



FISHING & INTERVENTION

LEAD SEAL CASING PATCH

Manual XXXX

**THE LEGACY
LIVES ON**

Contents

Logan Lead Seal Casing Patch

| | |
|-------------------------------------|-------|
| Overview | 2 |
| Uses..... | 2 |
| Construction..... | 2 |
| Operation | 2 |
| To Release From a Fish..... | 3 |
| Maintenance | 3 |
| Disassembly | 3 |
| Assembly | 4 |
| Tool Illustration..... | 5 |
| Calculated Strength Data | 6 |
| Specifications and Parts Lists..... | 7 - 8 |

LEGAL NOTICE

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OVERVIEW

When the faulting or caving of a formation ruptures, crushes, or displaces the upper portion of a casing string from the lower portion, the upper portion must be removed. After new casing is placed, the Logan Lead Seal Casing Patch forms the patching means between the old and new strings.

The Logan Lead Seal Casing Patch is an external catch tool that is designed to repair, pack off, and become a permanent part of properly prepared pipe without restricting the bore of the casing. 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 H₂S (hydrogen sulfide) service are also available.

USES

Logan Lead Seal Casing Patches are specifically engineered to effectively engage and pack off a string of casing. After the Lead Seal Casing Patch has been set in position, the lead seals require only a minimum load to maintain their proper sealing position. Usually, the tensile load required to set the slips to maintain the pipe is more than adequate.

In cases where the casing patch is to be cemented in place, Logan manufactures a Lead Seal Cementing Casing Patch specifically designed for this purpose. Please contact the Sales Department.

Logan Lead Seal Casing Patches are particularly suited 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 Casing Patches are composed of ten parts — two body parts and eight internal parts. A guide and bowl make up the O.D. components. A spiral grapple, grapple carrier, spiral grapple control, spiral grapple control set screws, top and bottom seal rings, lead seals, and a center seal ring make up the remainder of the Lead Seal Casing Patch.

The bowl contains and supports the load-bearing spiral grapple and grapple carrier. The spiral grapple is the gripping mechanism of the Lead Seal Casing Patch and is the major working component of the Lead Seal Casing Patch. The outside diameter of the spiral grapple features a left-handed helix-shaped section that conforms to the interior wickers of the grapple carrier.

These specially hardened wickers ensure positive engagement with the fish. 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) and minimizes any possible damage to the fish or Lead Seal Casing Patch.

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

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 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 Lead Seal Casing Patch by blocking the entry of a fish that exceeds its maximum casing O.D.

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 lead seals are manufactured from pure, fully annealed lead.

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

OPERATION

Be sure the Logan Lead Seal Casing Patch is correctly assembled and the fish is properly prepared. This usually includes washing over to clean the upper end of the fish, removing burrs and splits, and sizing the fish.

Properly cut and remove the damaged portion of casing from the hole. Prepare the top of the casing for engagement and pack off.

The Lead Seal Casing Patch is made up to the bottom of the new casing string. Use tongs only near the threaded top connection on the upper end of the bowl.

CAUTION: The bowl is thin walled and may be crushed or damaged by the tongs.

Lower the tool into the hole with slow

rotation until the top of the fish is reached. The combination of slow rotation and lowering is important to the proper operation of the tool. Continue lowering the string while slowly rotating the Lead Seal Casing Patch to the right until the fish passes through the guide and has bottomed out against the upper shoulder of the grapple carrier.

Observe the rig weight indicator. Allow 15,000 to 20,000 pounds of weight to be supported by the Lead Seal Casing Patch to ensure complete engagement.

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

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

Set the lead seal into position by raising the string. The spiral grapple, grapple carrier, and spiral grapple control 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 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.

The effectiveness of the lead seal may be checked by the application of pump pressure. See page 6 for maximum allowed pressure differential. Before applying any appreciable pressure, first reduce the working load to 40% of the setting load. See page 6 for the appropriate setting load and maximum pressure differential for that load.

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

Once the lead seals are set they will require only a minimum of load to maintain them in proper sealing position. Usually, the tensile load required to set the slips to maintain the pipe is more than adequate. Avoid any unnecessary pull load.

To Release From a Fish

If it is necessary to release the Logan Lead Seal Casing Patch from the casing string, proceed as follows:

Firmly bump down until the top of the grapple carrier bottoms against the top sub to break the hold between the grapple and the grapple carrier. After bumping down, with slow right-hand rotation slowly raise the string. Continue slow rotation and elevation until the Lead Seal Casing Patch is clear of the casing. Combined slow rotation and elevation is important to the proper release of the Casing Patch.

MAINTENANCE

Since the Logan Lead Seal Casing Patch is not normally reused, usual maintenance procedures do not apply. However, if the 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.

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. Remove the end seal ring from the bowl and set it aside.
4. Remove the first lead seal from the bowl.
5. Remove the center seal ring from the bowl.
6. Remove the second lead seal from the bowl.
7. Remove the end seal ring from the bowl.
8. Slide the grapple carrier sub-assembly from the bowl.
9. Remove the bowl from the vise.
10. Secure the grapple carrier horizontally, near its center, in a suitable vise.

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

11. Remove the two (2) control set screws from the grapple control.
12. Remove the grapple control from the grapple carrier.
13. Unscrew the grapple with right-hand rotation and remove it from the grapple carrier.
14. Thoroughly clean and inspect all parts.

ASSEMBLY

Referring to the illustration on page 5, assemble the Logan Lead Seal 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.

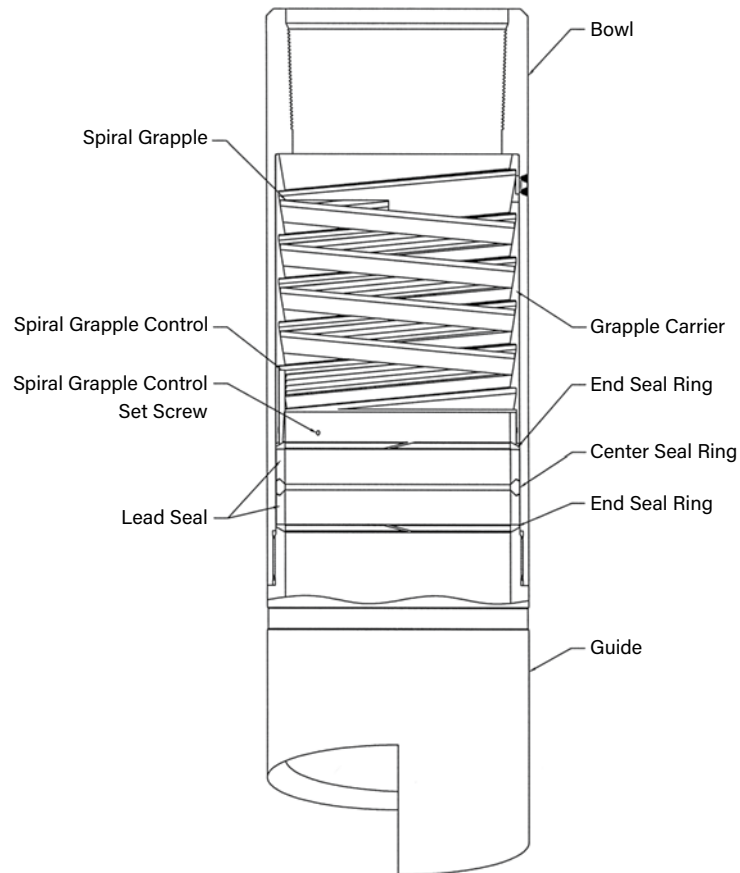
3. Grasp the tanged control end of the grapple and screw it into the grapple carrier with left-hand rotation. Insert the grapple deep enough into the grapple carrier to allow the tang to rest in the slot near the lower end of the grapple carrier.
4. Insert the grapple control into the grapple carrier with its control finger towards the grapple. Allow the control finger to lay alongside the left side (viewed from the lower end) of the grapple tang. The upper face of the 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 grapple control. Tighten the screws.
6. Remove the grapple carrier sub-assembly from the vise. Remove any burrs that may have been created during handling.
7. Secure the bowl horizontally in the vise.
8. Slide the grapple carrier sub-assembly, slotted end first, into the bowl.

Rotate the grapple carrier until it mates with the lug and slide it up until the lug rests in the slot.

9. Place the first end seal ring in the bowl with the bevelled face up, against the matching bevelled faces of the spiral grapple control and grapple carrier.
10. Place one (1) lead seal in the bowl 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 with a soft piece of wood and a small hammer to seat them.

11. Insert the center seal ring.
12. Install the second lead seal into the bowl with the bevelled lip face up.
13. Install the second end seal ring in the bowl. The flat face of the bottom seal ring should rest against the lead seal and its bevelled lip facing downward.
14. After all the seals have been seated in successive stages, apply thread dope to the threads of the guide and install the guide into the bowl. Carefully and firmly tighten the guide.



Logan Lead Seal Casing Patch

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

CALCULATED STRENGTH DATA

| COMPLETE ASSEMBLY LOGAN PART NO. | BOWEN NO. | CASING O.D. | PATCH O.D. | SETTING LOAD LBS | WORKING LOAD (40% SETTING LOAD) LBS | WELL PRESSURE TO BURST: WITH SETTING LOAD APPLIED | WITH WORKING LOAD APPLIED | PULL LOAD TO BURST PATCH (NO WELL PRESSURE) |
|-------------------------------------|-----------|-------------|------------|------------------------|---|---|------------------------------|---|
| 504-343 | 17258 | 2-3/8 | 3-7/16 | 10,800 | 4,300 | 9,550 | 10,200 | 107,300 |
| 504-400 | 16140 | 2-7/8 | 4 | 13,000 | 5,200 | 8,400 | 9,000 | 124,250 |
| 504-475 | 26525 | 3-1/2 | 4-3/4 | 20,000 | 8,000 | 6,550 | 7,150 | 151,400 |
| 504-525 | 22400 | 4 | 5-1/4 | 22,550 | 9,000 | 5,400 | 6,000 | 154,600 |
| 504-575 | 13270 | 4-1/2 | 5-3/4 | 25,100 | 10,050 | 3,750 | 4,300 | 134,800 |
| 504-625 | 13280 | 5 | 6-1/4 | 27,700 | 11,050 | 3,850 | 4,350 | 159,600 |
| 504-681 | 12315 | 5-1/2 | 6-13/16 | 30,200 | 12,100 | 3,150 | 3,600 | 154,500 |
| 504-706 | 22410 | 5-3/4 | 7-1/16 | 31,250 | 12,500 | 2,950 | 3,400 | 155,900 |
| 504-731 | 13290 | 6 | 7-5/16 | 32,500 | 13,000 | 2,750 | 3,150 | 156,600 |
| 504-793 | 13300 | 6-5/8 | 7-63/64 | 37,600 | 15,050 | 2,400 | 2,800 | 167,000 |
| 504-825 | 12500 | 7 | 8-3/8 | 39,600 | 15,800 | 2,250 | 2,650 | 173,900 |
| 504-900 | 13070 | 7-5/8 | 9 | 43,000 | 17,200 | 1,950 | 2,300 | 175,500 |
| 504-1006 | 13310 | 8-5/8 | 10-5/64 | 54,400 | 21,750 | 1,550 | 1,950 | 190,400 |
| 504-1113 | 12475 | 9-5/8 | 11-1/8 | 58,200 | 23,200 | 1,500 | 1,850 | 212,500 |
| 504-1231 | 13320 | 10-3/4 | 12-5/16 | 64,700 | 25,850 | 1,350 | 1,650 | 234,100 |
| 504-1325 | 20855 | 11-3/4 | 13-1/2 | 70,500 | 28,200 | 1,600 | 1,880 | 298,000 |
| 504-1550 | 18445 | 13-3/8 | 15-1/2 | 116,700 | 46,650 | 1,500 | 1,850 | 423,700 |

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.

CALCULATED STRENGTH DATA - LEAD SEAL CASING PATCHES FOR H2S SERVICE

| COMPLETE ASSEMBLY LOGAN PART NO. | BOWEN NO. | CASING O.D. | PATCH O.D. | SETTING LOAD LBS | WORKING LOAD (40% SETTING LOAD) LBS | WELL PRESSURE TO BURST: WITH SETTING LOAD APPLIED | WITH WORKING LOAD APPLIED | PULL LOAD TO BURST PATCH (NO WELL PRESSURE) |
|-------------------------------------|-----------|-------------|------------|------------------------|---|---|------------------------------|---|
| ... | 42757 | 2-3/8 | 3-7/16 | 10,800 | 4,300 | 5,000 | 5,650 | 61,300 |
| ... | 42760 | 2-7/8 | 4 | 13,000 | 5,200 | 4,350 | 4,950 | 70,900 |
| ... | 42763 | 3-1/2 | 4-3/4 | 20,000 | 8,000 | 3,300 | 3,900 | 86,500 |
| ... | 42766 | 4 | 5-1/4 | 22,550 | 9,000 | 2,700 | 3,250 | 88,300 |
| ... | 42769 | 4-1/2 | 5-3/4 | 25,100 | 10,050 | 2,200 | 2,750 | 89,800 |
| ... | 42775 | 5 | 6-1/4 | 27,700 | 11,050 | 1,850 | 2,340 | 91,180 |
| ... | 42754 | 5-1/2 | 6-13/16 | 30,200 | 12,100 | 1,850 | 2,300 | 103,000 |
| ... | 42778 | 5-3/4 | 7-1/16 | 31,250 | 12,500 | 1,700 | 2,150 | 103,900 |
| ... | 42781 | 6 | 7-5/16 | 32,500 | 13,000 | 1,600 | 2,000 | 104,450 |
| ... | 42784 | 6-5/8 | 7-63/64 | 37,600 | 15,050 | 1,350 | 1,750 | 111,400 |
| ... | 42787 | 7 | 8-3/8 | 39,600 | 15,800 | 1,300 | 1,700 | 115,900 |
| ... | 42790 | 7-5/8 | 9 | 43,000 | 17,200 | 1,180 | 1,450 | 117,000 |
| ... | 42793 | 8-5/8 | 10-5/64 | 54,400 | 21,750 | 800 | 1,200 | 126,900 |
| ... | 42796 | 9-5/8 | 11-1/8 | 58,200 | 23,200 | 800 | 1,150 | 141,700 |
| ... | 42799 | 10-3/4 | 12-5/16 | 64,700 | 25,900 | 700 | 1,050 | 156,070 |
| ... | 42802 | 11-3/4 | 13-1/2 | 70,500 | 28,200 | 850 | 1,150 | 195,960 |
| ... | 42808 | 13-3/8 | 15-1/2 | 116,700 | 46,650 | 820 | 1,170 | 282,500 |

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 Casing Patches

| | | | | | | | | |
|-------------------------------|-----------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| O.D. CASING | | 2-3/8 | 2-7/8 | 3-1/2 | 4 | 4-1/2 | 5 | 5-1/2 |
| O.D. PATCH | | 3-7/16 | 4 | 4-3/4 | 5-1/4 | 5-3/4 | 6-1/4 | 6-13/16 |
| COMPLETE ASSEMBLY | Logan Part No. | 504-343 | 504-400 | 504-475 | 504-525 | 504-575 | 504-625 | 504-681 |
| | Bowen No. | 17258 | 16140 | 26525 | 22400 | 13270 | 13280 | 12315 |
| BOWL | Logan Part No. | AA1000 | AA1001 | AA10015 | AA1002 | AA1003 | AA1004 | AA1005 |
| | Bowen No. | 17259 | 16141 | 26526 | 22401 | 13271 | 13281 | 12316 |
| GRAPPLE CARRIER | Logan Part No. | AA2000 | AA2001 | AA20015 | AA2002 | AA2003 | AA2004 | AA2005 |
| | Bowen No. | 17260 | 16142 | 26527 | 22402 | 13272 | 13282 | 12317 |
| SPIRAL GRAPPLE | Logan Part No. | AA3000 | AA3001 | AA30015 | AA3002 | AA3003 | AA3004 | AA3005 |
| | Bowen No. | 17261 | 16143 | 26528 | 22403 | 13273 | 13283 | 12318 |
| SPIRAL GRAPPLE CONTROL | Logan Part No. | AA4000 | AA4001 | AA40015 | AA4002 | AA4003 | AA4004 | AA4005 |
| | Bowen No. | 17262 | 16144 | 26529 | 22404 | 13274 | 13284 | 12319 |
| GUIDE | Logan Part No. | AA5000 | AA5001 | AA50015 | AA5002 | AA5003 | AA5004 | AA5005 |
| | Bowen No. | 17263 | 16145 | 26530 | 22405 | 13275 | 13285 | 12320 |
| LEAD SEAL | Logan Part No. | AA6000 | AA6001 | AA60015 | AA6002 | AA6003 | AA6004 | AA6005 |
| | Bowen No. | 17264 | 16146 | 26531 | 22406 | 13276 | 13286 | 12324 |
| | No. Req'd | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| END SEAL RING | Logan Part No. | AA7000 | AA7001 | AA70015 | AA7002 | AA7003 | AA7004 | AA7005 |
| | Bowen No. | 17265 | 16147 | 26532 | 22407 | 13277 | 13287 | 12322 |
| | No. Req'd | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| CENTER SEAL RING | Logan Part No. | AA8000 | AA8001 | AA80015 | AA8002 | AA8003 | AA8004 | AA8005 |
| | Bowen No. | 17266 | 16148 | 26533 | 22408 | 13278 | 13288 | 12323 |
| CONTROL SET SCREW | Logan Part No. | AA9000 | AA9000 | AA9000 | AA9000 | AA9000 | AA9000 | AA9000 |
| | Bowen No. | 12329 | 12329 | 12329 | 12329 | 12329 | 12329 | 12329 |
| | No. Req'd | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

Lead Seal Casing Patches

| | | | | | | | | |
|-------------------------------|-----------------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|
| O.D. CASING | | 5-3/4 | 6 | 6-5/8 | 7 | 7-5/8 | 8-5/8 | 9-5/8 |
| O.D. PATCH | | 7-1/16 | 7-5/16 | 7-15/16 | 8-3/8 | 9 | 10-1/16 | 11-1/8 |
| COMPLETE ASSEMBLY | Logan Part No. | 504-706 | 504-731 | 504-793 | 504-825 | 504-900 | 504-1006 | 504-1113 |
| | Bowen No. | 22410 | 13290 | 13300 | 12500 | 13070 | 13310 | 12475 |
| BOWL | Logan Part No. | AA1006 | AA1007 | AA1008 | AA1009 | AA1010 | AA1011 | AA1012 |
| | Bowen No. | 22411 | 13291 | 13301 | 12501 | 13071 | 13311 | 12476 |
| GRAPPLE CARRIER | Logan Part No. | AA2006 | AA2007 | AA2008 | AA2009 | AA2010 | AA2011 | AA2012 |
| | Bowen No. | 22412 | 13292 | 13302 | 12502 | 13072 | 13312 | 12477 |
| SPIRAL GRAPPLE | Logan Part No. | AA3006 | AA3007 | AA3008 | AA3009 | AA3010 | AA3011 | AA3012 |
| | Bowen No. | 22413 | 13293 | 13303 | 12503 | 13073 | 13313 | 12478 |
| SPIRAL GRAPPLE CONTROL | Logan Part No. | AA4006 | AA4007 | AA4008 | AA4009 | AA4010 | AA4011 | AA4012 |
| | Bowen No. | 22414 | 13294 | 13304 | 12504 | 13074 | 13314 | 12479 |
| GUIDE | Logan Part No. | AA5006 | AA5007 | AA5008 | AA5009 | AA5010 | AA5011 | AA5012 |
| | Bowen No. | 22415 | 13295 | 13305 | 12505 | 13075 | 13315 | 12480 |
| LEAD SEAL | Logan Part No. | AA6006 | AA6007 | AA6008 | AA6009 | AA6010 | AA6011 | AA6012 |
| | Bowen No. | 22416 | 13296 | 13306 | 12506 | 13076 | 13316 | 12481 |
| | No. Req'd | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| END SEAL RING | Logan Part No. | AA7006 | AA7007 | AA7008 | AA7009 | AA7010 | AA7011 | AA7012 |
| | Bowen No. | 22417 | 13297 | 13307 | 12507 | 13077 | 13317 | 12482 |
| | No. Req'd | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| CENTER SEAL RING | Logan Part No. | AA8006 | AA8007 | AA8008 | AA8009 | AA8010 | AA8011 | AA8012 |
| | Bowen No. | 22418 | 13298 | 13308 | 12508 | 13078 | 13318 | 12483 |
| CONTROL SET SCREW | Logan Part No. | AA9000 | AA9000 | AA9000 | AA9000 | AA9000 | AA9001 | P12003 |
| | Bowen No. | 12329 | 12329 | 12329 | 12329 | 12329 | 12484 | 12484 |
| | No. Req'd | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

Lead Seal Casing Patches

| | | | | | | | | |
|-------------------------------|-----------------------|-----------------|-----------------|-----------------|--|--|--|--|
| O.D. CASING | | 10-3/4 | 11-3/4 | 13-3/8 | | | | |
| O.D. PATCH | | 12-5/16 | 13-1/4 | 15-1/2 | | | | |
| COMPLETE ASSEMBLY | Logan Part No. | 504-1231 | 504-1325 | 504-1550 | | | | |
| | Bowen No. | 13320 | 20855 | 18445 | | | | |
| BOWL | Logan Part No. | AA1013 | AA1014 | AA1015 | | | | |
| | Bowen No. | 13321 | 20856 | 18446 | | | | |
| GRAPPLE CARRIER | Logan Part No. | AA2013 | AA2014 | AA2015 | | | | |
| | Bowen No. | 13322 | 20857 | 18447 | | | | |
| SPIRAL GRAPPLE | Logan Part No. | AA3013 | AA3014 | AA3015 | | | | |
| | Bowen No. | 13323 | 20858 | 18448 | | | | |
| SPIRAL GRAPPLE CONTROL | Logan Part No. | AA4013 | AA4014 | AA4015 | | | | |
| | Bowen No. | 13324 | 20859 | 18449 | | | | |
| GUIDE | Logan Part No. | AA5013 | AA5014 | AA5015 | | | | |
| | Bowen No. | 13325 | 20860 | 18450 | | | | |
| LEAD SEAL | Logan Part No. | AA6013 | AA6014 | AA6015 | | | | |
| | Bowen No. | 13326 | 20861 | 18451 | | | | |
| | No. Req'd | 2 | 2 | 2 | | | | |
| END SEAL RING | Logan Part No. | AA7013 | AA7014 | AA7015 | | | | |
| | Bowen No. | 13327 | 20862 | 18452 | | | | |
| | No. Req'd | 2 | 2 | 2 | | | | |
| CENTER SEAL RING | Logan Part No. | AA8013 | AA8014 | AA8015 | | | | |
| | Bowen No. | 13328 | 20863 | 18453 | | | | |
| CONTROL SET SCREW | Logan Part No. | AA9001 | AA9001 | AA9001 | | | | |
| | Bowen No. | 12484 | 12484 | 12484 | | | | |
| | No. Req'd | 2 | 2 | 2 | | | | |

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

Special Notes:

(1) H₂S service are available upon request.

When ordering, please specify:

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



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