FIELD PROVEN

BLAZE® Cages Extend Run-Life of Sucker Rod Pumps in the Permian Basin

ENDURANCE LIFT SOLUTIONS

A FIELD PROVEN WHITEPAPER

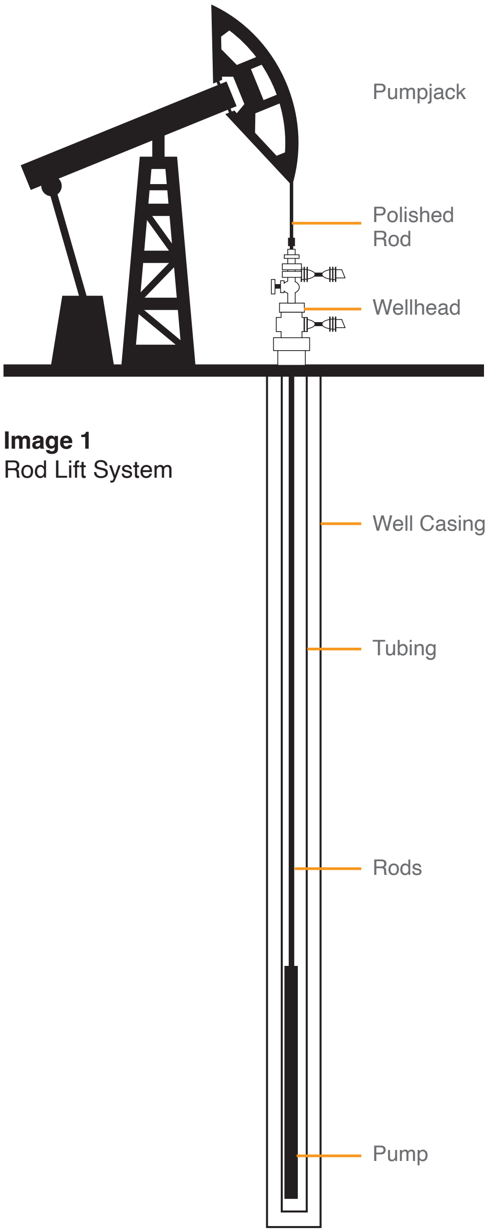


Image 1
Rod Lift System

In artificial lift applications, sandy and corrosive environments, along with highly deviated wellbores, are often encountered. Each of these conditions can lead to mechanical wear, abrasion, or corrosion of the many critical parts that comprise an artificial lift system. These issues can have a significant impact on the longevity of equipment and often result in higher operating expenses for the operator due to equipment replacements, well interventions, and lost production resulting from downtime.

One of the most common forms of artificial lift used to extract oil from a reservoir is rod lift. A rod lift system [Image 1] consists of a prime mover, a surface pump, sucker rod string, and downhole pump. The prime mover provides energy to the surface pumping unit to drive the vertical reciprocating action that lifts and lowers the rod string connected to the downhole pump. This reciprocating action powers the downhole pump, which displaces the wellbore fluid up the tubing, where it exits through the surface flowline.

The Sucker Rod Pump Cage – Critical to Rod Pump System Life and Efficiency

The efficiency of the downhole pump is a key determining factor in achieving optimal production of a sucker rod pumped well. Critical to pump efficiency is the sucker rod pump cage [Image 2] – an essential component that is often exposed to mechanical wear, along with abrasive, erosive, or corrosive well conditions downhole.

Image 2
Sucker Rod Pump Cage

The cage serves to limit the movement of the valve ball (i.e., two-stage valve) – constraining its motion and ensuring the ball moves within a specific range. A properly designed cage contributes to overall pump performance by maintaining optimal valve ball movement, reducing wear, and stabilizing the system.

Given the role a cage plays in a sucker rod pump system, it is subject to a lot of abuse [Image 3]. Bearing this in mind, material selection and cage design should be matched to specific well conditions in order to optimize performance and the run life of the pump.

Image 3
Examples of common failure modes of sucker rod pump cages

Abrasion/Stuck | Abrasion | Abrasion/Side Load | Corrosion/Pitting | Beat Out

BLAZE®-Treated Sucker Rod Pump Cages – Extending the Mean Time to Failure

This article highlights the use of BLAZE® technology to extend the mean time to failure of sucker rod pump cages for a large E&P company operating in the Permian. Historically, this producer utilized stainless steel or Monel cages in their downhole pumps with varying levels of success. Table 1 reflects the run-time performance for a sample of twenty-five wells evaluated.

Table 1 - Historical Run Time Performance (days)

Material Type	Average	Minimum	Maximum
MONEL	220	33	713
SS	156	78	281

Sample Size (n = 25)

In 2022, this E&P company began utilizing BLAZE®-treated cages with its downhole pumps in the Permian. The company made this move in response to the premature wear and short run-time performance being experienced by the cages due to excessive sand and corrosive conditions that were prevalent in many of the company's sucker rod-pumped wells. Since incorporating BLAZE® technology in their downhole pumps, the company has experienced an average 4x increase in run-time performance (288 days longer) compared to stainless and Monel cages for the wells evaluated [Table 2].

Table 2 - Run time comparison, BLAZE® vs Other Materials – Same Wells

WELL NAME	BEFORE BLAZE	AFTER BLAZE	DELTA	BLAZE PERFORMANCE MULTIPLE
WELL 1	65	610	545	9.4x
WELL 2	76	603	600	7.9x
WELL 3	207	600	393	2.9x
WELL 4	491	593	102	1.2x
WELL 5	81	572	491	7.1x
WELL 6	713	579	-134	.8x
WELL 7	110	567	457	5.2x
WELL 8	700	566	-134	.8x
WELL 9	49	602	553	12.3x
WELL 10	497	561	64	1.1x
WELL 11	48	560	492	8.2x
WELL 12	140	496	356	3.5x
WELL 13	118	484	366	4.1x
WELL 14*	133	481	348	3.6x
WELL 15	224	468	244	2.1x
WELL 16	187	449	262	2.4x
WELL 17	252	397	145	1.6x
WELL 18	172	394	222	2.3x
WELL 19	187	338	151	1.8x
WELL 20	121	446	325	3.7x
WELL 21*	33	58	25	1.8x
WELL 22	144	533	389	3.7x
WELL 23	78	589	511	7.9x
WELL 24	121	512	391	4.2x
WELL 25	281	392	111	1.4x
AVERAGE	210	498	288	4.0x

*Pump pulled. All others still active.

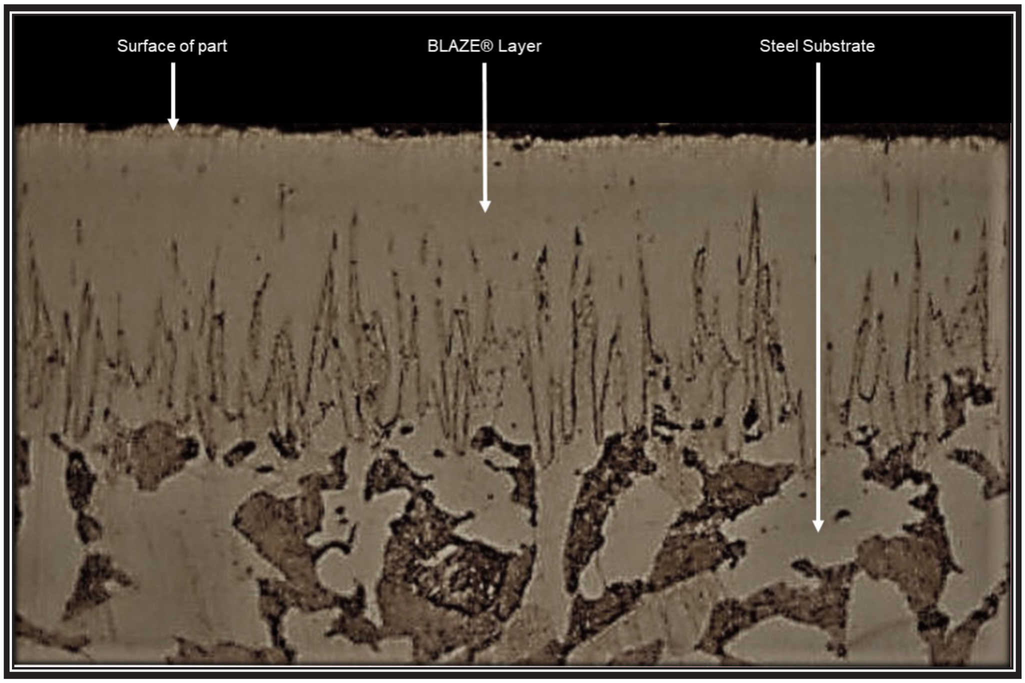
Given the success achieved with BLAZE cages, the E&P company has deployed other BLAZE-treated products, such as couplings, valve rod guides, and other pump components, to address wear-related issues and extend run times for over 400 of its wells in the Permian Basin.

BLAZE® Surface Treatment

The BLAZE® surface treatment creates a slick, hard, intermetallic boride layer that (unlike coatings or plating) does not alter the dimensions of the part. This treatment's slick, hard, and corrosion-resistant surface slows wear by protecting the cage from the effects of abrasion, erosion, and corrosion.

BLAZE surface treatment is a form of surface hardening in which boron is diffused into the steel substrate, resulting in a composite layer of boron at the surface of the substrate [Image 3]. Based on the combination of extreme hardness, abrasion resistance, and corrosion resistance, BLAZE- treated parts have demonstrated a consistent ability to outlast untreated parts in even the most challenging conditions. While the treatment is not suited for some materials, such as copper, aluminum and resulfurized steel, it works on many of the ferrous and nonferrous materials used in the oil and gas industry.

Image 3
Microscopic view of the BLAZE® Layer



Used effectively in a wide range of artificial lift parts, BLAZE treatment has also been successfully applied to couplings, trim kits, plungers, and other pump components and related equipment with similar positive results.

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For more information concerning
Endurance Lift Rod Lift Solutions

Visit: https://endurancelift.com
Call: (940) 301-3501
Email: rod@endurancelift.com