INNOVEX
LOGAN FISHING TOOLS

FISHING & INTERVENTION

HIGH PRESSURE TYPE L PACKER TYPE CASING PATCHES

Manual C320

THE LEGACY LIVES ON

Contents

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OVERVIEW

Logan High Pressure Type L Packer Type Casing Patches are designed to engage and seal off a properly prepared casing string. The Casing Patch design leaves the operator with a casing string that has a full-bore internal diameter. Logan High Pressure Type L Packer Type Casing Patches will not restrict the bore of the casing and are available in popular casing sizes from 4-1/2 to 13-5/8 inches OD. Larger size Casing Patches are available upon request.

The Logan High Pressure Type L Packer Type Casing Patches are available in 7,000, 10,000, and 12,000 psi working pressure ratings and are designed to seal both internal and external pressure. Lower and higher pressure Casing Patches of this design are available upon request. Logan also manufactures a High Pressure Casing Patch that is rated at 15,000 psi working pressure.

Logan High Pressure Type L Packer Type Casing Patches are available with or without five-foot extension subs. Extension subs allow sufficient length to catch the casing by pulling additional length into the Casing Patch.

The Type L packer is made from hydrogenated nitrile (HBNR) compound and is rated at 275 °F (dry, with no circulation) and at 325 °F (with partial circulation.

USES

Logan High Pressure Type L Packer Type Casing Patches may be used to patch any casing, but is specifically intended for use in casing landing operations on the sub-surface wellheads of offshore installations.

Logan High Pressure Type L Packer Type Casing Patches for H_2S (sour service) are available upon request.

CONSTRUCTION

The Logan High Pressure Type L Packer Type Casing Patch is very similar in design and construction to the Logan Series 150 Overshot. A top sub, extension sub (optional), bowl, and cut-lipped guide make up the outer components of the assembly. A basket grapple control, basket grapple, four Logan Type L packers, packer protector, and shear pins are components inside the assembly. Major load bearing components are manufactured from 4140 alloy steel. The Type L packers are composed of a blend of synthetic rubber and Kevlar material that is compatible for service with most drilling and completion fluids, and is resistant to gas invasion and abrasion.

The top sub is the uppermost component of the Casing Patch assembly.

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

The bowl contains and supports the load-bearing basket grapple. The basket grapple is the gripping mechanism of the Casing Patch. The basket grapple is a slotted, expandable cylinder that freely opens to allow the fish to enter and securely engages it with the hardened wickers of its inside diameter. Its tapered exterior conforms to the interior of the bowl.

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

The basket grapple control acts as a key that transmits torque from the bowl to the grapple while allowing the grapple to move vertically inside the bowl during operation.

Extension subs are used when the upper portion of the fish is damaged and can not be engaged. Additional extension subs will permit the Casing Patch to be lowered far enough over the fish to ensure secure engagement and pack off. Extension subs are five feet long.

After the fish is engaged and passed into the extension sub, the uppermost packer provides a second seal around the fish.

The packer protector prevents the upper lip of the packer from being damaged when the fish enters the packer. Shear pins hold the packer protector in place until it is displaced by the fish. When the casing enters the casing patch, it will make contact at the bottom of the packer protector and cause the packer protector to slide upward.

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 (basket 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 OD.

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OPERATION

To Engage a Fish

Prior to operation, check the Logan High Pressure Type L Packer Type Casing Patch to assure that it is complete and properly assembled. Proper preparation of the casing to be patched is important to the success of the Casing Patch. The casing should be washed over to remove scale and splits, and the pipe sized for a uniform sealing surface.

The properly assembled Casing Patch should be lowered to the top of the fish. The combination of slow rotation with slow lowering is important to the operation of the assembly.

Continue slowly lowering the Casing Patch while maintaining slow rotation until the fish enters the Casing Patch far enough to displace the packer protector and enter the packers. The casing hanger should seat in the wellhead at the same time the fish displaces the packer protector and enters the packers. Once the fish has entered the Casing Patch, slowly reduce the rotation until the packer protector bottoms out against the shoulder in the top sub and the casing is fully engaged in the patch. Apply a tensile load to the Casing Patch to set the grapple. The slips should then be set on the running string.

Proper engagement may be proven by picking up on the casing hanger and testing by applying pump pressure. Allow any torque to slack from the running string. Avoid any backlash.

To test the patch, slowly engage the mud pumps so as not to slug the packers with excessive pressure. Then bring the pressure up to the desired test pressure.

CAUTION: Carefully and gradually increase the pump pressure to allow the packer to seat smoothly. Under no circumstances should the Casing Patch be shock loaded (slugged) by the mud pumps.

Once the fish has entered the Casing Patch and dislodged the packer protector, and the tool is subsequently disengaged from the fish, no attempt should be made to re-engage the tool without first bringing it to the surface to reset the packer protector. The upper lip of the packer may be ruptured and rendered useless if the packer protector is not in position.

NOTE: The Casing Patch may be easily released any time prior to cementing. However, once it is cemented in place, the internal parts may no longer function and the Casing Patch may fail to release. In such cases, it may be removed by milling it away or cutting the casing string below the Casing Patch, whichever is simpler.

Salvaging Stuck Casing

Sometimes, during landing operations, the casing being landed gets stuck off bottom. If this happens while the casing is being floated down in cement, an expensive and time consuming fishing job could result.

In place of conventional fishing, the operation may be salvaged by using a Logan High Pressure Type L Packer Type Casing Patch in the following manner:

Assemble a length of casing between the casing hanger and the top sub. The operator should determine the required length of casing so that when the Casing Patch is engaged, the casing hanger will be seated in the casing wellhead.

Locate the first collar below the wellhead. Cut the casing immediately below this collar with a Logan Hydraulic Internal Cutter. Remove the upper portion of the casing from the well. Pick up the remaining portion of casing with the Logan High Pressure Type L Packer Type Casing Patch, pull it up into the wellhead and lock it in position.

After the cement cures, additional tension may be applied to the cemented string by catching it with a Logan Standard Releasing Spear. Pull the upper end of the cemented string several feet into the extension sub of the Casing Patch provided for the purpose.

CAUTION: Use tongs on the top sub only. Exerting undue pressure on the bowl may crush or distort the bowl.

To Release From a Fish

If for any reason it is desired to release the Casing Patch from the casing string, proceed as follows:

Firmly bump down to break the connection between the grapple and the fish. After bumping down, with slow right-hand rotation slowly raise the running string. Continue slow rotation and elevation until the 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 High Pressure Type L Packer Type 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 its use, the tool should be disassembled, thoroughly cleaned and greased, and reassembled so it is ready for service.

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DISASSEMBLY

Disassembly should be conducted in a clean, well-equipped shop.

1. Break out and remove the top sub from the extension sub. Remove the large and small top sub seals from the top sub and discard them.
2. Remove the shear pins from the packer protector.
3. Secure the Casing Patch in a vise. Clamp on the extension sub rather than on the bowl to avoid crushing or distorting the bowl. Loosen the extension sub and cut-lipped guide.
4. Remove the packer protector from the extension sub.
5. Loosen and remove the extension sub from the bowl. Remove the large and small extension sub seals from the extension sub and discard them.
6. Remove the four (4) Type L packers from the bowl and discard them.

NOTE: The 15K working pressure Casing Patch for 14-inch casing also has four (4) each steel non-extrusion rings and lead seal protector rings as illustrated on page 24.

7. Loosen and remove the cut-lipped guide from the bowl.
8. Remove the basket grapple control from the basket grapple.
9. With right-hand rotation, unscrew the basket grapple from the lower end of the bowl.

ASSEMBLY

The Logan High Pressure Type L Packer Type Casing Patch is easily assembled using standard shop tools. No special tools are required.

Make sure all parts have been thoroughly cleaned, inspected, and lubricated prior to assembly.

1. Insert the four (4) Type L packers into the spaces provided in the bowl.
2. Insert the packer protector into the bowl from the guide end with the stinger end first.
3. After packer protector has been installed and covers all packers, insert the packer protector shear pins through the packer protector.
4. Screw the basket grapple into the lower end of the bowl, using left-hand rotation. The slot in the basket grapple should align with the slot in the bowl.
5. Insert the basket grapple control. Fit the finger of the basket grapple control into the slots of the bowl and the basket grapple. This keys the bowl and the basket grapple together.
6. Screw the cut-lipped guide into the lower end of the bowl.

NOTE: The 15K working pressure Casing Patch for 14-inch casing also has four (4) each steel non-extrusion rings and lead seal protector rings as illustrated on page 24.

7. Install the large and small extension sub seals on the extension sub. Then screw the extension sub into the top of the bowl.
8. Secure the Casing Patch in a vise. Clamp on the extension sub rather than the bowl, to avoid crushing or distorting the bowl. Tighten the extension sub and cut-lipped guide threaded connections.
9. Install the large and small top sub seals on the top sub. Assemble the extension sub(s) and top sub. Tighten the threaded connections.

If the Casing Patch is to be stored for some time before being used, paint or coat the outside with grease to prevent rust or corrosion.

The Logan High Pressure Type L Packer Type Casing Patch is now ready for use.

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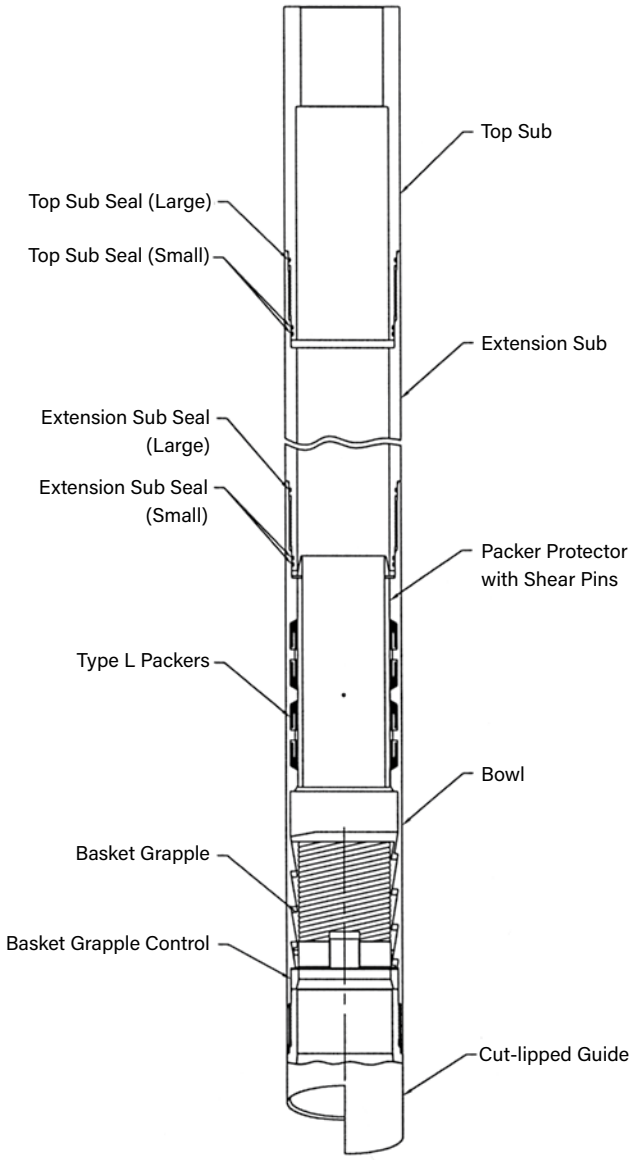

Logan Type L Packer Type Casing Patch for 7K, 10K, and 12K Assemblies

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

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Logan High Pressure Type L Packer Type Casing Patch - 7,000 PSI

O.D. CASING		4-1/2	5	5-1/2	7	7-5/8	9-5/8	9-7/8
O.D. PATCH		5-3/4	6-1/4	6-13/16	8-3/8	9	11-1/4	11-9/16
PRESSURE RATING (PSI)	7,000	7,000 **	7,000	7,000	7,000	7,000	7,000	
COMPLETE ASSEMBLY	**Logan Part No.**	**509-709 ***	**509-710 ***	**509-700**	**509-711**	**509-714 ***	**503L-014**	**509-703**
TOP SUB	**Logan Part No.**	**ZL1005**	**LP1010**	**LP1000**	**LP1011**	**LP1014**	**...**	**LP1003**
TOP SUB SEAL (SMALL)	**Logan Part No.**	**568-248**	**568-252**	**568-257**	**568-263**	**568-265**	**568-274**	**568-274**
	No. Req'd	2	2	2	2	2	2	2
TOP SUB SEAL (LARGE)	**Logan Part No.**	**568-251**	**568-254**	**568-257**	**568-265**	**568-266**	**568-274**	**568-275**
	No. Req'd	1	1	1	1	1	1	1
BOWL	**Logan Part No.**	**ZL2005**	**LP2010**	**LP2000**	**LP2011**	**LP2014**	**ZL2014**	**LP2003**
GUIDE	**Logan Part No.**	**Z7005**	**LP3010**	**LP3000**	**Z7011**	**Z7012**	**ZL7014**	**LP3003**
SHEAR PINS	**Logan Part No.**	**AC14002**	**AC14002**	**AC14002**	**AC14002**	**AC14002**	**AC14002**	**AC14002**
	No. Req'd	2	2	2	2	2	2	2
TYPE L PACKER	**Logan Part No.**	**AT6009**	**AT6010**	**AT6000**	**AT6001**	**AT6014**	**AT6002**	**AT6003**
	No. Req'd	4	4	4	4	4	2	4
PACKER PROTECTOR	**Logan Part No.**	**ZL3005**	**ZL3006**	**ZL3007**	**ZL3011**	**AT7014**	**ZL3014**	**AT7003**
GRAPPLE CONTROL	**Logan Part No.**	**Z6005 ***	**Z6006 ***	**ZL6007**	**Z6011**	**Z6012 ***	**ZL6014 ***	**AT10003**
GRAPPLE	**Logan Part No.**	**Z5005**	**ZL5006**	**ZL5007**	**Z5011**	**AT11014**	**ZL5014**	**AT11003**

OPTIONAL

EXTENSION SUB *(5 feet long)*	**Logan Part No.**	**ZLE1005**	**LPE1010**	**LPE1000**	**LPE1011**	**LPE1014**	**ZLE1014**	**LPE1003**
EXTENSION SUB SEAL (SMALL)	**Logan Part No.**	**568-248**	**568-252**	**568-257**	**568-263**	**...**	**568-274**	**568-274**
	No. Req'd	2	2	2	2	...	2	2
EXTENSION SUB SEAL (LARGE)	**Logan Part No.**	**568-251**	**568-254**	**568-257**	**568-265**	**...**	**568-274**	**568-275**
	No. Req'd	1	1	1	1	...	1	1

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

Notes:
(1) H_2S casing patches available upon request.
(2) Higher pressure casing patches of this design are available upon request.
(3) Other sizes of casing patches are available upon request.
(4) Casing patches can be made from special materials. Prices and delivery information is available upon request.

** Assembly furnished with mill control packer.*
*** Strength chart available upon request.*

When ordering, please specify:
(1) Complete assembly or part number
(2) Size and type of connection
(3) With or without five-foot extensions

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Logan High Pressure Type L Packer Type Casing Patch - 7,000 PSI

O.D. CASING		10-3/4	13-3/8	13-5/8	20			
O.D. PATCH		12-5/16	15-1/2	15-3/4	23-1/2			
PRESSURE RATING (PSI)	7,000	7,000	7,000	7,000				
COMPLETE ASSEMBLY	**Logan Part No.**	**509-704**	**509-707**	**509-708**	**514-520**			
TOP SUB	**Logan Part No.**	**LP1004**	**LP1007**	**LP1008**	**BP1025**			
TOP SUB SEAL	**Logan Part No.**	**568-275**	**568-279**	**568-280**	**568-390**			
(SMALL)	No. Req'd	2	2	2	2			
TOP SUB SEAL	**Logan Part No.**	**568-276**	**568-280**	**568-280**	**568-390**			
(LARGE)	No. Req'd	1	1	1	1			
BOWL	**Logan Part No.**	**LP2004**	**LP2007**	**LP2008**	**BP2020**			
GUIDE	**Logan Part No.**	**LP3004**	**LP3007**	**LP3008**	**BP3020**			
SHEAR PINS	**Logan Part No.**	**AC14002**	**AC14002**	**AC14008**	**AC14008**			
	No. Req'd	2	2	2	2			
TYPE L PACKER	**Logan Part No.**	**AT6004**	**AT6007**	**AT6008**	**AT6017**			
	No. Req'd	4	4	4	4			
PACKER PROTECTOR	**Logan Part No.**	**AY6004**	**AT7007**	**AT7008**	**BP4020**			
GRAPPLE CONTROL	**Logan Part No.**	**AY9004**	**AT10007**	**AT10008**	**BP5020**			
GRAPPLE	**Logan Part No.**	**AY10004**	**AT11007**	**AT11008**	**BP6020**			

OPTIONAL

EXTENSION SUB	**Logan Part No.**	**LPE1004**	**LPE1007**	**LPE1008**	**BPE1020**			
(5 feet long)								
EXTENSION SUB SEAL	**Logan Part No.**	**568-275**	**568-279**	**568-280**	**568-390**			
(SMALL)	No. Req'd	2	2	2	2			
EXTENSION SUB SEAL	**Logan Part No.**	**568-276**	**568-280**	**568-280**	**568-390**			
(LARGE)	No. Req'd	1	1	1	1			

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

Notes:
(1) H_2S casing patches available upon request.
(2) Higher pressure casing patches of this design are available upon request.
(3) Other sizes of casing patches are available upon request.
(4) Casing patches can be made from special materials. Prices and delivery information is available upon request.

When ordering, please specify:
(1) Complete assembly or part number
(2) Size and type of connection
(3) With or without five-foot extensions

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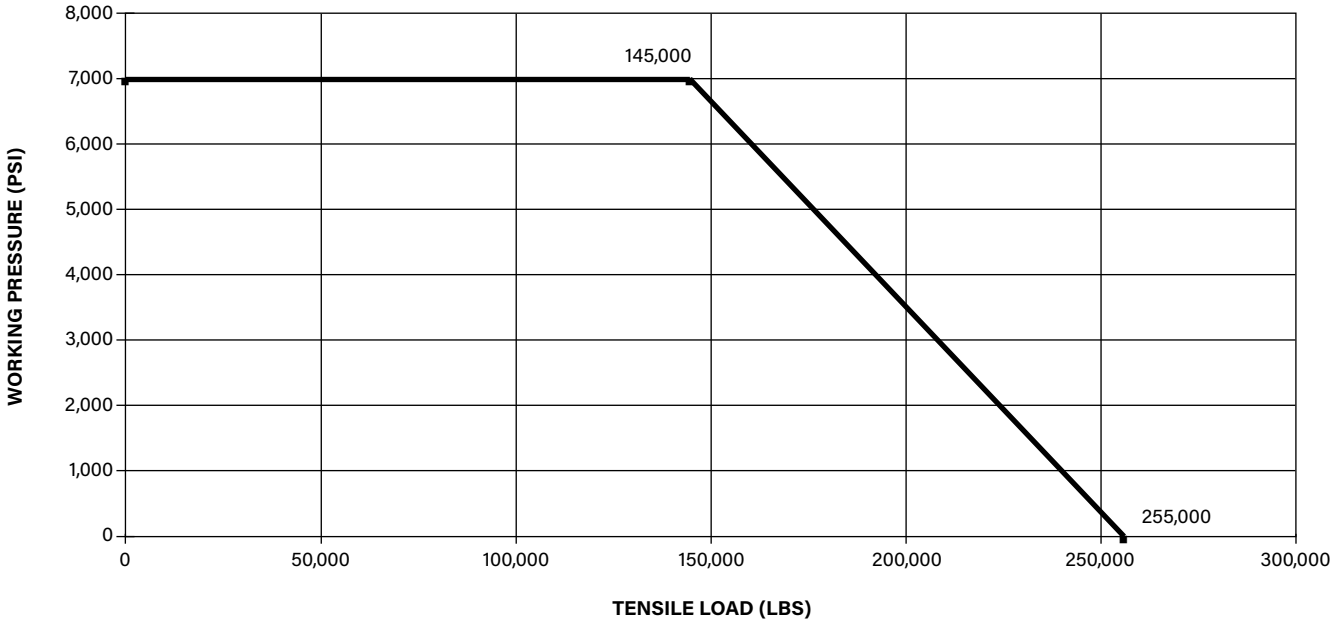
STRENGTH DATA FOR 5-3/4" OD CASING PATCH FOR 4-1/2" CASING, ASSEMBLY NO. 509-709

7,000 MAXIMUM WORKING PRESSURE, 110K YIELD MATERIAL

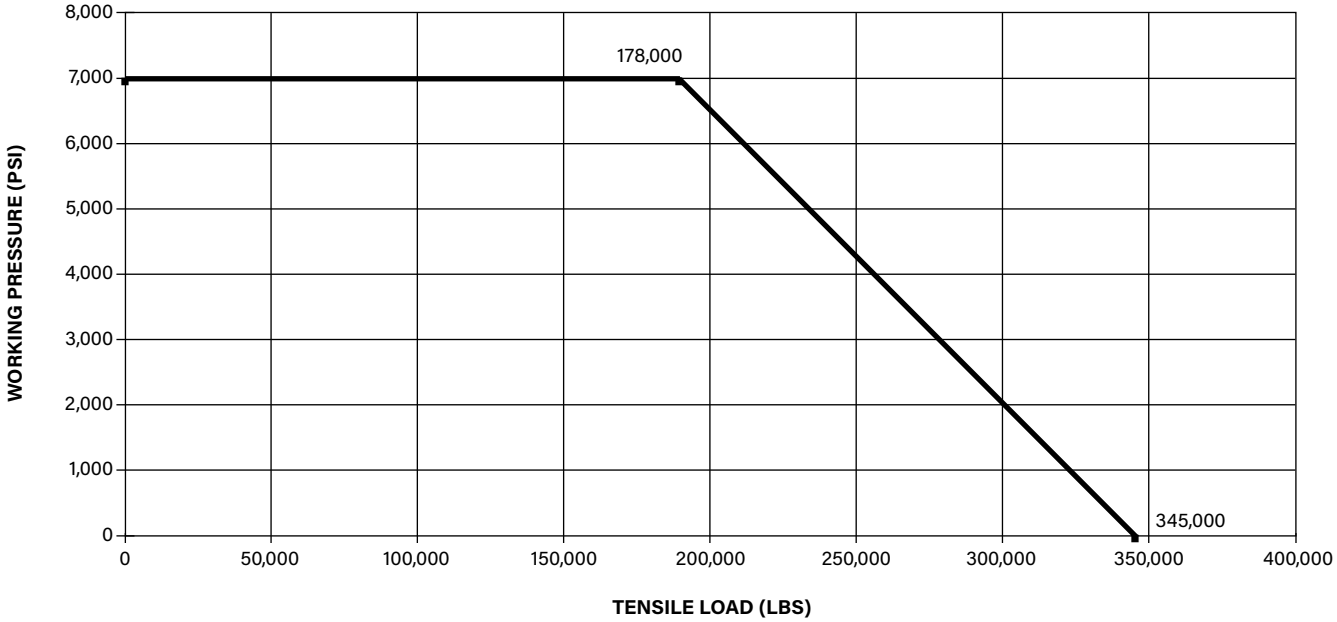


Collapse Pressure:
7,830 psi @ 0 lbs Tensile
4,120 psi @ 255 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 320,000 lbs
With 10K psi Internal Pressure = 208,000,000 lbs

STRENGTH DATA FOR 6-13/16" OD CASING PATCH FOR 5-1/2" CASING, ASSEMBLY NO. 509-700

7,000 MAXIMUM WORKING PRESSURE, 125K YIELD MATERIAL



Collapse Pressure:
8,445 psi @ 0 lbs Tensile
5,041 psi @ 345,000 lbs Tensile

Torque:
Top Sub to Bowl = 6,680 ft/lbs
Bowl to Guide = 1,500 ft/lbs

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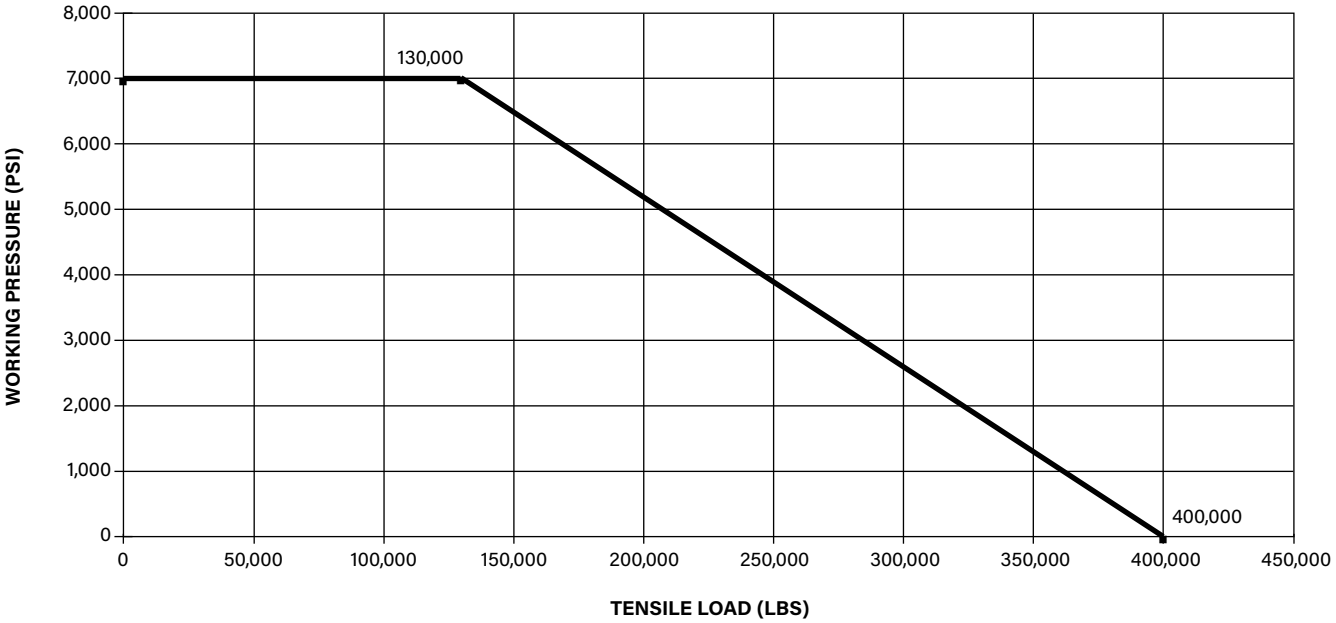
STRENGTH DATA FOR 8-3/8" OD CASING PATCH FOR 7" CASING, ASSEMBLY NO. 509-711

7,000 MAXIMUM WORKING PRESSURE, 140K YIELD MATERIAL

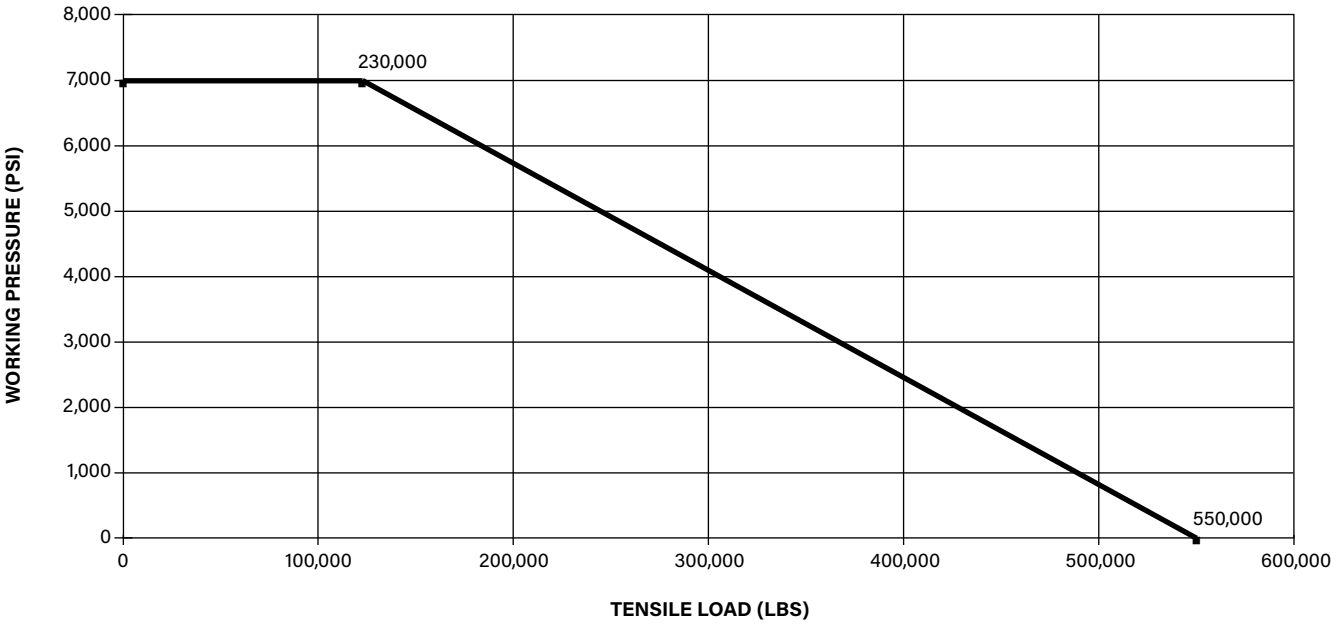


Collapse Pressure:
7,445 psi @ 0 lbs Tensile
5,657 psi @ 400,000 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 500,000 lbs
With 7K psi Internal Pressure = 231,000 lbs

STRENGTH DATA FOR 9" OD CASING PATCH FOR 7-5/8" CASING, ASSEMBLY NO. 509-714

7,000 MAXIMUM WORKING PRESSURE, 140K YIELD MATERIAL



Collapse Pressure:
7,560 psi @ 0 lbs Tensile
4,400 psi @ 550,000 lbs Tensile

Torque:
Maximum = 9,000 ft/lbs
Recommended = 4,500 ft/lbs

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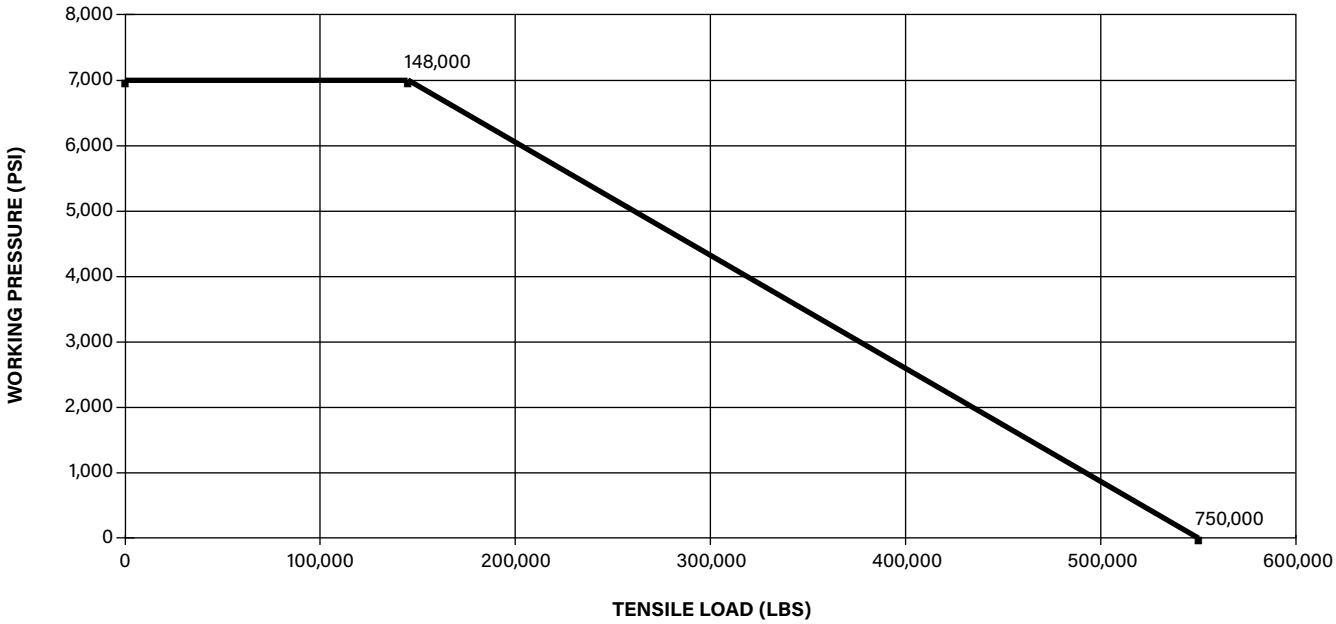
STRENGTH DATA FOR 11-1/4" OD CASING PATCH FOR 9-5/8" CASING, ASSEMBLY NO. 503L-014

7,000 MAXIMUM WORKING PRESSURE, 110K YIELD MATERIAL



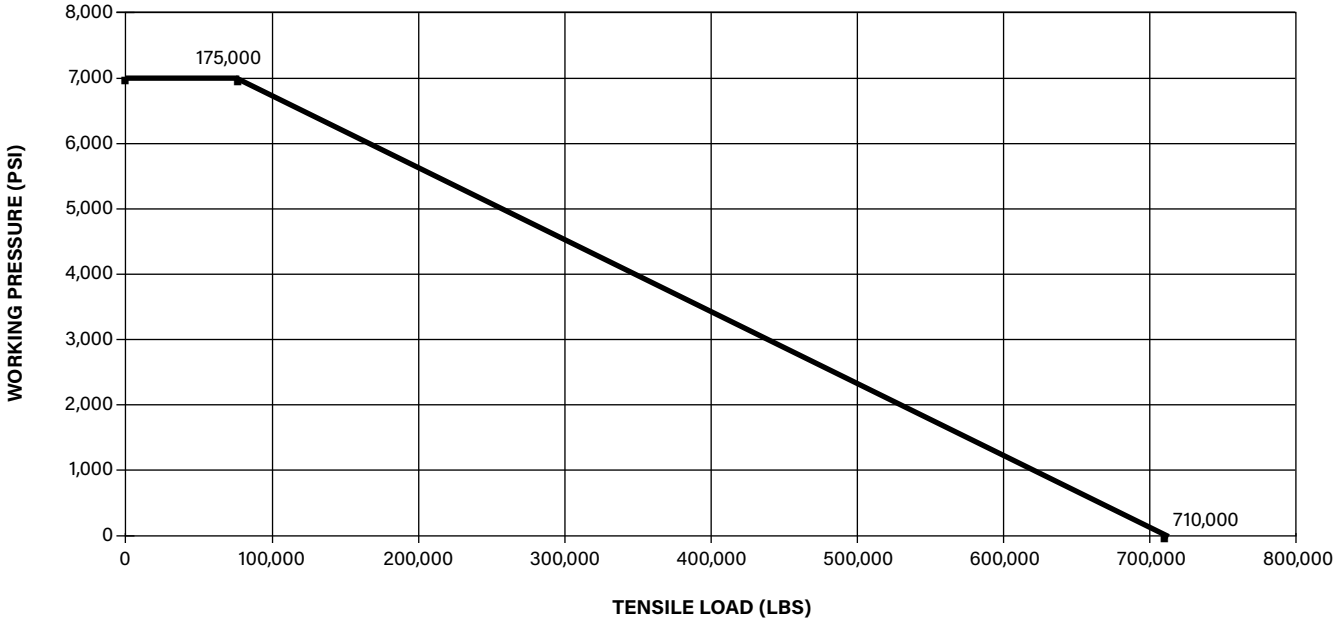
Collapse Pressure:
6,796 psi @ 0 lbs Tensile
6,393 psi @ 148,000 lbs Tensile

Torque:
Top Sub to Bowl = 15,000 ft/lbs
Bowl to Guide = 7,500 ft/lbs

Burst Pressure:
8,800 psi

STRENGTH DATA FOR 11-9/16" OD CASING PATCH FOR 9-7/8" CASING, ASSEMBLY NO. 509-703

7,000 MAXIMUM WORKING PRESSURE, 110K YIELD MATERIAL



Collapse Pressure:
7,269 psi @ 0 lbs
4,957 psi @ 711,120 lbs

Tensile Strength @ Yield:
Tensile Strength w/0 Int. Pressure = 911,020 lbs
Tensile Strength w/ 7K Int. Pressure = 352,780 lbs

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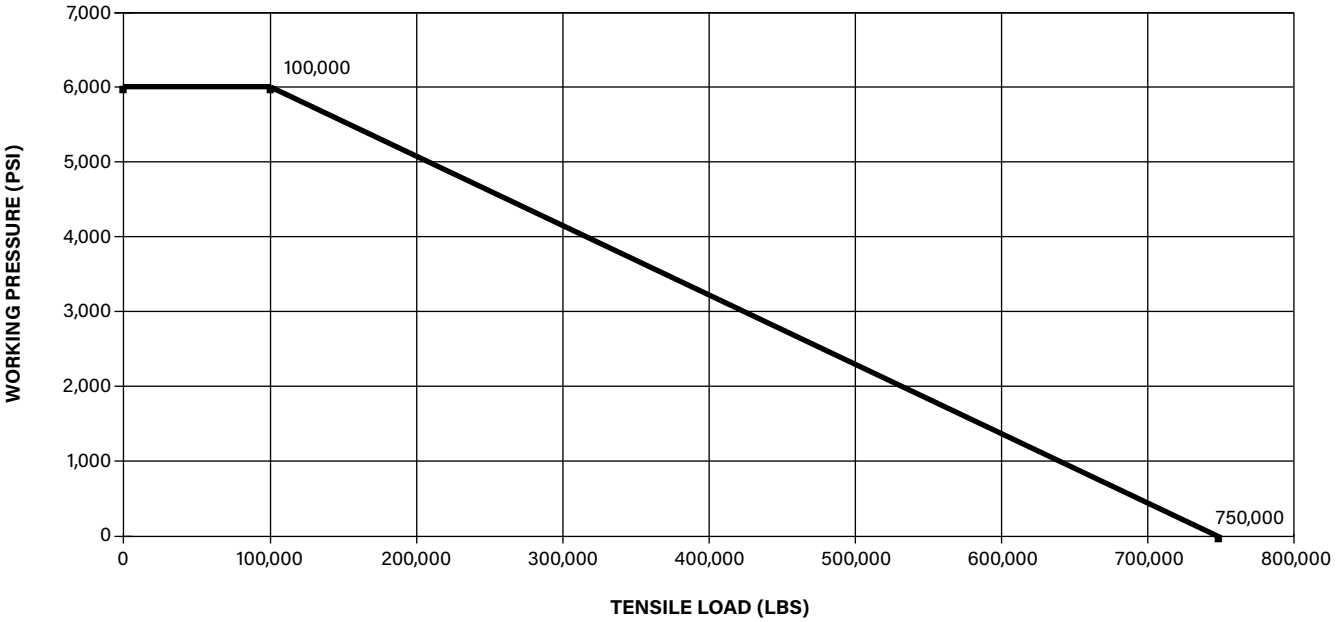
STRENGTH DATA FOR 12-5/16" OD CASING PATCH FOR 10-3/4" CASING, ASSEMBLY NO. 509-704

7,000 MAXIMUM WORKING PRESSURE, 125K YIELD MATERIAL



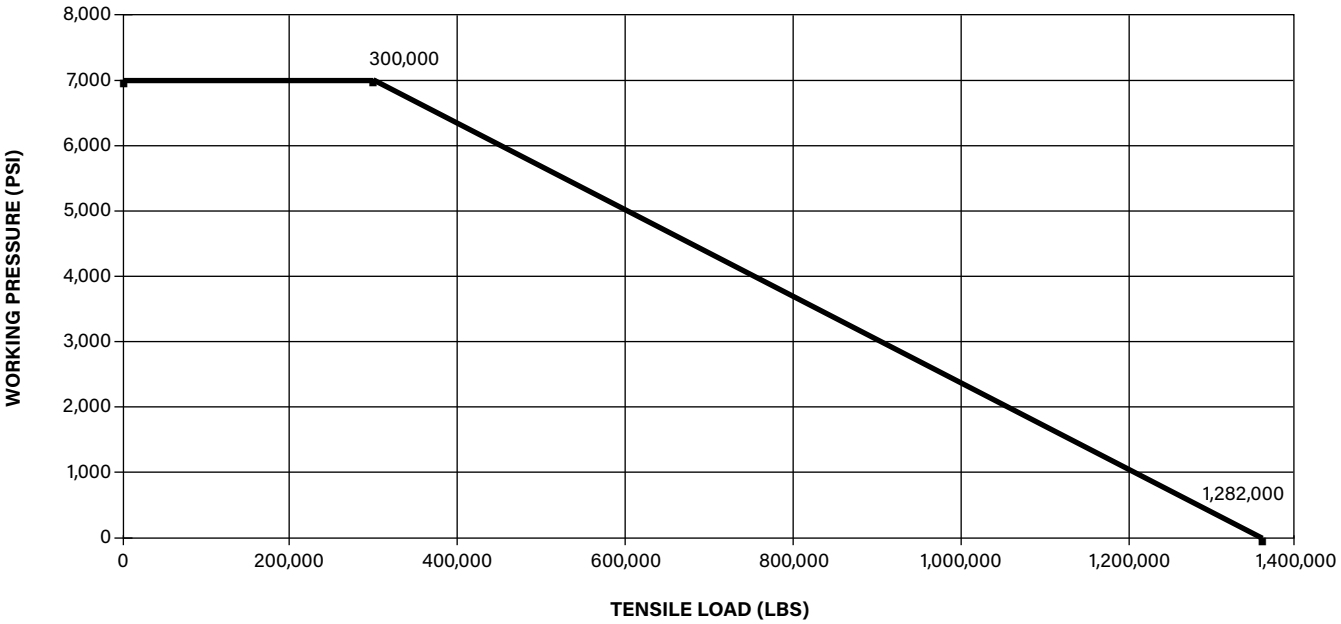
Collapse Pressure:
6,482 psi @ 0 lbs Tensile
4,303 psi @ 750,000 lbs Tensile

Torque:
Top Sub to Bowl = 5,000 ft/lbs
Bowl to Guide = 1,500 ft/lbs

Burst Pressure:
9,794 psi

STRENGTH DATA FOR 15-1/2" OD CASING PATCH FOR 13-3/8" CASING, ASSEMBLY NO. 509-707

7,000 MAXIMUM WORKING PRESSURE, 18" MINIMUM GRAPPLE LENGTH



Collapse Pressure:
8,428 psi @ 0 lbs Tensile
5,396 psi @ 1,465,000 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 1,825,991 lbs
With 7K psi Internal Pressure = 841,753 lbs

Torque:
Top Sub to Bowl = 12,000 ft/lbs
Bowl to Guide = 4,000 ft/lbs

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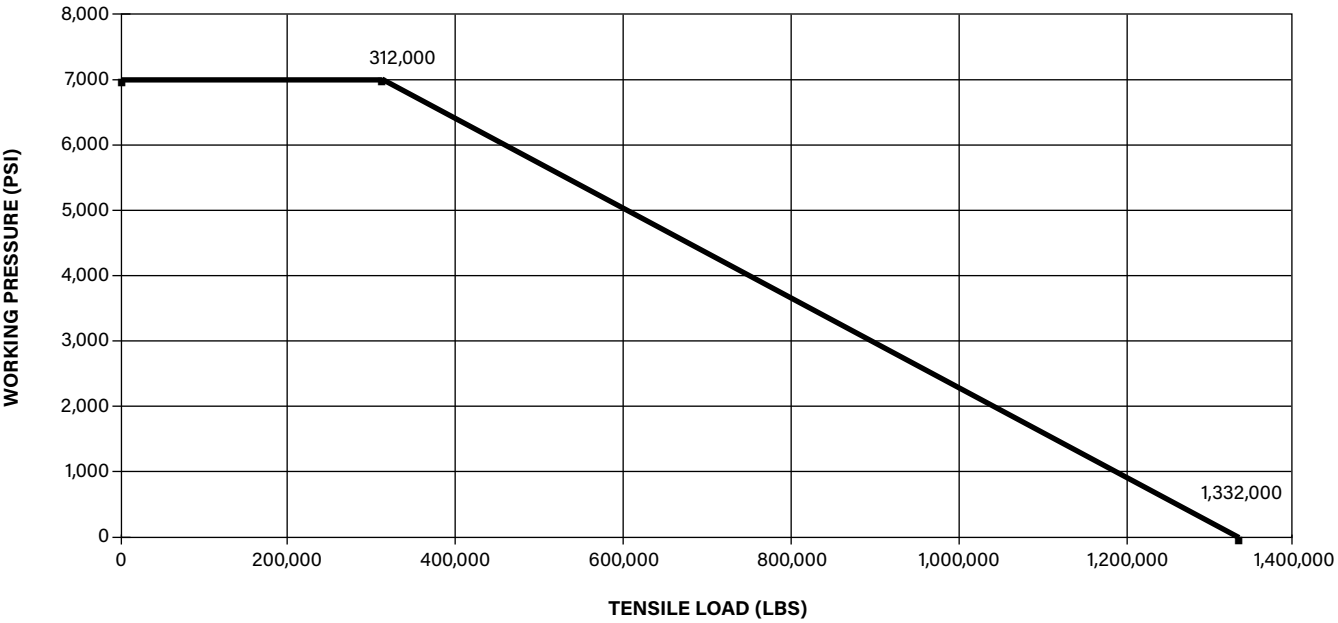
STRENGTH DATA FOR 15-3/4" OD CASING PATCH FOR 13-5/8" CASING, ASSEMBLY NO. 509-708

7,000 MAXIMUM WORKING PRESSURE, 110K YIELD MATERIAL



Collapse Pressure:
7,945 psi @ 0 lbs Tensile
5,664 psi @ 1,332,000 lbs Tensile

Tensile Strength @ Yield:
Top Sub to Bowl = 12,000 ft/lbs
Bowl to Guide = 4,500 ft/lbs

STRENGTH DATA FOR 23-1/2" OD CASING PATCH FOR 20" CASING, ASSEMBLY NO. 514-520

7,000 MAXIMUM WORKING PRESSURE

Collapse Pressure:
9,018 psi @ 0 lbs Tensile
7,936 psi @ 1,174,778 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 3,373,893 lbs
With 10K psi Internal Pressure = 1,174,778 lbs

Torque:
Top Sub to Bowl = 25,000 ft/lbs
Bowl to Guide = 8,500 ft/lbs

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Logan High Pressure Type L Packer Type Casing Patch - 10,000 PSI

O.D. CASING		4-1/2	5-1/2	7	9-5/8	9-7/8	10-3/4	13-3/8
O.D. PATCH		5-7/8	7	8-5/8	11.43	11-3/4	12-3/4	15-5/8
PRESSURE RATING (PSI)	10,000	10,000	10,000	10,000	10,000	10,000	10,000	
COMPLETE ASSEMBLY	**Logan Part No.**	**510L-005**	**510L-007**	**510L-011**	**510-963-010**	**510-1175-010**	**510-1275-010**	**510-1338**
TOP SUB	**Logan Part No.**	**ZL1005-10**	**ZL1007-10**	**ZL1011-10**	**BT1002-010**	**BT1003-010**	**BT2004-010**	**BT2007-010**
TOP SUB SEAL (SMALL)	**Logan Part No.**	**568248-200**	**568257-200**	**568263-200**	**568274-200**	**568274-400**	**568275-200**	**568279-200**
	No. Req'd	2	2	2	2	2	2	2
TOP SUB SEAL (LARGE)	**Logan Part No.**	**568251-200**	**568257-200**	**568265-200**	**568274-200**	**568275-400**	**568276-200**	**568280-200**
	No. Req'd	1	1	1	1	1	1	1
BOWL	**Logan Part No.**	**ZL2005-10**	**ZL2007-10-001**	**ZL2011-10**	**BT12002-010**	**BT2003-010**	**BT11004-010**	**BT11007-010**
GUIDE	**Logan Part No.**	**Z7005-10**	**ZL3007-10**	**Z7011-10**	**BT13002-010**	**BT3003-010**	**BT12004-010**	**BT12007-010**
SHEAR PINS	**Logan Part No.**	**AC14002**	**AC14002**	**AC14002**	**AC14008**	**AC14002**	**AC14008**	**AC14000**
	No. Req'd	2	2	2	2	2	2	2
TYPE L PACKER	**Logan Part No.**	**AT6009**	**AT6000**	**AT6001**	**AT6002**	**AT6003**	**AT6004**	**AT6007**
	No. Req'd	4	4	4	4	4	4	4
PACKER PROTECTOR	**Logan Part No.**	**ZL3005**	**ZL3007-10**	**ZL3011**	**AT7002**	**AT7003**	**AY6004-500**	**AT7007**
GRAPPLE CONTROL	**Logan Part No.**	**Z6005 ***	**ZL6007**	**Z6011**	**AT10002**	**AT10003**	**AY9004**	**AT10007**
GRAPPLE	**Logan Part No.**	**Z5005**	**ZL5007**	**Z5011**	**AT11002**	**AT11003**	**AY10004**	**AT11007**

OPTIONAL

EXTENSION SUB *(5 feet long)*	**Logan Part No.**	**ZLE1005-10**	**ZLE1007-10**	**ZLE1011-10**	**BT3002-010**	**BTE1003-010**	**BTE3004-010**	**BT3007-010**
EXTENSION SUB SEAL (SMALL)	**Logan Part No.**	**568248-200**	**568257-200**	**568263-200**	**568274-200**	**568274-400**	**568275-200**	**568279-200**
	No. Req'd	2	2	2	2	2	2	2
EXTENSION SUB SEAL (LARGE)	**Logan Part No.**	**568251-200**	**568257-200**	**568265-200**	**568274-200**	**568275-400**	**568276-200**	**568280-200**
	No. Req'd	1	1	1	1	1	1	1

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

** Mill Control Packer instead of Grapple Control*

Notes:
(1) H_2S casing patches available upon request.
(2) Higher pressure casing patches of this design are available upon request.
(3) Other sizes of casing patches are available upon request.
(4) Casing patches can be made from special materials. Prices and delivery information is available upon request.

When ordering, please specify:
(1) Complete assembly or part number
(2) Size and type of connection
(3) With or without five-foot extensions

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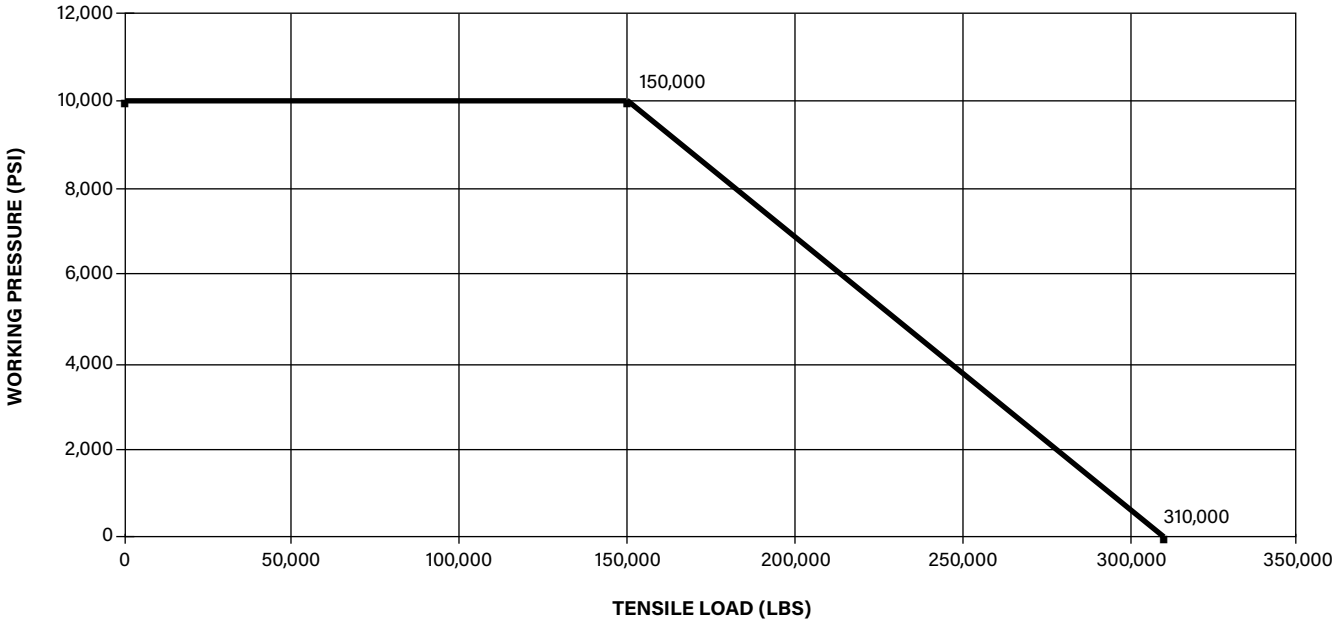
STRENGTH DATA FOR 5-7/8" OD CASING PATCH FOR 4-1/2" CASING, ASSEMBLY NO. 510L-005

10,000 MAXIMUM WORKING PRESSURE, 110K YIELD MATERIAL

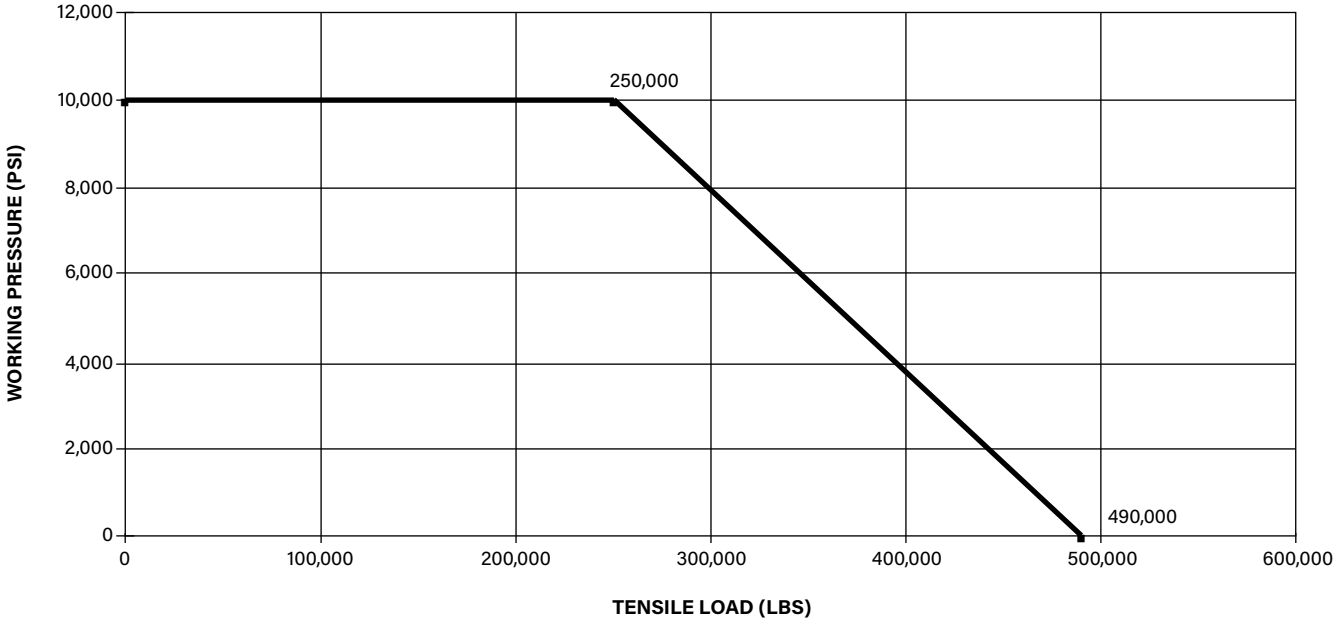


Collapse Pressure:
9,892 psi @ 0 lbs Tensile
5,715 psi @ 310,000 lbs Tensile

Torque:
Maximum = 8,500 ft/lbs
Recommended = 4,400 ft/lbs

STRENGTH DATA FOR 7" OD CASING PATCH FOR 5-1/2" CASING, ASSEMBLY NO. 510L-007

10,000 MAXIMUM WORKING PRESSURE, 125K YIELD MATERIAL



Collapse Pressure:
11,310 psi @ 0 lbs Tensile
6,693 psi @ 490,000 lbs Tensile

Torque:
Top Sub to Bowl = 6,680 ft/lbs
Bowl to Guide = 1,500 ft/lbs

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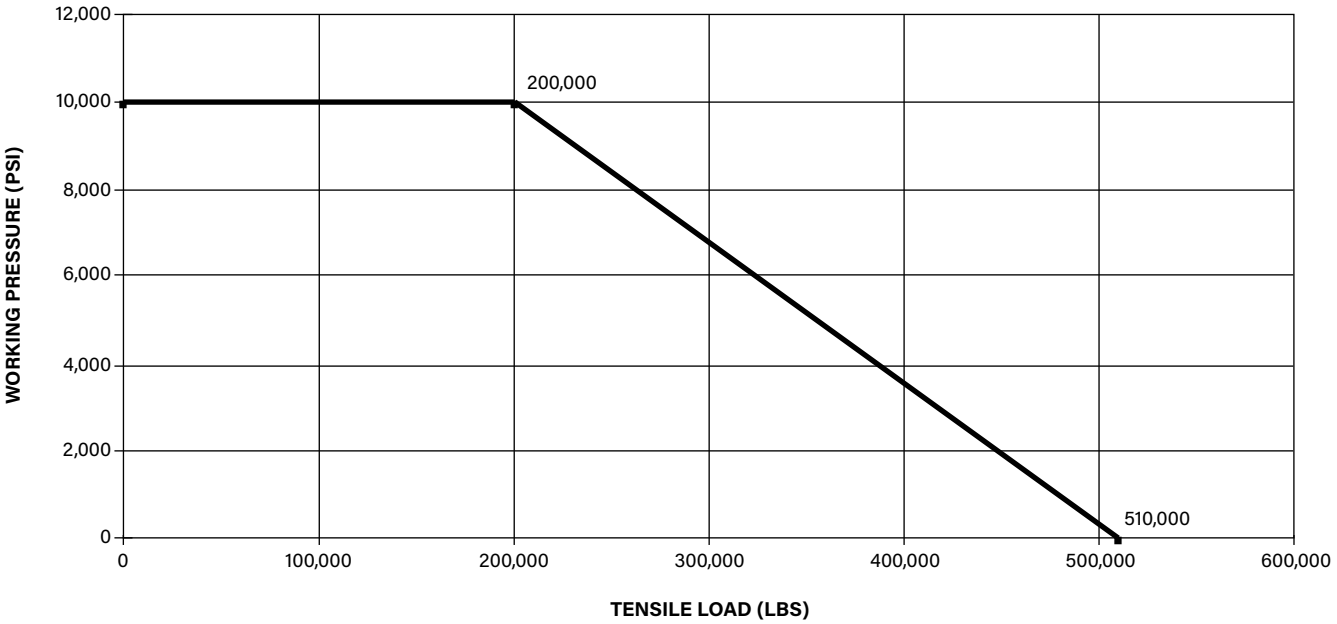
STRENGTH DATA FOR 8-5/8" OD CASING PATCH FOR 7" CASING, ASSEMBLY NO. 510L-011

10,000 MAXIMUM WORKING PRESSURE, 125K YIELD MATERIAL

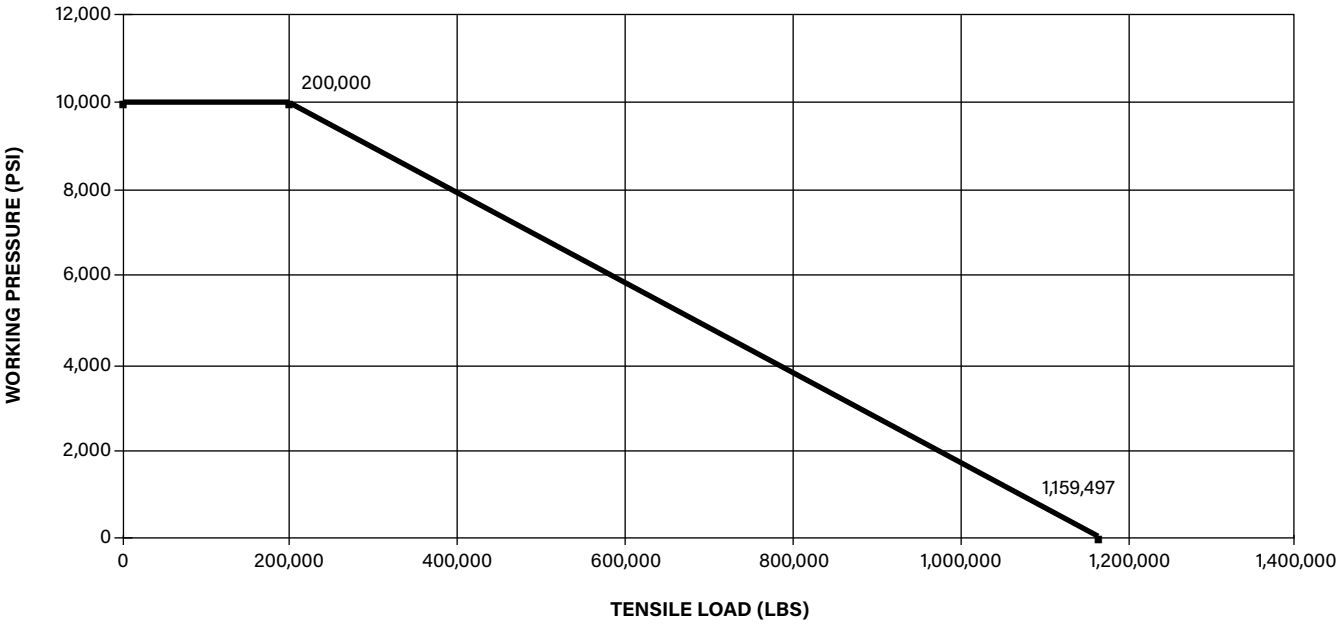


Collapse Pressure:
10,910 psi @ 0 lbs Tensile
8,063 psi @ 510,000 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 650,000 lbs
With 10K psi Internal Pressure = 215,000 lbs

STRENGTH DATA FOR 11.43" OD CASING PATCH FOR 9-5/8" CASING, ASSEMBLY NO. 510-963-010-002

10,000 MAXIMUM WORKING PRESSURE, 125K YIELD MAT'L



Collapse Pressure:
9,556 psi @ 0 lbs Tensile
4,002 psi @ 1,159,497 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 1,159,497 lbs
With 10K psi Internal Pressure = 439,899 lbs

Top Sub to Bowl = 28,335 ft/lbs
Bowl to Guide = 16,604 ft/lbs

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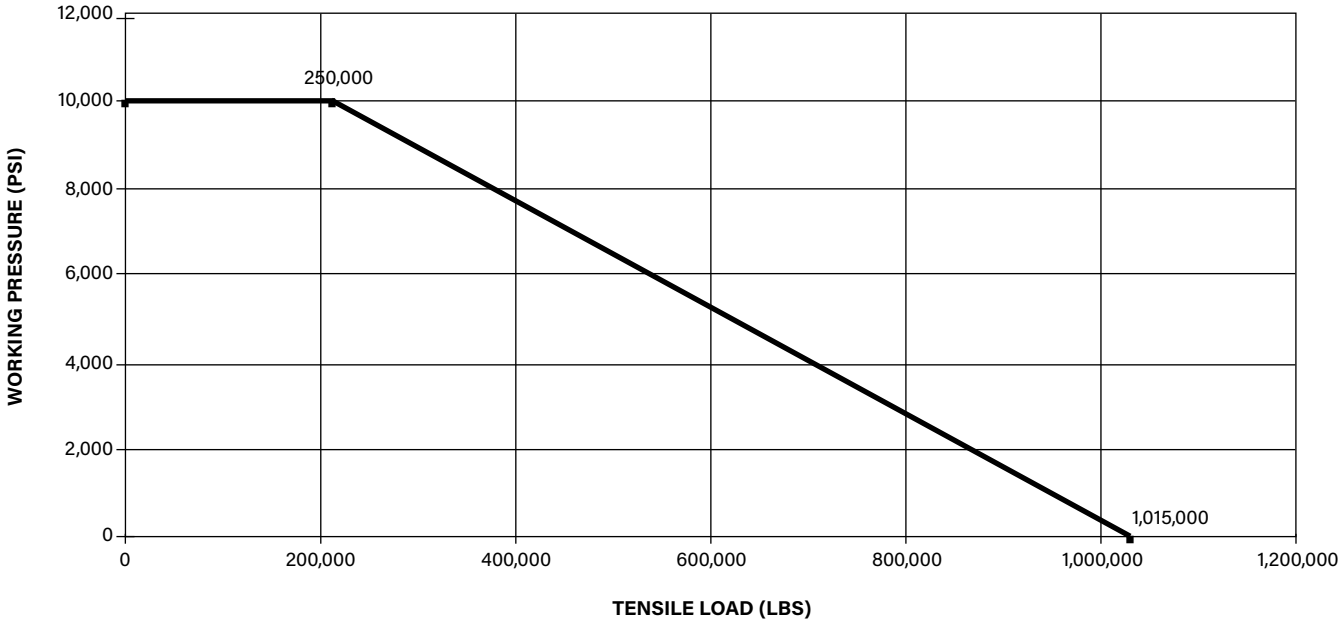
STRENGTH DATA FOR 11-3/4" OD CASING PATCH FOR 9-7/8" CASING, ASSEMBLY NO. 510-1175-010

10,000 MAXIMUM WORKING PRESSURE, 125K YIELD MATERIAL

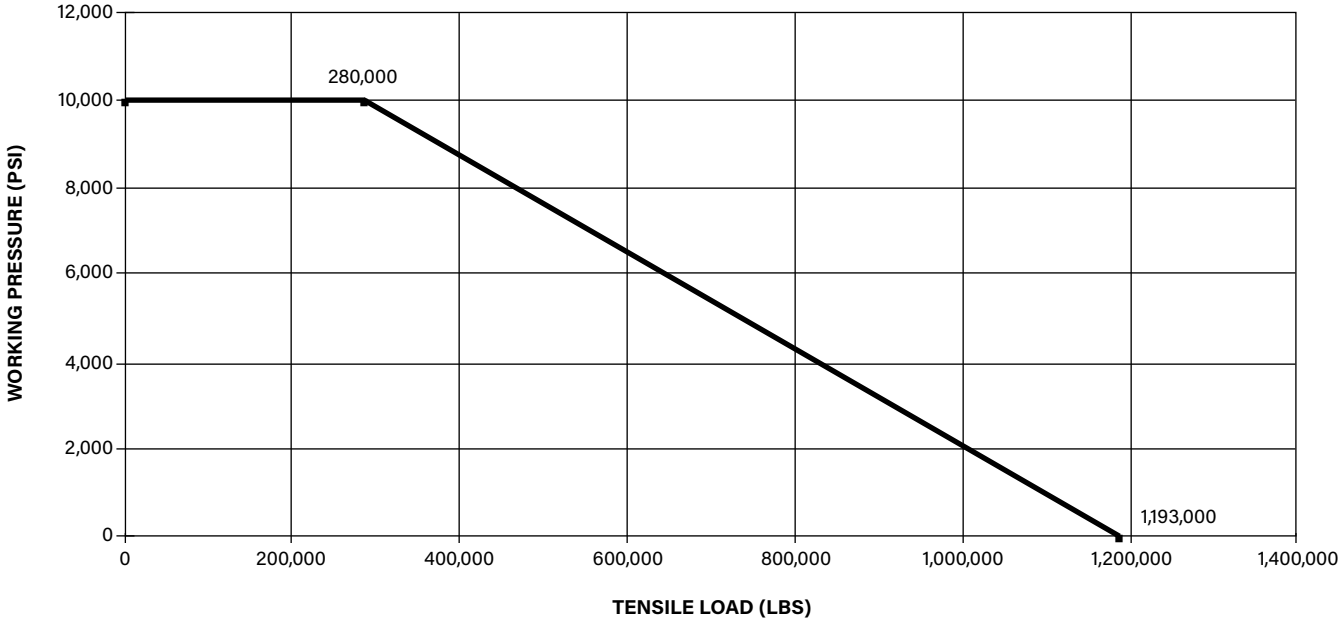


Collapse Pressure:
9,990 psi @ 0 lbs Tensile
6,787 psi @ 1,015,885 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 1,269,857 lbs
With 10K psi Internal Pressure = 503,971 lbs

STRENGTH DATA FOR 12-3/4" OD CASING PATCH FOR 10-3/4" CASING, ASSEMBLY NO. 510-1275-010

10,000 MAXIMUM WORKING PRESSURE, 125K YIELD MATERIAL



Collapse Pressure:
10,265 psi @ 0 lbs Tensile
9,153 psi @ 496,835 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 1,400,000 lbs
With 10K psi Internal Pressure = 496,835 lbs

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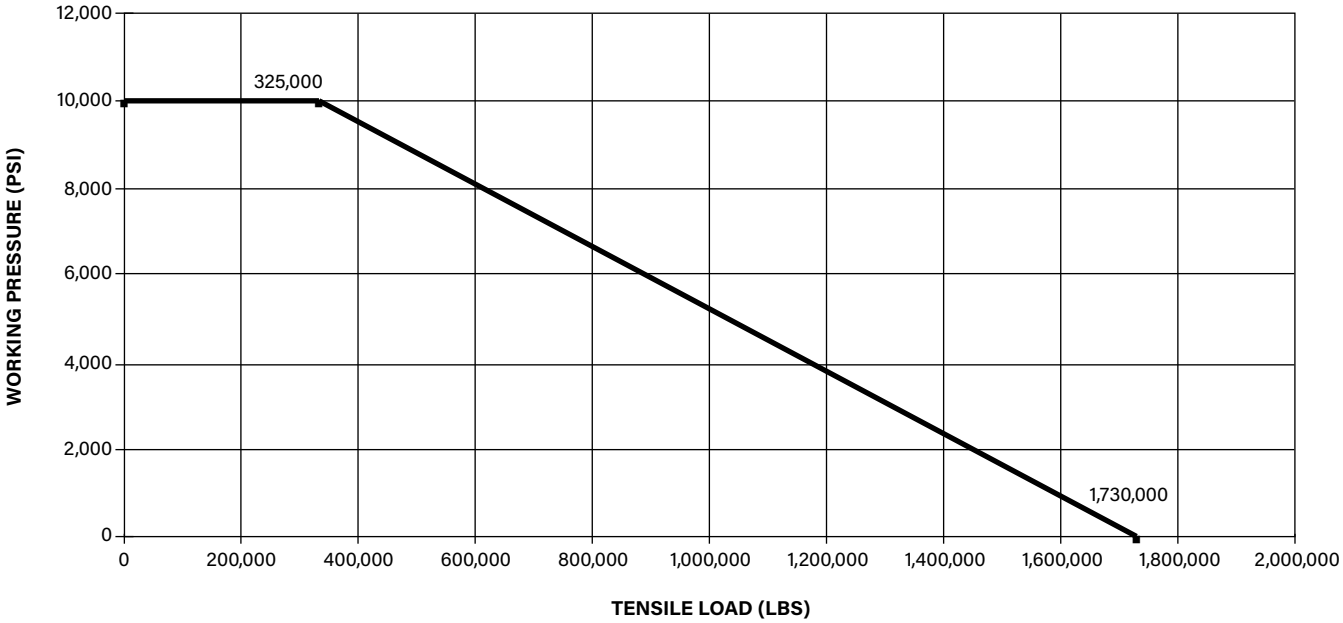
STRENGTH DATA FOR 15-5/8" OD CASING PATCH FOR 13-3/8" CASING, ASSEMBLY NO. 510-1338

10,000 MAXIMUM WORKING PRESSURE



Collapse Pressure:
10,037 psi @ 0 lbs Tensile
6,986 psi @ 1,730,000 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 2,038,725 lbs
With 10K psi Internal Pressure = 633,721 lbs

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Logan High Pressure Type L Packer Type Casing Patch - 12,000 PSI

O.D. CASING		5-1/2	9-5/8	9-7/8	10-3/4	11-3/4	13-3/8	13-5/8
O.D. PATCH		7-1/8	11-5/8	11-7/8	12-7/8	14-3/8	15-3/4	16-1/8
PRESSURE RATING (PSI)	12,000	12,000	12,000	12,000	12,000	12,000	12,000	
COMPLETE ASSEMBLY	**Logan Part No.**	**512-550-012**	**512-963-012**	**507-1188-12K**	**507-1288-012**	**507-1438-12K-500**	**507-1544-012-500**	**512-1363**
TOP SUB	**Logan Part No.**	**AT1000-12**	**AT1002-012**	**AY2003-12K**	*	**AY2006-12K-500**	**AY2007-012**	**AT1008-012**
TOP SUB SEAL (SMALL)	**Logan Part No.**	**568257-200**	**568273-200**	**568274-200**	*	**568278-200**	**568279-200**	**568279-200**
	No. Req'd	2	2	2	2	2	2	2
TOP SUB SEAL (LARGE)	**Logan Part No.**	**568257-200**	**568273-200**	**568275-200**	*	**568278-200**	**568280-200**	**568280-200**
	No. Req'd	1	1	1	1	1	1	1
BOWL	**Logan Part No.**	**AT12000-12**	**AT12002-012**	**AY11003-12K-500**	*	**AY11006-12K-500**	**AY11007-012-502**	**AT12008-012**
GUIDE	**Logan Part No.**	**AT13000-12**	**AT13002-012**	**AY12003-12K-500**	*	**AY12006-12K-500**	**AY12007-012-502**	**AT13008-012**
SHEAR PINS	**Logan Part No.**	**AC14002**	**AC14002**	**AC14002**	*	**AC14002**	**AC14008**	**AC14008**
	No. Req'd	2	2	2	2	2	2	2
TYPE L PACKER	**Logan Part No.**	**AT6000**	**AT6002**	**AT6003**	**AT6004**	**AT6006**	**AT6004**	**AT6008**
	No. Req'd	4	4	4	4	4	4	4
PACKER PROTECTOR	**Logan Part No.**	**ZL3007**	**AT7002**	**AY6003-500**	*	**AY6006-12K-500**	**AY6007-012-502**	**AT7008**
GRAPPLE CONTROL	**Logan Part No.**	**Z6007**	**AT10002**	**AY9003-500**	*	**AY9006-12K-500**	**AY9007-501**	**AT10008**
GRAPPLE	**Logan Part No.**	**Z5007**	**AT11002**	**AY10003**	*	**AY10006**	**AY10007-502**	**AT11008**

OPTIONAL

EXTENSION SUB *(5 feet long)*	**Logan Part No.**	**AT3000-12**	**AT3002-012**	**AY3003-12K-500**	*	**AY3006-12K-500**	**AY3007-012-502**	**AT3008-012**
EXTENSION SUB SEAL (SMALL)	**Logan Part No.**	**568257-200**	**568273-200**	**568274-200**	*	**568278-200**	**568279-200**	**568279-200**
	No. Req'd	2	2	2	2	2	2	2
EXTENSION SUB SEAL (LARGE)	**Logan Part No.**	**568257-200**	**568273-200**	**568275-200**	*	**568278-200**	**568280-200**	**568280-200**
	No. Req'd	1	1	1	1	1	1	1

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

** Part numbers available upon request*

Notes:
(1) H_2S casing patches available upon request.
(2) Higher pressure casing patches of this design are available upon request.
(3) Other sizes of casing patches are available upon request.
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When ordering, please specify:
(1) Complete assembly or part number
(2) Size and type of connection
(3) With or without five-foot extensions

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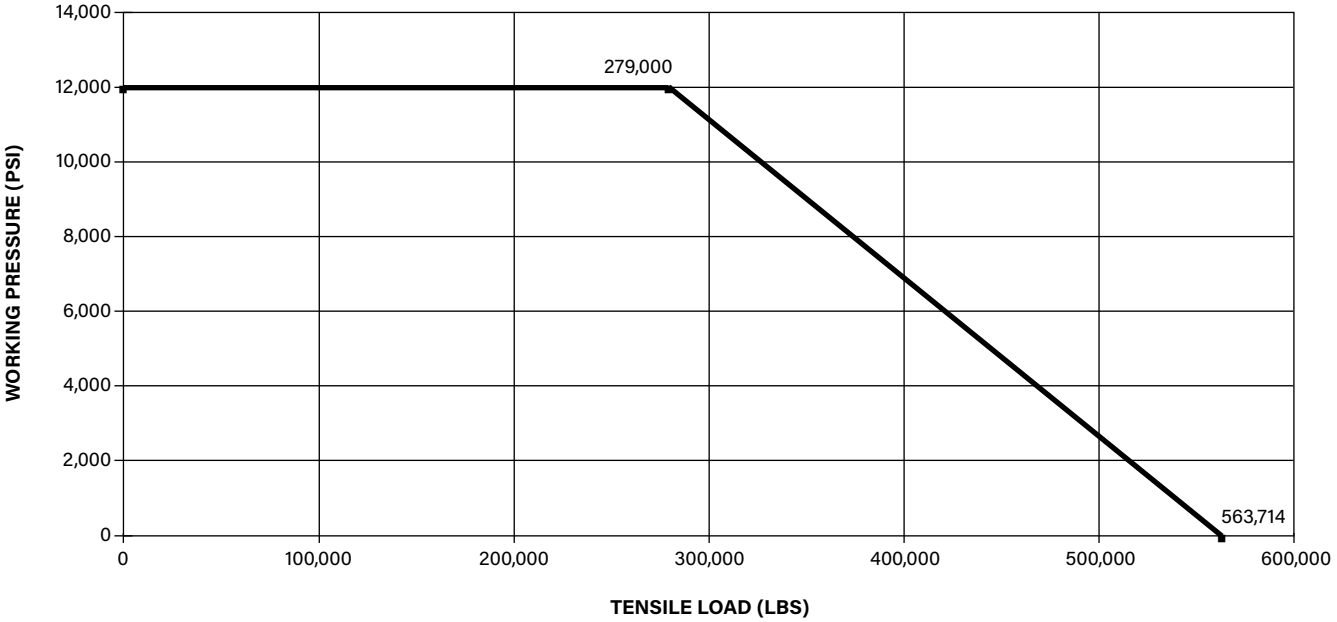
STRENGTH DATA FOR 7-1/8" OD CASING PATCH FOR 5-1/2" CASING, ASSEMBLY NO. 512-550-012

12,000 MAXIMUM WORKING PRESSURE, 140K YIELD MATERIAL

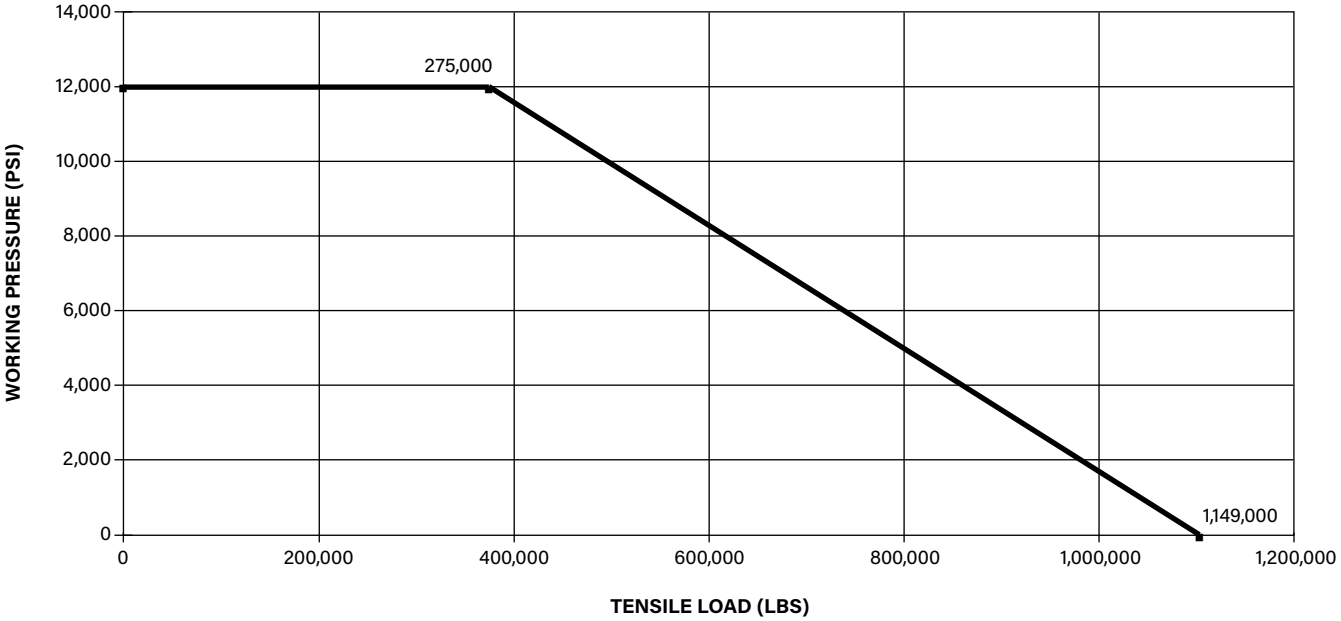


Collapse Pressure:
14,727 psi @ 0 lbs Tensile
9,863 psi @ 565,000 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 663,193 lbs
With 10K psi Internal Pressure = 378,093 lbs

STRENGTH DATA FOR 11-5/8" OD CASING PATCH FOR 9-5/8" CASING, ASSEMBLY NO. 512-963-012

12,000 MAXIMUM WORKING PRESSURE, 125K YIELD MATERIAL



Collapse Pressure:
11,380 psi @ 0 lbs Tensile
7,667 psi @ ? lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 1,436,280 lbs
With 12K psi Internal Pressure = 562,256 lbs

Torque @ Yield = 77,106 ft/lbs
Top Sub to Bowl = 24,500 ft/lbs
Bowl to Guide = 13,500 ft/lbs

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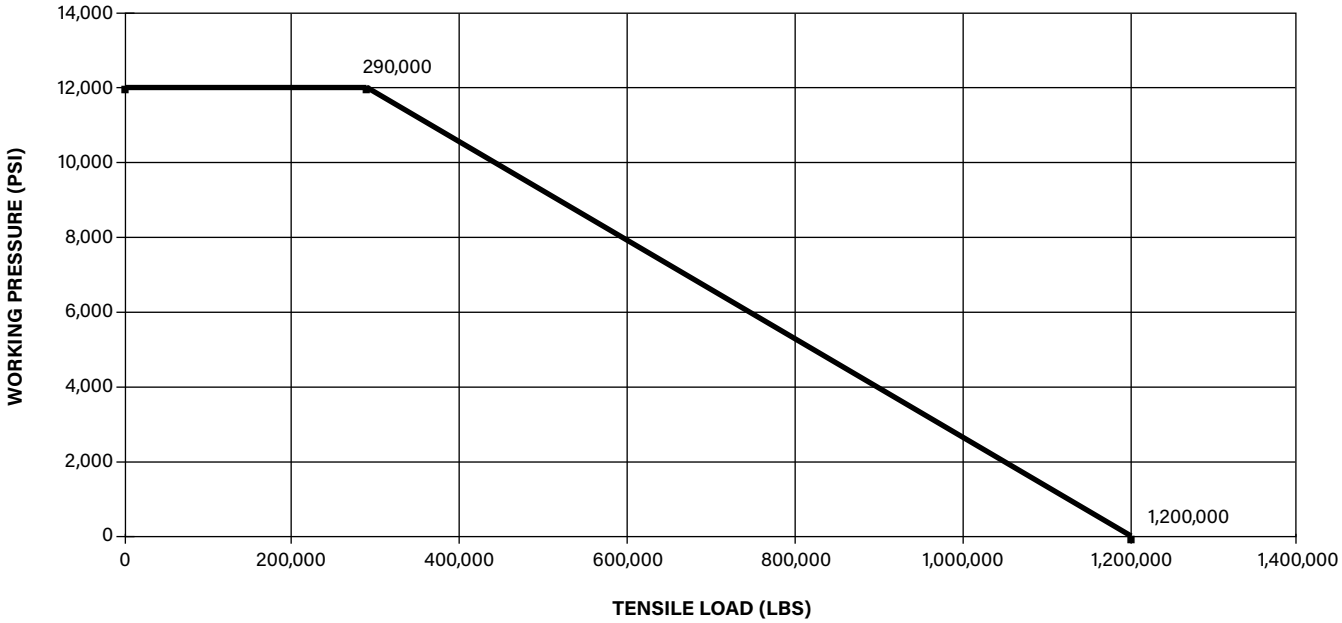
STRENGTH DATA FOR 11-7/8" OD CASING PATCH FOR 9-7/8" CASING, ASSEMBLY NO. 507-1188-12K

12,000 MAXIMUM WORKING PRESSURE, 125K YIELD MATERIAL

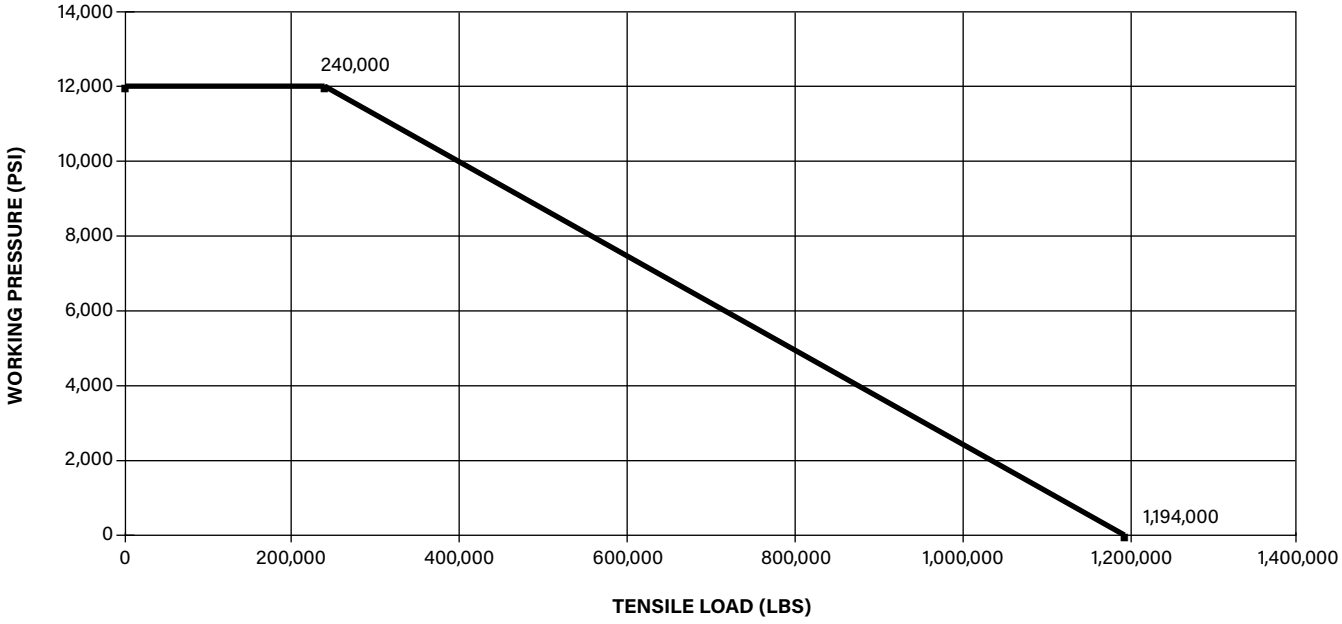


Collapse Pressure:
12,428 psi @ 0 lbs Tensile
8,019 psi @ 1,015,885 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 1,606,620 lbs
With 12K psi Internal Pressure = 733,503 lbs

STRENGTH DATA FOR 12-7/8" OD CASING PATCH FOR 10-3/4" CASING, ASSEMBLY NO. 507-1288-012

12,000 MAXIMUM WORKING PRESSURE, 125K YIELD MATERIAL



Collapse Pressure:
11,314 psi @ 0 lbs Tensile
7,854 psi @ 1,332,538 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 1,568,000 lbs
With 10K psi Internal Pressure = 478,541 lbs

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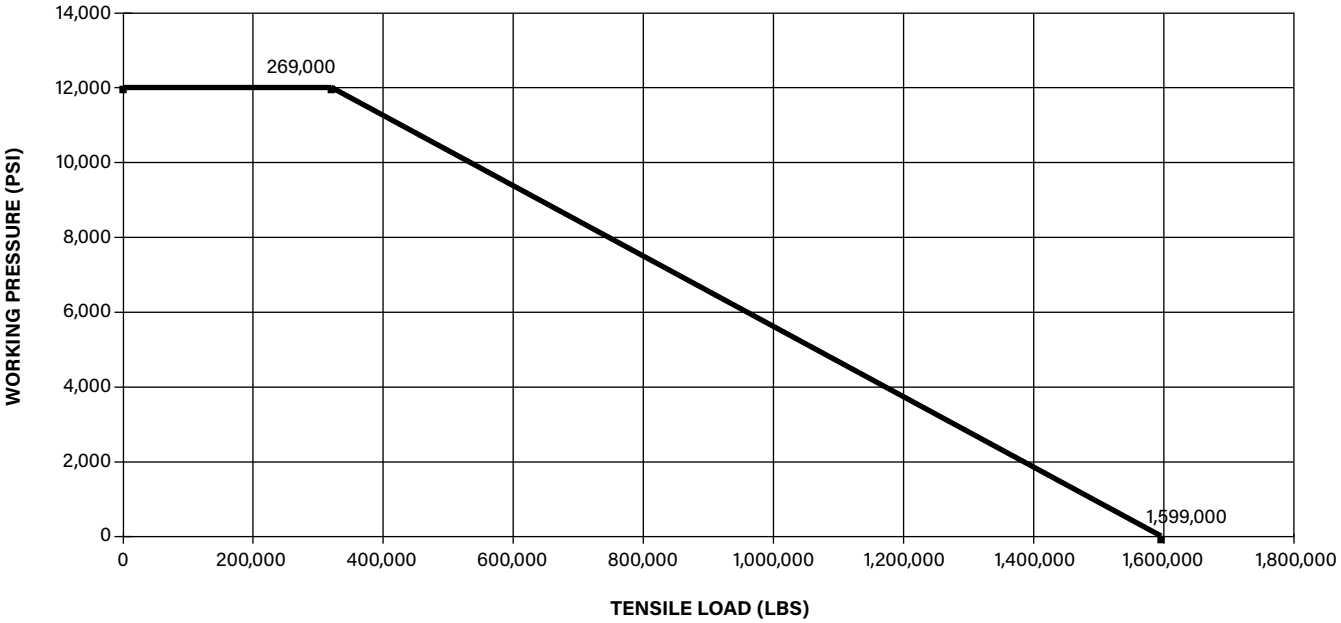
STRENGTH DATA FOR 14-3/8" OD CASING PATCH FOR 11-7/8" CASING, ASSEMBLY NO. 507-1438-12K-500

12,000 MAXIMUM WORKING PRESSURE, 125K YIELD MATERIAL

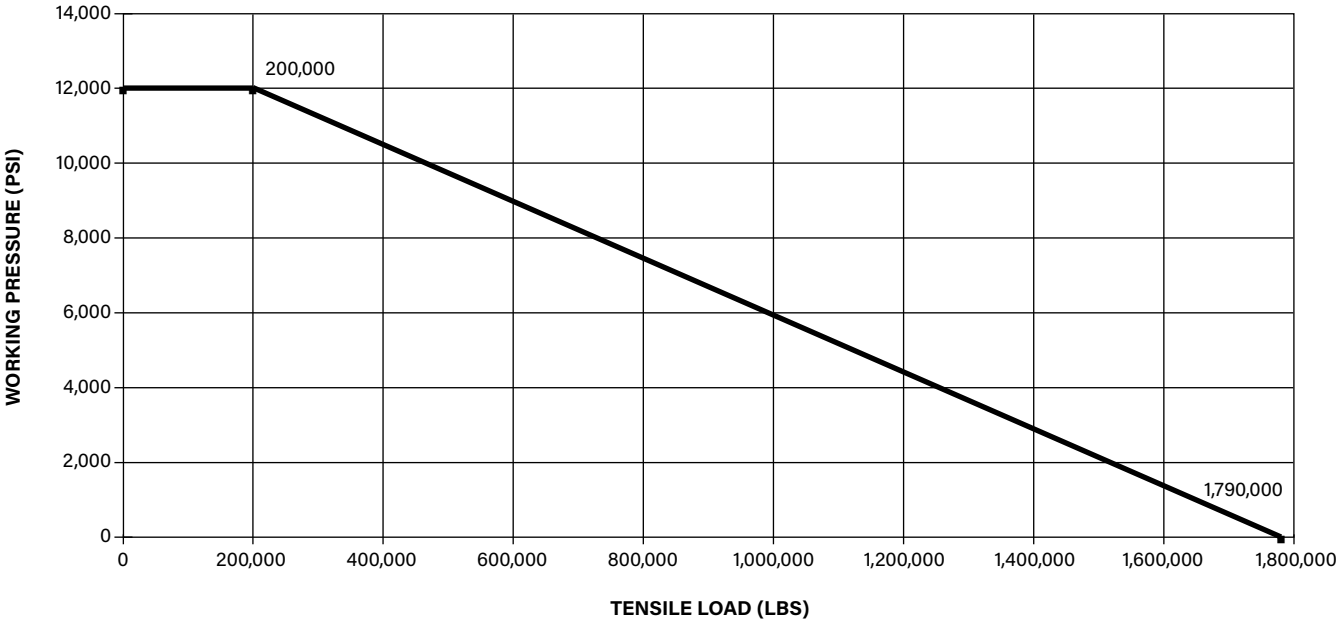


Collapse Pressure:
13,134 psi @ 0 lbs Tensile
10,410 psi @ 1,599,000 lbs Tensile

Torque:
Maximum = 14,720 ft/lbs
Recommended = 7,500 ft/lbs
Guide = 3,500 ft/lbs

STRENGTH DATA FOR 15-3/4" OD CASING PATCH FOR 13-3/8" CASING, ASSEMBLY NO. 507-1544-012-500

12,000 MAXIMUM WORKING PRESSURE



Collapse Pressure:
12,676 psi @ 0 lbs Tensile
8,378 psi @ 1,790,000 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 2,239,373 lbs
With 12K psi Internal Pressure = 572,874 lbs

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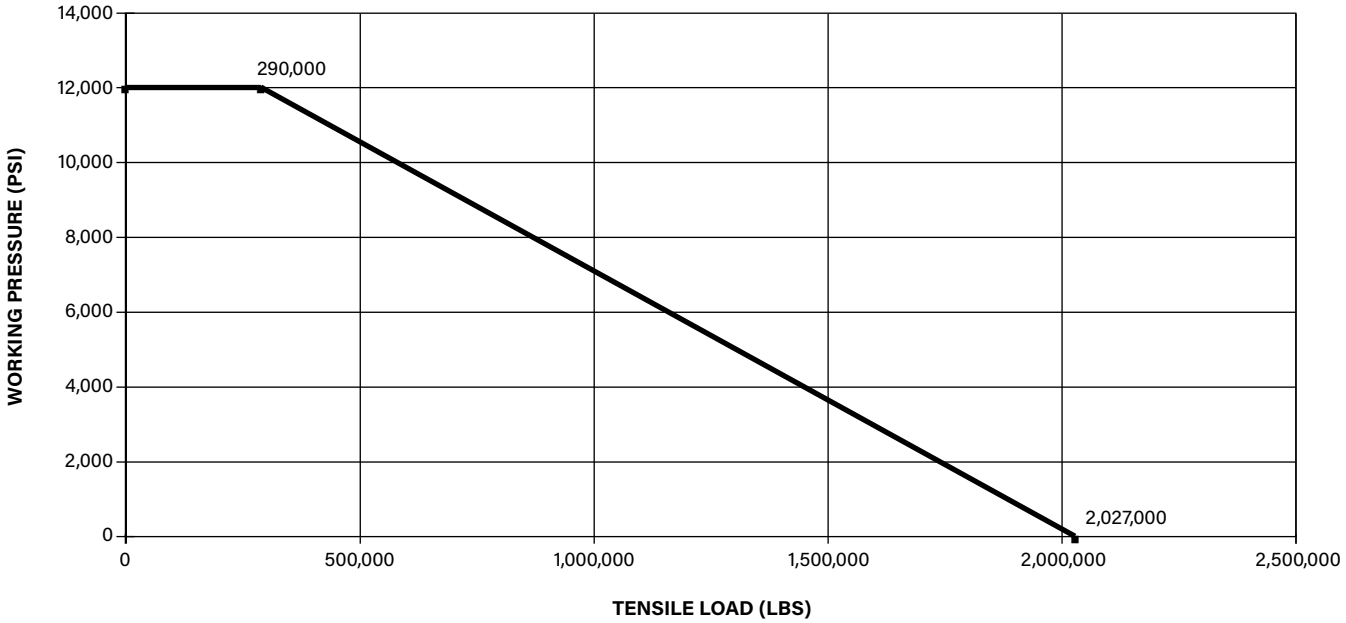
STRENGTH DATA FOR 16-1/8" OD CASING PATCH FOR 13-5/8" CASING, ASSEMBLY NO. 512-1363

12,000 MAXIMUM WORKING PRESSURE



Collapse Pressure:
11,500 psi @ 0 lbs Tensile
8,000 psi @ 2,027,443 lbs Tensile

Torsional Strength:
Torsional Strength @ Yield = 385,208 ft/lbs
Recommended Make Up Torque = 15,760 ft/lbs

Burst Pressure:
18,812 psi

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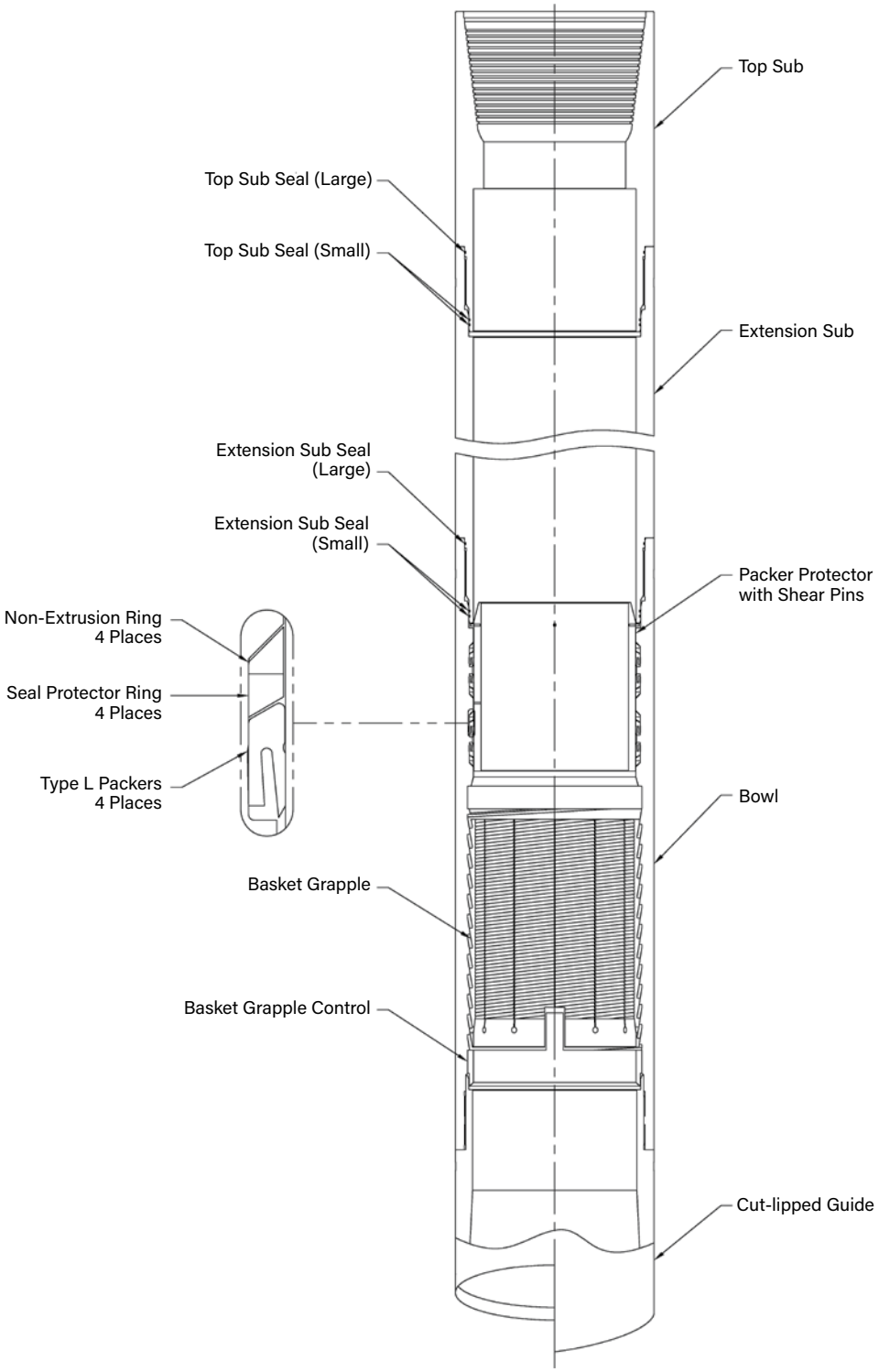

Logan Type L Packer Type Casing Patch
15K Assembly

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Logan High Pressure Type L Packer Type Casing Patch - 15,000 PSI

O.D. CASING		4-1/2	5-1/2	14				
O.D. PATCH		6-1/4	7-1/8	17-3/8				
PRESSURE RATING (PSI)	15,000	15,000	15,000					
COMPLETE ASSEMBLY	**Logan Part No.**	**515-625-15**	**515-713**	**515-1738**				
TOP SUB	**Logan Part No.**	**BT1005-15**	**ZL1007-15**	**AT1009-15**				
TOP SUB SEAL (SMALL)	**Logan Part No.**	**568248-200**	**568257-200**	**568280-200**				
	No. Req'd	2	2	2				
TOP SUB SEAL (LARGE)	**Logan Part No.**	**568251-200**	**568257-200**	**568281-200**				
	No. Req'd	1	1	1				
BOWL	**Logan Part No.**	**BT2005-15**	**ZL2007-15**	**AT12009-15**				
GUIDE	**Logan Part No.**	**BT7005-15**	**ZL7007-15**	**AT13009-15**				
SHEAR PINS	**Logan Part No.**	**AC14002**	**AC14002**	**AC14008**				
	No. Req'd	2	2	4				
TYPE L PACKER	**Logan Part No.**	**AT6009**	**AT6000**	**AT15009-15-002**				
	No. Req'd	4	4	4				
SEAL PROTECTOR RING, LEAD	**Logan Part No.**	**...**	**...**	**AT15009-15-003**				
	No. Req'd	...	...	4				
NON-EXTRUSION RING, STEEL	**Logan Part No.**	**...**	**...**	**AT15009-15-004**				
	No. Req'd.	...	...	4				
PACKER PROTECTOR	**Logan Part No.**	**ZL3005-001**	**ZL3007**	**AT7009-15**				
GRAPPLE CONTROL	**Logan Part No.**	**Z6005 ****	**ZL6007-15**	**AT10009-15**				
GRAPPLE	**Logan Part No.**	**Z5005**	**ZL5007-15**	**AT11009-15**				

OPTIONAL

EXTENSION SUB *(5 feet long)*	**Logan Part No.**	**BTE1005-15**	**BTE1007-15**	**AT3009-15**				
EXTENSION SUB SEAL (SMALL)	**Logan Part No.**	**568248-200**	**568257-200**	**568280-200**				
	No. Req'd	2	2	2				
EXTENSION SUB SEAL (LARGE)	**Logan Part No.**	**568251-200**	**568257-200**	**568281-200**				
	No. Req'd	1	1	1				

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*** Mill Control Packer instead of Grapple Control*

Notes:
(1) H_2S casing patches available upon request.
(2) Other sizes of casing patches are available upon request.
(3) Casing patches can be made from special materials.
Prices and delivery information is available upon request.

When ordering, please specify:
(1) Complete assembly or part number
(2) Size and type of connection
(3) With or without five-foot extensions

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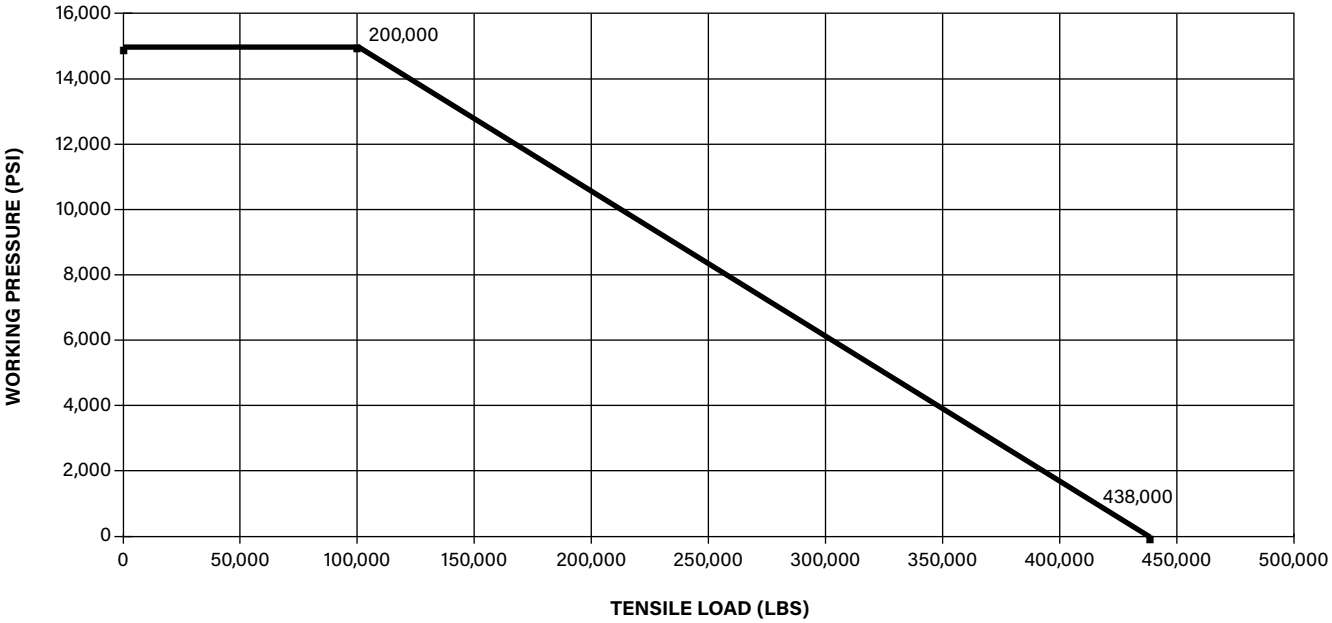
STRENGTH DATA FOR 6-1/4" OD CASING PATCH FOR 4-1/2" CASING, ASSEMBLY NO. 515-625-15

15,000 MAXIMUM WORKING PRESSURE, 150K YIELD MATERIAL



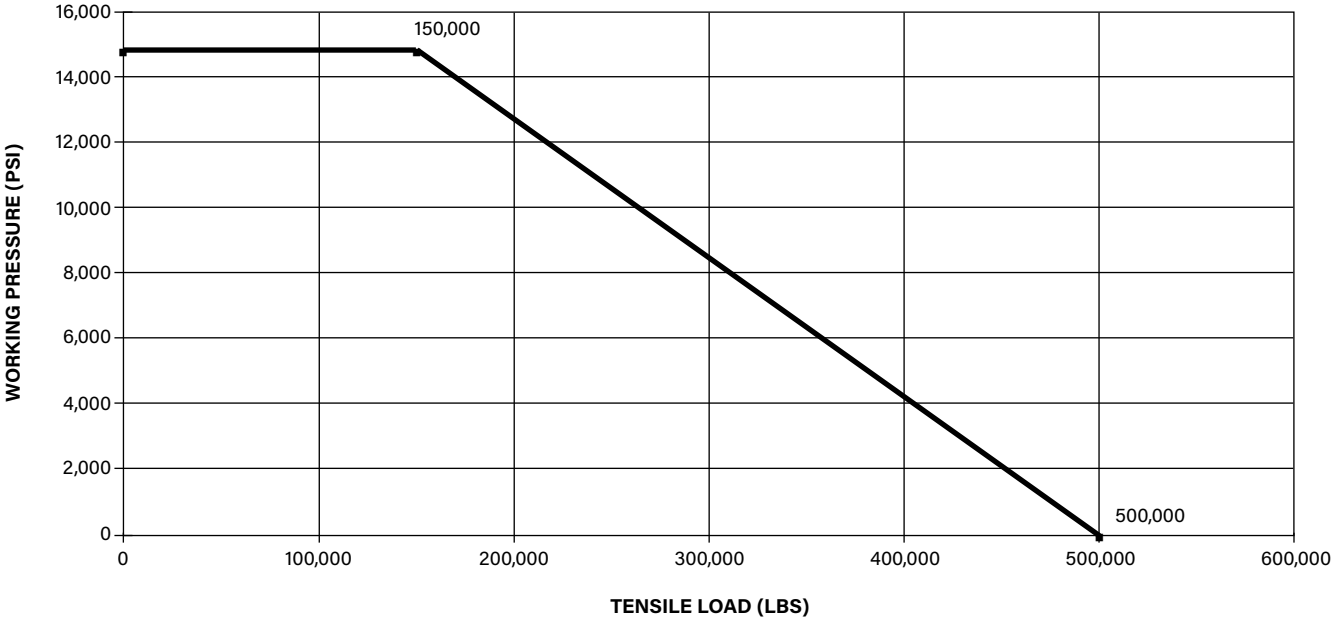
Collapse Pressure:
20,557 psi @ 0 lbs Tensile
10,095 psi @ 1,174,778 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 548,205 lbs
With 15K psi Internal Pressure = 309,641 lbs

Torque:
Maximum = 12,035 ft/lbs
Recommended = 7,055 ft/lbs

STRENGTH DATA FOR 7-1/8" OD CASING PATCH FOR 5-1/2" CASING, ASSEMBLY NO. 515-713

15,000 MAXIMUM WORKING PRESSURE, 140K YIELD MATERIAL



Collapse Pressure:
16,537 psi @ 0 lbs Tensile
11,317 psi @ 632,968 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 632,968 lbs
With 15K psi Internal Pressure = 276,593 lbs

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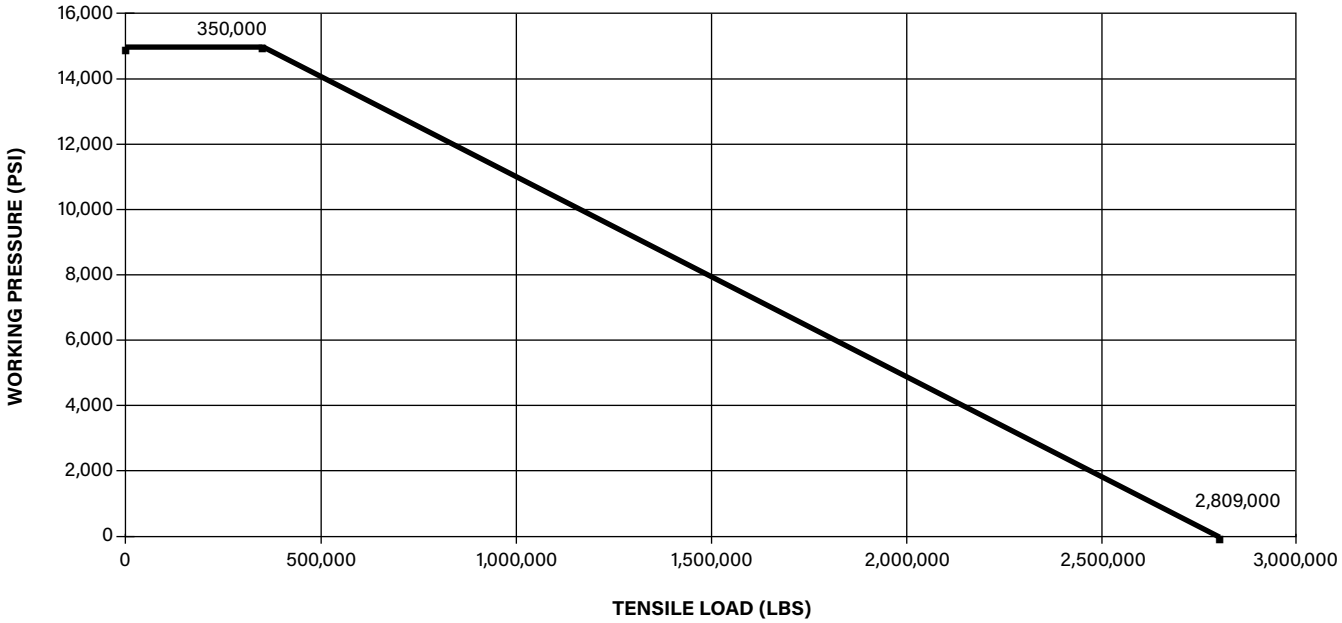
STRENGTH DATA FOR 17-3/8" OD CASING PATCH FOR 14" CASING, ASSEMBLY NO. 515-1738

15,000 MAXIMUM WORKING PRESSURE, 125K PSI YIELD MATERIAL



Collapse Pressure:
15,684 psi @ 0 lbs Tensile
11,862 psi @ 2,809,070 lbs Tensile

Tensile Strength @ Yield:
With 0 psi Internal Pressure = 3,511,338 lbs
With 15K psi Internal Pressure = 1,202,267 lbs

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