



FISHING & INTERVENTION

# LEAD SEAL CEMENTING CASING PATCH

Manual F645

**THE LEGACY  
LIVES ON**

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#### LEGAL NOTICE

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## OVERVIEW

The Logan Lead Seal Cementing Casing Patch is an external catch tool that is designed to cement two strings of casing together in a single operation and form a permanent sealed connection between them without restricting the bore of the casing. The Casing Patch becomes a permanent part of the well casing.

In addition to utilizing the field proven, compression-type lead seals of the Logan Lead Seal Casing Patch, the Logan Lead Seal Cementing Casing Patch incorporates a valve system that allows the patch and running string to be cemented in place immediately after the lead seals have been compressed. Since the valve is incorporated into the tool, this eliminates the need for a circulating cementing valve or perforations near the Casing Patch.

Patches are available in popular tubing and casing sizes ranging from 2-3/8 to 13-3/8 inches OD.

If hydrogen sulfide is suspected or known to exist in a well, Logan Lead Seal Casing Patches for H<sub>2</sub>S (hydrogen sulfide) service are also available.

## USES

Logan Lead Seal Cementing Casing Patches are specifically engineered to replace the upper portion of casing that has been previously cemented in place. It conveniently combines sealing and cementing into one operation, thereby eliminating the time and inconvenience of doing two separate trips.

Logan Lead Seal Cementing Casing Patches are suitable for use in wells that contain fluids or gases harmful to rubber and synthetic packers, and are as strong as the string being repaired.

## CONSTRUCTION

Logan Lead Seal Cementing Casing Patches are composed of: a top sub, bowl, grapple carrier, spiral grapple, spiral grapple control with set screws, lead seal assembly, stinger, stinger retainer, and a guide. The lead seal assembly consists of two (2) lead seals separated by a center seal ring. There are two (2) end seal rings — one (1) at each end of the assembly.

Two (2) O-rings are installed at the threads where the top sub and guide are connected to the bowl. The lower lead seal nests in a groove on the top end of the packer stinger.

The stinger retainer holds the spiral grapple, spiral grapple control, lead seal assembly, and packer stinger in place.

The bowl is the major working component of the Lead Seal Cementing Casing Patch. The inside diameter of the bowl features a threaded section that conforms to the exterior threads of the spiral grapple. This design permits any expansion or compression strain to be evenly distributed over the entire working surface of the bowl, spiral grapple, and the fish (casing that is to be engaged during a casing landing operation). Any possible damage to the fish or Lead Seal Cementing Casing Patch is thereby minimized.

The bowl contains and supports the load-bearing spiral grapple. The spiral grapple is the gripping mechanism of the Lead Seal Cementing Casing Patch. The left-handed, helix-shaped spiral grapple conforms to the interior wickers of the bowl. The specially hardened wickers ensure positive engagement with the fish.

As tensile load is applied and increased on the bowl, the spirals between the bowl and the spiral grapple's outside diameter cause the spiral grapple to tightly engage a large area of the fish.

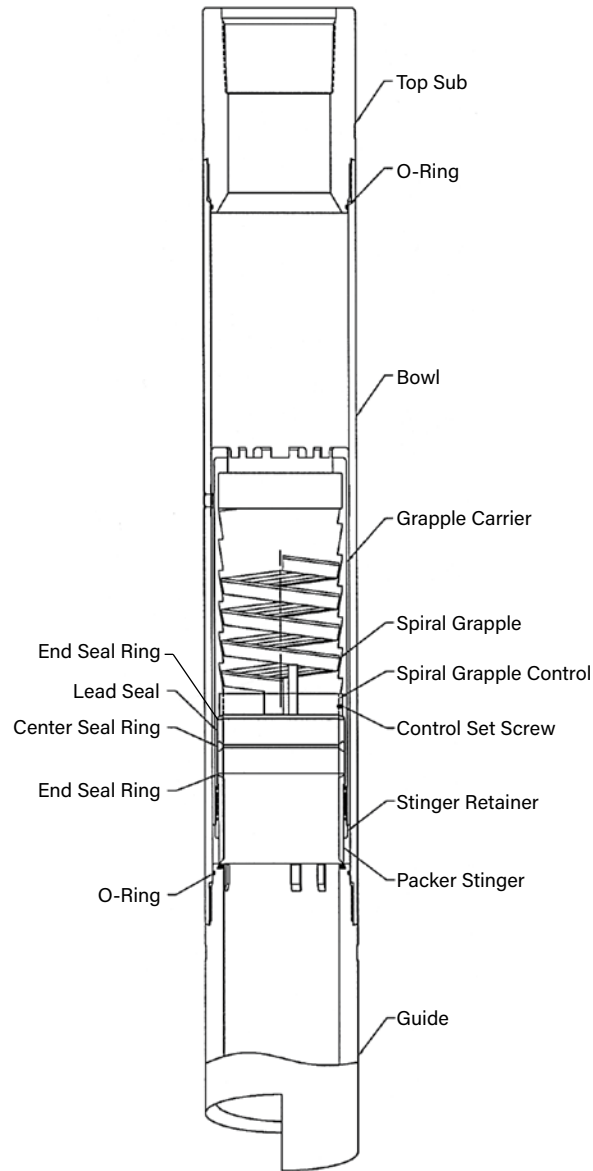
The grapple carrier has external grooves for cement flow, a shoulder at the top of the inside diameter, and threads at the bottom for the stinger retainer.

The spiral grapple control acts as a key that transmits torque from the bowl to the grapple while allowing the grapple to move vertically while inside the bowl during operation. The spiral grapple control is plain — that is, without milling teeth or a pack-off mechanism.

The lowermost component of the Lead Seal Cementing Casing Patch assembly is the cut-lipped guide. As the name implies, it guides the fish into the internal gripping mechanism (spiral grapple) of the Casing Patch. The guide also minimizes possible damage to the Casing Patch by blocking the entry of a fish that exceeds its maximum casing O.D. Extra-long guides are available upon request if longer stabilizing length and greater cementing area are desired.

Parts are manufactured from materials that are specifically suitable for each part. Load bearing components are high strength, heat-treated alloy steel to maintain string integrity. The seal assembly is manufactured from pure, unalloyed, fully annealed lead that is particularly suited for use in wells that contain fluids or gases harmful to rubber or synthetic packers.

A box connection on the upper end of the Lead Seal Cementing Casing Patch will be cut according to customer specifications.



**Logan Lead Seal Cementing Casing Patch**

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## OPERATION

Be sure the Logan Lead Seal Cementing Casing Patch is correctly assembled and the fish (casing engaged in a lead sealing and cementing operation) is properly prepared. This usually includes washing over to clean the upper end of the fish and remove any existing cement, removing burrs and splits, resizing the hole around the upper end of the fish, as well as sizing the fish.

In addition to preparing the hole and the outer diameter of the fish, set a temporary bridge plug or packer in the upper end of the fish to stop the cement. After patching and cementing operations have been completed, the bridge plug or packer may be removed and the casing reamed.

Properly cut and remove the damaged portion of casing from the hole. Prepare the top of the casing for engagement and pack off. If necessary, roll the casing with a Logan Casing Roller to ensure proper diameter and roundness.

The Lead Seal Cementing Casing Patch is made up to the bottom of the running string.

**CAUTION: The bowl is thin walled and may be crushed or damaged by the tongs. Use tongs only on the top sub.**

Slowly lower the string to the top of the prepared fish with right-hand rotation. Combined slow rotation while lowering is important to good operation. Continue to slowly rotate over the fish contacts the shoulder at the upper end of the grapple carrier. The grapple carrier will push up as the fish is engaged until it bottoms against the top sub. Observe the weight indicator. Allow 15,000 to 20,000 pounds of weight to be supported by the Casing Patch to ensure good complete engagement.

Stop rotation and slowly pick up the running string to remove the weight from the Casing Patch and allow torque to slack from the running string.

**CAUTION: Avoid backlash from residual weight or torque. Backlash could cause the Casing Patch to disengage.**

Set the lead seals into position by raising the running string. The spiral grapple, spiral grapple control, and grapple carrier will remain stationary. Compression between the grapple carrier and the guide will cause the lead seals to flow around the casing to form a rigid, leak-proof connection.

The load required to set the Lead Seal Cementing Casing Patch will depend on the size of the Casing Patch. This setting load will vary from 10,000 pounds to more than 100,000 pounds. Refer to page 6 for the appropriate setting load.

Check the effectiveness of the lead seals by the applying of pump pressure. Do not exceed a nominal 500 to 1,000 psi. Before applying any appreciable pressure, first reduce the setting load to a nominal 10,000 to 15,000 lbs., or approximately one-fourth of the original setting load, whichever is smaller. Refer to page 6 for the appropriate setting loads.

**CAUTION: Exercise care during all stages of operation to ensure that the formation and the Casing Patch are not shock loaded (slugged) with pressure from the mud pumps.**

Once the lead seals have been set and the pressure checked, open the Casing Patch to circulation. Slowly lower the running string until the string weight has equalized and approximately 15,000 to 20,000 lbs. of weight is resting on the Casing Patch. This will telescope the grapple carrier up against the top sub and the packer stinger will pull up off the lead seal on the face of the guide. Circulation through the Casting Patch may then be resumed.

After good circulation has been established, immediately pump cement down the hole. Cement will exit through the valve in the patch, placing cement around the outside of the patch and casing. Allow sufficient time to position the cement column and stop circulation. Reestablish the seal by elevating the string until a pull load equal to the initial setting load is reached. Set the slips and maintain an upward load on the running string while the cement hardens.

Excess cement may be drilled out after the cement has cured. Remove the bridge plug or packer and condition the hole.

Logan Lead Seal Cementing Casing Patches are designed to withstand pressures equal to the capacity of the running string, and in most cases, these pressures are greater after cementing.

**CAUTION: Do not exceed the actual required pressures to perform necessary functions until the Lead Seal Cementing Casing Patch is permanently cemented.**

### To Release From a Fish

If during operation, it becomes necessary to release the Logan Lead Seal Cementing Casing Patch from the fish, proceed as follows:

Break the hold between the spiral grapple and the grapple carrier by firmly bumping down until the top of the grapple carrier bottoms against the top sub. After bumping down, with slow right-hand rotation, slowly raise the string. Continue slow rotation and elevation until the Lead Seal Cementing Casing Patch is clear of the fish. Combined slow rotation and elevation is important to the proper release of the Casing Patch.

## **MAINTENANCE**

Since the Logan Lead Seal Cementing Casing Patch is not normally reused, usual maintenance procedures do not apply. However, if the Lead Seal Cementing Casing Patch is to be stored for a period of time before it is used, the tool should be disassembled, thoroughly cleaned and greased, and reassembled so it is ready for service.

## **DISASSEMBLY**

Disassembly should be conducted in a clean, well-equipped shop. No special tools are required.

1. Secure the bowl horizontally in the vise.

**CAUTION: Clamp only near the threaded top connection on the upper end of the bowl. Clamping too tightly may distort or damage the grapple carrier.**

2. Unscrew the guide from the bowl.
3. Unscrew the top sub from the bowl.
3. Remove the O-rings from the top sub and guide.
4. Slide the grapple carrier sub-assembly from the bowl.
5. Remove the bowl from the vise and set it aside.
6. Secure the grapple carrier horizontally, near its center, in a suitable vise.

**CAUTION: Clamping with excessive pressure may distort or damage the grapple carrier.**

7. Using a pipe wrench, unscrew the stinger retainer from the grapple carrier sub-assembly.
8. Remove the packer stinger.
9. Remove the first end seal ring.
10. Remove the first lead seal.
11. Remove the center seal ring.

12. Remove the second lead seal.
13. Remove the second end seal ring.
14. Remove the two (2) control set screws from the spiral grapple control.
15. Remove the spiral grapple control.
16. Unscrew the spiral grapple with right-hand rotation and remove it from the grapple carrier.
17. Thoroughly clean and inspect all parts. Replace any damaged parts.

**NOTE: Since the Lead Seal Cementing Casing Patch becomes a permanent part of the well casing, spare parts are not normally required. However, seals may be damaged because of misruns or other circumstances. It is therefore recommended that one (1) or two (2) extra sets of lead seals be ordered when the Lead Seal Cementing Casing Patch is to be used in a remote location.**

## **ASSEMBLY**

Referring to the illustration on page 3, assemble the Logan Lead Seal Cementing Casing Patch in the following manner:

1. Thoroughly clean all parts.
2. Secure the grapple carrier horizontally, near its center, in a suitable vise.

**CAUTION: Clamping too tightly may distort or damage the grapple carrier.**

3. Grasp the tanged control end of the spiral grapple and screw it into the grapple carrier with left-hand rotation. Insert the spiral grapple deep enough into the grapple carrier to allow the tang to rest in the slot near the lower end of the grapple carrier.
4. Insert the spiral grapple control into the grapple carrier with its control finger towards the spiral grapple.

Allow the control finger to lay alongside the left side (viewed from the lower end) of the spiral grapple tang. The upper face of the spiral grapple control should seat against the lower spiral of the grapple carrier.

5. Insert two (2) control set screws into the tapped holes of the spiral grapple control from the inside. Tighten the screws against the wall of the grapple carrier.
6. Insert an end seal ring into the grapple carrier with the bevelled face up, matching bevelled faces of the spiral grapple control and spiral grapple.
7. Place one (1) lead seal in the grapple carrier with the flat face up and the bevelled lip down.

**NOTE: If the lead seals become slightly distorted from handling, lightly tap the inside wall of the seals a soft piece of wood and a small hammer to seat them.**

8. Insert the center seal ring. The center seal ring may be assembled with either face up as both faces are identical.
9. Install the second lead seal into the grapple carrier with its flat side against the center seal ring.
10. Install the second end seal ring in the grapple carrier. The flat face of the end seal ring should rest against the lead seal with its bevelled lip face down.
11. Insert the packer stinger with its larger diameter end against the lower end seal ring. Match the bevelled face with the end seal ring.

**CAUTION: Be sure the cross-slots at the end opposite the stinger are inserted towards the upper end of the bowl and that the stinger is directed downward towards the guide.**

**NOTE: The top end of the bowl is the end nearest the integral lug located inside the bowl. One of the splines on the outside diameter of the grapple carrier will mate with this lug. The remainder of the splines allow passage for the cement slurry.**

12. Apply thread dope to the threads of the stinger retainer and screw it into the grapple carrier. Using a pipe wrench, firmly but carefully seat the stinger retainer.

This completes the grapple carrier sub-assembly. Remove the grapple carrier sub-assembly from the vise and set it aside.

13. Secure the bowl horizontally in the vise.

14. Insert one (1) O-ring into the groove at the lower end of the top sub. Apply thread dope to the threads of the top sub and O-ring. Insert the top sub into the bowl, being careful to not nick or cut the O-ring. Tighten the connection between the top sub and the bowl.

15. Test the operation of the grapple carrier sub-assembly before assembling the guide with the bowl. Reach into the grapple carrier, grasp it, and slide it back and forth. The grapple carrier should freely telescope up and down.

16. Grease the splines on the outside diameter of the grapple carrier. Insert the grapple carrier sub-assembly, slotted end first, into the bowl. Rotate the grapple carrier until it mates with the lug. Slide the grapple carrier up until the lug rests in the slot.

17. Install an O-ring on the upper end of the guide.

18. Apply thread dope to the threads of the guide and install the guide into the lower end of the bowl. Carefully and firmly tighten the connection between the guide and the bowl.

Assembly of the Logan Lead Seal Cementing Casing Patch is now complete.

## Calculated Strength Data

COMPLETE ASSEMBLY		CASING O.D.	PATCH O.D.	WORKING LOAD (40% SETTING LOAD) LBS	WITH SETTING LOAD APPLIED LBS	WELL PRESSURE TO BURST:		PULL LOAD TO BURST PATCH (NO WELL PRESSURE)
LOGAN PART NO.	BOWEN NO.					WITH SETTING LOAD APPLIED	WITH WORKING LOAD APPLIED	
505-413	40514	2-3/8	4-1/8	9,141	3,656	12,094	12,691	120,391
505-463	41209	2-7/8	4-5/8	10,869	4,347	9,416	9,952	125,396
505-525	41210	3-1/2	5-1/4	15,839	6,336	6,673	7,205	135,165
505-575	40596	4	5-3/4	17,853	7,141	5,482	5,972	137,795
505-650	40619	4-1/2	6-1/2	19,871	7,948	4,418	4,872	135,943
505-675	40649	5	6-3/4	21,888	8,755	3,863	4,286	141,840
505-744	38179	5-1/2	7-7/16	23,912	9,565	3,033	3,429	133,786
505-775	41088	5-3/4	7-3/4	24,916	9,966	2,966	3,350	140,469
505-800	40679	6	8	25,929	10,372	2,758	3,130	141,217
505-863	40858	6-5/8	8-5/8	30,022	12,009	2,326	2,686	146,662
505-913	40859	7	9-1/8	31,620	12,648	2,362	2,707	161,482
505-988	40869	7-5/8	9-7/8	34,273	13,709	2,237	2,561	176,429
505-1113	41004	8-5/8	11-1/8	44,549	17,820	2,202	2,529	224,349
505-1194	41085	9-5/8	11-15/16	47,195	18,878	1,550	1,841	198,140
505-1363	41086	10-3/4	13-5/8	52,450	20,980	1,835	2,101	269,178
505-1475	41089	11-3/4	14-3/4	56,938	22,775	1,656	1,903	285,670
505-1663	41087	13-3/8	16-5/8	95,652	38,261	1,580	2,550	396,488

*These strength calculations are considered accurate within ± 20% and are intended only as a guide. They do not constitute a guarantee, actual or implied. Make an appropriate allowance as a safety factor.*



## Lead Seal Cementing Casing Patch

<b>O.D. CASING</b>		2-3/8	2-7/8	3-1/2	4	4-1/2	5	5-1/2
<b>O.D. PATCH</b>		4-1/8	4-5/8	5-1/4	5-3/4	6-1/2	6-3/4	7-7/16
<b>COMPLETE ASSEMBLY</b>	<b>Logan Part No.</b>	<b>505-413</b>	<b>505-463</b>	<b>505-525</b>	<b>505-575</b>	<b>505-650</b>	<b>505-675</b>	<b>505-744</b>
	Bowen No.	40514	41209	41210	40596	40619	40649	38179
<b>TOP SUB</b>	<b>Logan Part No.</b>	<b>AB12000</b>	<b>AB12001</b>	<b>AB12016</b>	<b>AB12002</b>	<b>AB12003</b>	<b>AB12004</b>	<b>AB12005</b>
	Bowen No.	41092	41098	41104	41110	41116	41122	38415
<b>BOWL</b>	<b>Logan Part No.</b>	<b>AB1000</b>	<b>AB1001</b>	<b>AB1016</b>	<b>AB1002</b>	<b>AB1003</b>	<b>AB1004</b>	<b>AB1005</b>
	Bowen No.	41093	41099	41105	41111	41117	41123	38416
<b>GRAPPLE CARRIER</b>	<b>Logan Part No.</b>	<b>AB2000</b>	<b>AB2001</b>	<b>AB2016</b>	<b>AB2002</b>	<b>AB2003</b>	<b>AB2004</b>	<b>AB2005</b>
	Bowen No.	41095	41101	41107	41113	41119	41125	38417
<b>GRAPPLE</b>	<b>Logan Part No.</b>	<b>AA3000</b>	<b>AA3001</b>	<b>AB3016</b>	<b>AA3002</b>	<b>AA3003</b>	<b>AA3004</b>	<b>AA3005</b>
	Bowen No.	17261	16143	26528	22403	13273	13283	12318
<b>GRAPPLE CONTROL</b>	<b>Logan Part No.</b>	<b>AA4000</b>	<b>AA4001</b>	<b>AB4016</b>	<b>AA4002</b>	<b>AA4003</b>	<b>AA4004</b>	<b>AA4005</b>
	Bowen No.	17262	16144	26529	22404	13274	13284	12319
<b>GUIDE</b>	<b>Logan Part No.</b>	<b>AB5000</b>	<b>AB5001</b>	<b>AB5016</b>	<b>AB5002</b>	<b>AB5003</b>	<b>AB5004</b>	<b>AB5005</b>
	Bowen No.	41094	41100	41106	41112	41118	41124	38421
<b>LEAD SEAL</b>	<b>Logan Part No.</b>	<b>AA6000</b>	<b>AA6001</b>	<b>AB6016</b>	<b>AA6002</b>	<b>AA6003</b>	<b>AA6004</b>	<b>AA6005</b>
	Bowen No.	17264	16146	26531	22406	13276	13286	12324
	No. Req'd	2	2	2	2	2	2	2
<b>END SEAL RING</b>	<b>Logan Part No.</b>	<b>AA7000</b>	<b>AA7001</b>	<b>AB7016</b>	<b>AA7002</b>	<b>AA7003</b>	<b>AA7004</b>	<b>AA7005</b>
	Bowen No.	17265	16147	26532	22407	13277	13287	12322
	No. Req'd	2	2	2	2	2	2	2
<b>CENTER SEAL RING</b>	<b>Logan Part No.</b>	<b>AA8000</b>	<b>AA8001</b>	<b>AB8016</b>	<b>AA8002</b>	<b>AA8003</b>	<b>AA8004</b>	<b>AA8005</b>
	Bowen No.	17266	16148	26533	22408	13278	13288	12323
<b>PACKER STINGER</b>	<b>Logan Part No.</b>	<b>AB10000</b>	<b>AB10001</b>	<b>AB10016</b>	<b>AB10002</b>	<b>AB10003</b>	<b>AB10004</b>	<b>AB10005</b>
	Bowen No.	41096	41102	41108	41114	41120	41126	38420
<b>STINGER RETAINER</b>	<b>Logan Part No.</b>	<b>AB11000</b>	<b>AB11001</b>	<b>AB11016</b>	<b>AB11002</b>	<b>AB11003</b>	<b>AB11004</b>	<b>AB11005</b>
	Bowen No.	41097	41103	41109	41115	41121	41127	38419
<b>CONTROL SET SCREW</b>	<b>Logan Part No.</b>	<b>AA9000</b>	<b>AA9000</b>	<b>AA9000</b>	<b>AA9000</b>	<b>AA9000</b>	<b>AA9000</b>	<b>AA9000</b>
	Bowen No.	12329	12329	12329	12329	12329	12329	12329
	No. Req'd	2	2	2	2	2	2	2
<b>BOWL SEAL</b>	<b>Logan Part No.</b>	<b>568-237</b>	<b>568-240</b>	<b>568-246</b>	<b>568-250</b>	<b>568-255</b>	<b>568-258</b>	<b>568-260</b>
	Bowen No.	30-15	30-18	30-24	30-28	30-33	30-36	30-38
	No. Req'd	2	2	2	2	2	2	2

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*Special Notes:*

(1) H<sub>2</sub>S service, available upon request.

**When ordering, please specify:**

- (1) Name and number of assembly or part
- (2) Casing O.D.
- (3) Size and type of connection



## Lead Seal Cementing Casing Patch

O.D. CASING		5-3/4	6	6-5/8	7	7-5/8	8-5/8	9-5/8
O.D. PATCH		7-3/4	8	8-5/8	9-1/8	9-7/8	11-1/8	11-15/16
<b>COMPLETE ASSEMBLY</b>	<b>Logan Part No.</b>	<b>505-775</b>	<b>505-800</b>	<b>505-863</b>	<b>505-913</b>	<b>505-988</b>	<b>505-1113</b>	<b>505-1194</b>
	Bowen No.	41088	40679	40858	40859	40869	41004	41085
<b>TOP SUB</b>	<b>Logan Part No.</b>	<b>AB12006</b>	<b>AB12007</b>	<b>AB12008</b>	<b>AB12009</b>	<b>AB12010</b>	<b>AB12011</b>	<b>AB12012</b>
	Bowen No.	41128	41134	41140	41146	41152	41158	41164
<b>BOWL</b>	<b>Logan Part No.</b>	<b>AB1006</b>	<b>AB1007</b>	<b>AB1008</b>	<b>AB1009</b>	<b>AB1010</b>	<b>AB1011</b>	<b>AB1012</b>
	Bowen No.	41129	41135	41141	41147	41153	41159	41165
<b>GRAPPLE CARRIER</b>	<b>Logan Part No.</b>	<b>AB2006</b>	<b>AB2007</b>	<b>AB2008</b>	<b>AB2009</b>	<b>AB2010</b>	<b>AB2011</b>	<b>AB2012</b>
	Bowen No.	41131	41137	41143	41149	41155	41161	41167
<b>GRAPPLE</b>	<b>Logan Part No.</b>	<b>AA3006</b>	<b>AA3007</b>	<b>AA3008</b>	<b>AA3009</b>	<b>AA3010</b>	<b>AA3011</b>	<b>AA3012</b>
	Bowen No.	22413	13293	13303	12503	13073	13313	12478
<b>GRAPPLE CONTROL</b>	<b>Logan Part No.</b>	<b>AA4006</b>	<b>AA4007</b>	<b>AA4008</b>	<b>AA4009</b>	<b>AA4010</b>	<b>AA4011</b>	<b>AA4012</b>
	Bowen No.	22414	13294	13304	12504	13074	13314	12479
<b>GUIDE</b>	<b>Logan Part No.</b>	<b>AB5006</b>	<b>AB5007</b>	<b>AB5008</b>	<b>AB5009</b>	<b>AB5010</b>	<b>AB5011</b>	<b>AB5012</b>
	Bowen No.	41130	41136	41142	41148	41154	41160	41166
<b>LEAD SEAL</b>	<b>Logan Part No.</b>	<b>AA6006</b>	<b>AA6007</b>	<b>AA6008</b>	<b>AA6009</b>	<b>AA6010</b>	<b>AA6011</b>	<b>AA6012</b>
	Bowen No.	22416	13296	13306	12506	13076	13316	12481
	No. Req'd	2	2	2	2	2	2	2
<b>END SEAL RING</b>	<b>Logan Part No.</b>	<b>AA7006</b>	<b>AA7007</b>	<b>AA7008</b>	<b>AA7009</b>	<b>AA7010</b>	<b>AA7011</b>	<b>AA7012</b>
	Bowen No.	22417	13297	13307	28656	13077	13317	12482
	No. Req'd	2	2	2	2	2	2	2
<b>CENTER SEAL RING</b>	<b>Logan Part No.</b>	<b>AA8006</b>	<b>AA8007</b>	<b>AA8008</b>	<b>AA8009</b>	<b>AA8010</b>	<b>AA8011</b>	<b>AA8012</b>
	Bowen No.	22418	13298	13308	12508	13078	13318	12483
<b>PACKER STINGER</b>	<b>Logan Part No.</b>	<b>AB10006</b>	<b>AB10007</b>	<b>AB10008</b>	<b>AB10009</b>	<b>AB10010</b>	<b>AB10011</b>	<b>AB10012</b>
	Bowen No.	41132	41138	41144	41150	41156	41162	41168
<b>STINGER RETAINER</b>	<b>Logan Part No.</b>	<b>AB11006</b>	<b>AB11007</b>	<b>AB11008</b>	<b>AB11009</b>	<b>AB11010</b>	<b>AB11011</b>	<b>AB11012</b>
	Bowen No.	41133	41139	41145	41151	41157	41163	41169
<b>CONTROL SET SCREW</b>	<b>Logan Part No.</b>	<b>AA9000</b>	<b>AA9000</b>	<b>AA9000</b>	<b>AA9000</b>	<b>AA9000</b>	<b>AA9001</b>	<b>P12003</b>
	Bowen No.	12329	12329	12329	12329	12329	12484	12484
	No. Req'd	2	2	2	2	2	2	2
<b>BOWL SEAL</b>	<b>Logan Part No.</b>	<b>568-262</b>	<b>568-263</b>	<b>568-265</b>	<b>568-267</b>	<b>568-270</b>	<b>568-449</b>	<b>568-450</b>
	Bowen No.	30-40	30-41	30-43	30-45	30-48	27-76	27-77
	No. Req'd	2	2	2	2	2	2	2

*Innovex reserves the right to change or discontinue designs without notice.*

*Special Notes:*

(1) H<sub>2</sub>S service, available upon request.

**When ordering, please specify:**

- (1) Name and number of assembly or part
- (2) Casing O.D.
- (3) Size and type of connection

## Lead Seal Cementing Casing Patch

<b>O.D. CASING</b>		10-3/4	11-3/4	13-3/8				
<b>O.D. PATCH</b>		13-5/8	14-3/4	16-5/8				
<b>COMPLETE ASSEMBLY</b>	<b>Logan Part No.</b>	<b>505-1363</b>	<b>505-1475</b>	<b>505-1663</b>				
	Bowen No.	41086	41089	41087				
<b>TOP SUB</b>	<b>Logan Part No.</b>	<b>AB12013</b>	<b>AB12014</b>	<b>AB12015</b>				
	Bowen No.	41170	41176	41185				
<b>BOWL</b>	<b>Logan Part No.</b>	<b>AB1013</b>	<b>AB1014</b>	<b>AB1015</b>				
	Bowen No.	41171	41177	41182				
<b>GRAPPLE CARRIER</b>	<b>Logan Part No.</b>	<b>AB2013</b>	<b>AB2014</b>	<b>AB2015</b>				
	Bowen No.	41173	41179	41183				
<b>GRAPPLE</b>	<b>Logan Part No.</b>	<b>AA3013</b>	<b>AA3014</b>	<b>AA3015</b>				
	Bowen No.	13323	20858	18448				
<b>GRAPPLE CONTROL</b>	<b>Logan Part No.</b>	<b>AA4013</b>	<b>AA4014</b>	<b>AA4015</b>				
	Bowen No.	13324	20859	18449				
<b>GUIDE</b>	<b>Logan Part No.</b>	<b>AB5013</b>	<b>AB5014</b>	<b>AB5015</b>				
	Bowen No.	41172	41178	41184				
<b>LEAD SEAL</b>	<b>Logan Part No.</b>	<b>AA6013</b>	<b>AA6014</b>	<b>AA6015</b>				
	Bowen No.	13326	20861	18451				
	No. Req'd	2	2	2				
<b>END SEAL RING</b>	<b>Logan Part No.</b>	<b>AA7013</b>	<b>AA7014</b>	<b>AA7015</b>				
	Bowen No.	13327	20862	18452				
	No. Req'd	2	2	2				
<b>CENTER SEAL RING</b>	<b>Logan Part No.</b>	<b>AA8013</b>	<b>AA8014</b>	<b>AA8015</b>				
	Bowen No.	13328	20863	18453				
<b>PACKER STINGER</b>	<b>Logan Part No.</b>	<b>AB10013</b>	<b>AB10014</b>	<b>AB10015</b>				
	Bowen No.	41174	41180	41186				
<b>STINGER RETAINER</b>	<b>Logan Part No.</b>	<b>AB11013</b>	<b>AB11014</b>	<b>AB11015</b>				
	Bowen No.	41175	41181	41187				
<b>CONTROL SET SCREW</b>	<b>Logan Part No.</b>	<b>AA9001</b>	<b>AA9001</b>	<b>AA9001</b>				
	Bowen No.	12484	12484	12484				
	No. Req'd	2	2	2				
<b>BOWL SEAL</b>	<b>Logan Part No.</b>	<b>568-455</b>	<b>568-453</b>	<b>568-459</b>				
	Bowen No.	27-82	27-80	27-86				
	No. Req'd	2	2	2				

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*Special Notes:*

(1) H<sub>2</sub>S service, available upon request.

**When ordering, please specify:**

- (1) Name and number of assembly or part
- (2) Casing O.D.
- (3) Size and type of connection

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