloader, allowing time for the tubing and casing pressure to equalize. Continued upward movement of the work string unsets the slips, relaxes the packing elements and re-jays the packer. Rotate to the left 1/4 turn at the packer to return J-pin to the running position. The tool may now be moved and reset, or pulled from the well.

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. Elastomers 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.

G) PRESSURE AFFECTED AREAS 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 (IN)	**TUBING TO PACKER**			**PRESSURE AFFECTED AREA** (IN^2)			
	SIZE (IN)	**WEIGHT** (LB/FT)	**ID** (IN)	**ABOVE**		**BELOW**	
5-1/2	1.900	2.40	1.650	1.150	(DOWN)	2.424	(DOWN)
		2.90	1.610	1.150	(DOWN)	2.322	(DOWN)
	2.375	4.00	2.041	-0.445	(UP)	3.557	(DOWN)
		4.70	1.995	-0.445	(UP)	3.412	(DOWN)
		5.95	1.867	-0.445	(UP)	3.023	(DOWN)
	2.875	6.50	2.441	-2.507	(UP)	4.965	(DOWN)
		7.90	2.323	-2.507	(UP)	4.524	(DOWN)
		8.70	2.259	-2.507	(UP)	4.294	(DOWN)
	3.500	7.70	3.068	-5.636	(UP)	7.678	(DOWN)
		9.30	2.992	-5.636	(UP)	7.317	(DOWN)
		10.20	2.922	-5.636	(UP)	6.991	(DOWN)
		12.95	2.750	-5.636	(UP)	6.225	(DOWN)

Example: Consider a 5-1/2" X 2-3/8" HD Packer set on 2.375", 4.70 lb/ft 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" X 2-3/8" HD Packer run on 2.375", 4.70 lb/ft 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 -0.445 in^2. Multiplying the differential pressure (3,000 PSI) by the pressure affected area (-0.445 in^2) results in a force of -1,335 lbs. The piston effect on the packer mandrel is an upward force of 1,335 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** (F°)
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	DRAG BLOCK ASSEMBLY TOOL	AT055110
T2	1	BUTTON REMOVAL TOOL	AT-BRT000
T3	1 GAL	KOPR-KOTE® ANTI-SEIZE LUBRICANT	DL-KOPR-KOTE-1G

J) DISASSEMBLY

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

J-1.1) Beginning from lower end of tool, unscrew and remove set screws (7) from J-pin bottom sub (23). Move J-body (20) as necessary to access screws.

J-1.2) Unscrew and remove J-pin bottom sub (23) from inner mandrel (2).

NOTE3: Drag block body must be free to rotate.

J-1.2.1) Remove o-ring (37) from J-pin bottom sub (23).

J-1.3) Unscrew and remove set screws (34) from J-body (20).

J-1.4) Compress drag blocks (22) with drag block assembly tool (T1).

J-1.5) Unscrew and remove J-body (20) from drag block body (18) (**NOTE4**: Left-hand threads).

J-1.6) Remove drag block retainer (21) from drag block body (18).

J-1.7) Release drag blocks (22). Remove drag blocks (22) and drag block springs (3) from drag block body (18).

J-1.8) Unscrew and remove rubber mandrel cap (19) from rubber mandrel (11).

NOTE5: For added leverage, insert a rod through rubber retainer (15) and rubber mandrel (11) as needed.

J) DISASSEMBLY (cont'd)

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

J-1.9.1) Remove wedges (if needed). 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 (11).

J-1.11) Unscrew rubber mandrel (11) from valve body (28).

J-1.12) Remove rubber mandrel assembly and disassemble:

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

J-1.13) Unscrew and remove valve body (28) from central body (10).

J-1.13.1) Remove o-ring (39) from valve body (28).

J-1.14) Unscrew and remove central body (10) from hold down body (6).

J-2) Unclamp and remove top sub (1) from vise. Clamp inner mandrel (2) in vise.

CAUTION8: Do NOT wrench or clamp on seal surface.

J-2.1) From upper end of tool, unscrew and remove set screws (29) from top sub (1).

J-2.2) Unscrew and remove top sub (1) from inner mandrel (2).

J-2.2.1) Remove o-ring (38) from top sub (1).

J-2.3) Unscrew and remove hold down extension (33) from hold down body (6).

J-2.3.1) Remove o-ring (42) from hold down extension (33).

J-2.4) Unscrew and remove hold down cap (4) from hold down body (6).

J-2.5) Remove strap retainer (32) from hold down body (6) and move out of way to be removed from inner mandrel (2) in later step.

J-2.6) Unscrew and remove flat head cap screws (35) from hold down body (6).

J-2.7) Remove hold down straps (31) from hold down body (6).

J-2.8) Remove hold down button springs (26) from hold down buttons (30).

J-2.9) Remove hold down buttons (30) from hold down body (6) with button removal tool (T2).

J-2.9.1) Remove o-rings (36) from hold down buttons (30).

J-2.10) Remove hold down body (6) from inner mandrel (2).

J-2.10.1) Remove o-rings (40, 41) from hold down body (6).

J-2.11) Remove strap retainer (32) from inner mandrel (2).

J-2.12) Unscrew and remove compensating mandrel (8) from seal receptacle (5).

J-2.12.1) Remove compensating piston (9) from compensating mandrel (8).

J-2.12.2) Remove o-rings (43, 44) from compensating piston (9).

J-3) Unclamp and remove inner mandrel (2) from vise.

J-3.1) Remove seal receptacle (5) from inner mandrel (2).

J-3.1.1) Unscrew and remove seal retainer (27) from seal receptacle (5).

J-3.1.1.1) Remove o-rings (39, 40) and quad seal (24) from seal receptacle (5).

K) ASSEMBLY

NOTE6: Clean and inspect all parts. Replace all worn and damaged parts. Install parts in proper order, and orientation and tighten/torque all connections properly.

NOTE2: Apply KOPR-KOTE anti-seize lubricant (T1) on STUB ACME and drill pipe connections when making up connections.

CAUTION6: To ensure tool operates properly, install o-rings in o-ring grooves **NOT** thread reliefs (Fig. 2).

K-1) Assemble seal receptacle assembly and install:

K-1.1) Install o-rings (39, 40) in o-ring grooves in seal receptacle (5).

K-1.2) Set quad seal (24) in place on seal receptacle (5).

K-1.3) Screw seal retainer (27) onto seal receptacle (5).

CAUTION7: Do not rip or tear o-rings or seal during installation.

K-1.4) Install seal receptacle assembly onto inner mandrel (2).

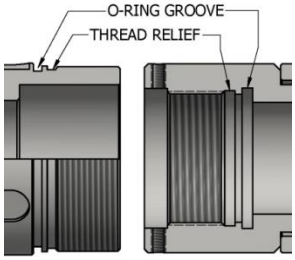


Fig. 2

K-2) Clamp lower end of inner mandrel (2) in vise.

CAUTION8: Do NOT wrench or clamp on seal surface.

K-2.1) Assemble compensating mandrel assembly and install:

K-2.1.1) Install o-rings (43, 44) into o-ring grooves in compensating piston (9).

K-2.1.2) Install compensating piston (9) onto compensating mandrel (8).

NOTE8: Compensating piston (9) MUST be installed in correct direction (refer to Technical Illustration, Det. A).

CAUTION7: Do not rip or tear o-ring during installation.

K-2.2) Screw compensating mandrel (8) into seal receptacle (5).

K-2.3) Install strap retainer (32) onto inner mandrel (2) to be installed onto hold down body (6) in later step.

K-2.4) Install o-rings (40, 41) in o-ring grooves in hold down body (6).

K-2.5) Install hold down body (6) onto inner mandrel (2).

K-2.6) Install o-ring (42) into o-ring groove in hold down extension (33).

K-2.7) Screw hold down extension (33) into hold down body (6).

CAUTION7: Do not rip or tear o-ring during installation.

K-2.8) Assemble hold down buttons (30) and install:

K-2.8.1) Install o-rings (36) in o-ring grooves in hold down buttons (30).

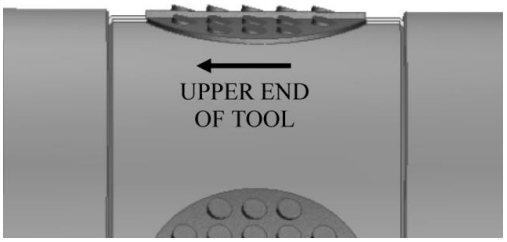


Fig. 3

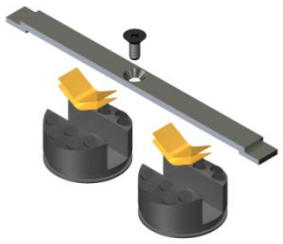


Fig. 4

K-2.8.2) Install hold down buttons (30) into hold down body (6) (Fig. 3). Align slot in hold down buttons (30) with slot in hold down body (6).

CAUTION7: Do not rip or tear o-rings during installation.

K-2.8.3) Install hold down button springs (26) into hold down buttons (30).

NOTE7: Install two (2ea) springs per button (Fig. 4).

K) ASSEMBLY (cont'd)

K-2.8.4) Set hold down straps (31) in slots in hold down buttons (30) and hold down body (6).

K-2.8.5) Screw flat head cap screws (35) into hold down body (6).

K-2.9) Install strap retainer (32)—installed in prior step—onto hold down body (6) to capture lower ends of hold down straps (31).

K-2.10) Screw hold down cap (4) onto hold down body (6) to capture upper ends of hold down straps (31).

K-2.11) Install o-ring (38) into o-ring groove in top sub (1).

K-2.12) Screw top sub (1) onto inner mandrel (2).

CAUTION$_7$: Do not rip or tear o-ring during installation.

K-2.13) Screw set screws (29) into top sub (1).

K-3) Unclamp and remove inner mandrel (2) from vise. Clamp top sub (1) in vise.

K-3.1) Screw central body (10) onto hold down body (6).

CAUTION$_7$: Do not rip or tear o-rings during installation.

K-3.2) Install o-ring (39) into o-ring groove in valve body (28).

K-3.3) Screw valve body (28) into central body (10).

K-3.4) Assemble rubber mandrel assembly and install:

K-3.4.1) Install rubber retainer (15), rubber spacers (12), and elements (13, 14) onto rubber mandrel (11).

K-3.4.2) Install rubber mandrel assembly onto inner mandrel (2) and screw rubber mandrel (11) into valve body (28).

CAUTION$_7$: Do not rip or tear o-ring during installation.

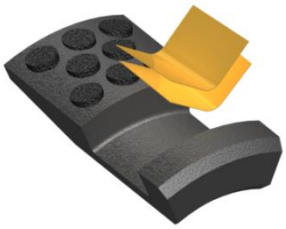


Fig. 5

K-3.5) Screw lower cone (16) into rubber retainer (11).

K-3.6) Assemble drag block body assembly and install:

K-3.6.1) Install lower slips (17) and lower slip springs (25). Wedge slips outward.

NOTE$_7$: Install two (2ea) springs per slip (Fig. 5).

K-3.6.2) Install drag block body assembly onto rubber mandrel (11). Remove wedges.

K-3.7) Screw rubber mandrel cap (19) onto rubber mandrel (11).

NOTE$_5$: For added leverage, insert a rod through rubber retainer (15) and rubber mandrel (11) as needed.

K-3.8) Install drag blocks (22) and drag block springs (3) into drag block body (18). Compress drag blocks (22) with drag block assembly tool (T1).

NOTE$_9$: Install five (5ea) drag block springs per drag block (Fig. 6).

K-3.9) Install drag block retainer (21) onto drag block body (18) to capture ends of drag blocks (22).

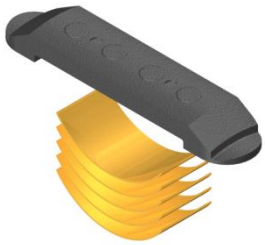


Fig. 6

K-3.10) Screw J-body (20) onto drag block body (18) (**NOTE$_4$**: Left-hand threads).

K-3.11) Screw set screws (34) into J-body (20). Release drag blocks (22).

K-3.12) Install o-ring (37) into o-ring groove in J-pin bottom sub (23).

K-3.13) Screw J-pin bottom sub (23) onto inner mandrel (2).

NOTE$_3$: Drag block body must be free to rotate.

CAUTION$_7$: Do not rip or tear o-ring during installation.

K-3.14) Screw set screws (7) into J-pin bottom sub (23). Move J-body (20) as needed to access threaded holes in J-pin bottom sub (23).

K-4) Unclamp top sub (1) from vice and remove assembled tool.

L) PARTS LIST

ITEM	QTY	DESCRIPTION	MATERIAL	14.0 – 20.0# P/N 61357RM	20.0 – 23.0# P/N 61356RM
1	1	TOP SUB	DLMS110	61355615	
2	1	MANDREL	DLMS110	61355215	
3	30	DRAG BLOCK SPRING	-	9100900	
4	1	HOLD DOWN CAP	DLMS110	61355370	61357370
5	1	SEAL RECEPTACLE	DLMS110	61355730	
6	1	HOLD DOWN BODY	DLMS110	61357321	
7	4	SET SCREW 3/8-16 UNC X 1/2	STEEL	SSS037C050	
8	1	COMPENSATING MANDREL	DLMS110	61355240	
9	1	COMPENSATING PISTON	DLMS110	61355710	
10	1	CENTRAL BODY	DLMS110	61355381	
11	1	RUBBER MANDREL	DLMS110	61355220	61357220
12	2	RUBBER SPACER	DLMS60	60255840	60257840
13	1	ELEMENT	80 DURO NITRILE	60255512	60257512
14	2	ELEMENT	90 DURO NITRILE	60255513	60257513
15	1	RUBBER RETAINER	DLMS110	61155850HT	61157850HT
16	1	LOWER CONE	DLMS110	60055420HT	
17	4	LOWER SLIP W/ CARBIDE	DLMS110	60055135C	
18	1	DRAG BLOCK BODY	P-110/1026	61357335	61355335
19	1	RUBBER MANDREL CAP	DLMS60	60055230	
20	1	J-BODY	P-110	61355342	
21	1	DRAG BLOCK RETAINER	DLMS60	60055910	60057910
22	6	DRAG BLOCK W/ CARBIDE	DLMSDB4	9055900C	9045900C
23	1	BOTTOM SUB	DLMS110	61355635	
24	1	QUAD SEAL	90 DURO NITRILE	61355520	
25	8	LOWER SLIP SPRING	-	7155901	
26	12	HOLD DOWN BUTTON SPRING	-	61355975	
27	1	SEAL RETAINER	DLMS80	61355530	
28	1	VALVE BODY	DLMS110	61355350	61357350
29	3	SET SCREW 3/8-16 UNC X 3/8	STEEL	SSS037C037	
30	6	HOLD DOWN BUTTON W/ CARBIDE	DLMS110	61357140C	61356140C

L) PARTS LIST (cont'd)

ITEM	QTY	DESCRIPTION	MATERIAL	14.0 – 20.0# P/N 61357RM	20.0 – 23.0# P/N 61356RM
31	3	HOLD DOWN STRAP	DLMSFB4	61355360	
32	1	STRAP RETAINER	DLMS60	61355650	61357650
33	1	HOLD EXTENSION	DLMS110	61355310	
34	4	SET SCREW 5/16-18 UNC X 1/2	STEEL	SSS031C050	
35	3	FLAT HEAD CAP SCREW 5/16-18 UNC X 1/2	STEEL	FHSC031C050	
36	6	224 O-RING	90 DURO NITRILE	90224	
37	1	229 O-RING	90 DURO NITRILE	90229	
38	1	231 O-RING	90 DURO NITRILE	90231	
39	2	235 O-RING	90 DURO NITRILE	90235	
40	2	236 O-RING	90 DURO NITRILE	90236	
41	1	241 O-RING	90 DURO NITRILE	90241	
42	1	334 O-RING	90 DURO NITRILE	90334	
43	1	339 O-RING	90 DURO NITRILE	90339	
44	1	342 O-RING	90 DURO NITRILE	90342	

REDRESS KIT (RDK)		61357050	61356050
ASSEMBLED WEIGHT		168 LBS	165 LBS

L) PARTS LIST (cont'd)

L-1) ELASTOMER TRIM OPTIONS

NOTE$_{10}$: For temperature range, refer to Elastomer Trim Temperature Guide.

L-1.1) HSN

ITEM	QTY	DESCRIPTION	MATERIAL	14.0 – 20.0# P/N 61357RMH	20.0 – 23.0# P/N 61356RMH
13	1	ELEMENT	80 DURO HSN	60255512H	60257512H
14	2	ELEMENT	90 DURO HSN	60255513H	60257513H
24	1	QUAD SEAL	90 DURO HSN	61355520H	
36	6	224 O-RING	90 DURO HSN	90224H	
37	1	229 O-RING	90 DURO HSN	90229H	
38	1	231 O-RING	90 DURO HSN	90231H	
39	2	235 O-RING	90 DURO HSN	90235H	
40	2	236 O-RING	90 DURO HSN	90236H	
41	1	241 O-RING	90 DURO HSN	90241H	
42	1	334 O-RING	90 DURO HSN	90334H	
43	1	339 O-RING	90 DURO HSN	90339H	
44	1	342 O-RING	90 DURO HSN	90342H	

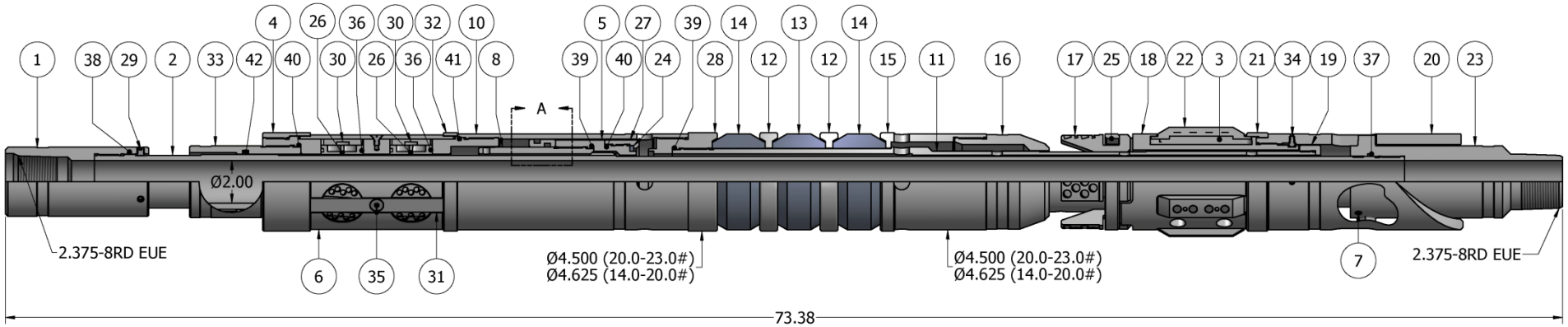
		REDRESS KIT (RDK)		61357050H	61356050H

L-1.2) VITON

ITEM	QTY	DESCRIPTION	MATERIAL	14.0 – 20.0# P/N 61357RMV	20.0 – 23.0# P/N 61356RMV
13	1	ELEMENT	80 DURO VITON	60255512V	60257512V
14	2	ELEMENT	90 DURO VITON	60255513V	60257513V
24	1	QUAD SEAL	90 DURO VITON	61355520V	
36	6	224 O-RING	90 DURO VITON	90224V	
37	1	229 O-RING	90 DURO VITON	90229V	
38	1	231 O-RING	90 DURO VITON	90231V	
39	2	235 O-RING	90 DURO VITON	90235V	
40	2	236 O-RING	90 DURO VITON	90236V	
41	1	241 O-RING	90 DURO VITON	90241V	
42	1	334 O-RING	90 DURO VITON	90334V	
43	1	339 O-RING	90 DURO VITON	90339V	
44	1	342 O-RING	90 DURO VITON	90342V	

		REDRESS KIT (RDK)		61357050V	61356050V

M) TECHNICAL ILLUSTRATION



N) REVISION HISTORY

DATE	REVISION	DESCRIPTION OF CHANGES	REVISED BY	APPROVED BY
01/24/2020	B	Revised Elastomer Trim Temp. Guide temp. ratings	J.Anderson	N.Banker
05/10/2016	A	Created new manual	-	-