

2.8 YEARS OF FIELD PERFORMANCE OF HIGH DENSITY POLYETHYLENE SLEEVED SINKERBARS (POLYBARS)

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ABSTRACT

During the past 18 years, rodstrings installed with a properly designed Sinkerbar Section have proven to reduce downstroke buckling and maintain tension in all rods. Results from use of these rodstring designs have been reduced rod-on-tubing wear and extended tubing and rod life.

During the past 5 years, use of high-density polyethylene liners in oilfield tubing has shown to increase wear resistance and reduce the coefficient of friction. Results from use of these liners in tubing have been reduced rod-on-tubing wear and extended tubing life.

These successful oil field products and their benefits have been combined to develop a high-density polyethylene sleeved Sinkerbar called a Polybar. During this test, these Polybars exhibited the resistance to buckling of a Sinkerbar with the wear resistance and coefficient of friction of polyethylene.

This paper presents results of a 2.8 year field test involving five (5)-producing wells installed with Polybars. The documented results show that no tubing leaks occurred in tubing protected by Polybars.

FIELD PERFORMANCE OF NON-SLEEVED SINKERBARS

In a well-documented 147 well failure reduction program, tubing leaks have been reduced 72% during four (4) years of operation using a Best Practices Program involving Sinkerbars. Listed below are program results that led to the consideration and development of Polybars.

*41 wells (28 %) have not experienced a tubing leak since the start of this program.

*33 wells (22 %) have experienced tubing leaks only in tubing protected by Sinkerbars.

Apparently, 33 wells have controlled downstroke rodstring buckling to only the Sinkerbar section of the rodstring. Therefore, the only rod-on-tubing wear is occurring in this portion of the rodstring. Development of a new generation of Sinkerbars that will further reduce this wear would impact 22% of this 147 well Best Practices Program. These are the wells that have been identified to benefit from the creation and development of Polybars.

DESCRIPTION OF A POLYBAR

The Polybars utilized during this 2.8 year field test, were Steel Sinkerbars sleeved with high-density polyethylene. Listed below are specifications and components utilized to develop these Polybars.

*Polybar O.D.	1.559 inch O.D.
*Polybar Weight	5.2 Pounds per Foot
*Polybar Length	25.0 Feet
*Sinkerbar O.D.	1.375 inch O.D.
*Sinkerbar Grade	AISI 1042 (Grade-C) and AISI 4620 (Grade-K)
*Sinkerbar Weight	5.0 pounds per foot
*Polyethylene Sleeve I.D.	1.380 inch I.D.
*Sleeve Wall Thickness	0.092 inch
*Sleeve Weight	0.2 Pounds per foot

Patients are pending on this Polybar product and on several associated manufacturing processes.

OPERATIONAL BENEFITS OF POLYBARS

Several operational benefits were discovered during the 2.8 years of field testing. The benefits of installing Polyethylene on the O.D. of the Sinkerbar instead of the I.D. of tubing are listed below.

- *Inspection of Polyethylene is possible with each rodstring pull.
- *Internal diameter of tubing is not reduced.
- *Wells can produce with full size, insert rod pumps.
- *Damage to polyethylene from use of fishing tools in tubing is eliminated.

IMPACT OF WELLBORE FLUIDS ON POLYBARS

Wellbore fluids were found to impact the physical dimensions of the Polyethylene sleeve on the Polybar during the 2.8 years field test. Listed below are observations recorded during this test period;

- * The Polyethylene Sleeve expanded due to elevated wellbore fluid temperature and the migration of hydrocarbon and gas into the Polybar sleeve.
- * To compensate for these increases in sleeve length and sleeve diameter, the Polyethylene Sleeve was trimmed prior to installation on the Sinkerbar.
- * Polyethylene Sleeves were found to move on the Polybars during service.
- * Movement was minimized with couplings between Polybars and Master Centralized Flexbars between the pump and the last Polybar.
- * Polyethylene sleeve movement during service seemed to reduce rod-on-tubing friction.
- * Polyethylene sleeve movement during service helped clean the surface of the Sinkerbar.

PRODUCING WELLS UTILIZED DURING FIELD TEST

During this 2.8 year field test, four (4) producing companies selected five (5) producing wells. These five (5) test wells were selected because each well was experiencing tubing leaks inspite of various attempts to reduce the frequency of tubing leaks. Listed below is a description of each well with operating conditions and performance as of 12-22-2000.

	<u>Goldsmith</u>			<u>E.F.</u>	
	<u>San</u>	<u>Black</u>	<u>Preston</u>	<u>Cowden</u>	<u>J.B.</u>
	<u>Andres</u>	<u>"42"</u>	<u>Spraberry</u>	<u>"B"</u>	<u>Calverley</u>
		<u>Lease</u>	<u>Unit</u>	<u>Unit</u>	<u>Unit</u>
	<u>No. 1-12</u>	<u>No. 5</u>	<u>No. 3311-B</u>	<u>No. 18</u>	<u>No. 14</u>
Operating Company	Chevron	BP Permian	Pioneer	Occidental	BP-Permian
Pump Depth (Feet)	3,750	7,450	7,038	4,025	8,000
Pump Diameter (Inches)	2.0	1.25	1.25	2.25	1.25
Strokes Per Minute	10.1	6.6	6.6	8.65	6.0
100 % Production (BFPD)	706	73	89	871	70
Water Cut (%)	97	64	67	97	50
Polybar Installed (Feet)	250	425	525	575	350
Operation with Polybars	2.8 Years	1.7 Years	1.7 Years	1.6 Years	1.5 Years
Tubing O.D. (Feet)	2.875	2.375	2.375	2.875	2.375
Internal Surface of Tubing	Bare	Bare	Bare	Coated	Bare
	Inspected-B	New	Inspected	TK-99	New

DESCRIPTION OF ROD TAPERS (TOP TO BOTTOM)

Taper No. 1	1,800' 1.24" F.G.	2,850' 0.875" D	4,238' 0.990" F.G.	1,650' 1.24" F.G.	1,225' 0.875" D
Taper No. 2	600 1" D-mrgs	4,200' 0.750" D	2,275' 0.875" D	2,125' 1" D	250' 0.875D-mrgs
Taper No. 3	650' 1.500" -C	425' 1.559" Poly	525' 1.559" Poly	250 1.559" Poly	950' 0.875" D
Taper No. 4	450' 1.375" -K	N.A. N.A.	N.A. N.A.	N.A. N.A.	250' 0.875D-mrgs
Taper No. 5	250' 1.559" Poly	N.A. N.A.	N.A. N.A.	N.A. N.A.	575' 0.875" D
Taper No. 6	N.A. N.A.	N.A. N.A.	N.A. N.A.	N.A. N.A.	3,850' 0.750" D
Taper No. 7	N.A. N.A.	N.A. N.A.	N.A. N.A.	N.A. N.A.	550 0.875" D
Taper No. 8	N.A. N.A.	N.A. N.A.	N.A. N.A.	N.A. N.A.	350 1.559" Poly

INDIVIDUAL WELL PERFORMANCE AND GROUP PERFORMANCE WITH POLYBARS

Failure History of each of the five (5) wells was documented and recorded in failure vs. time graphs. Refer to Graphs 1,2,3,4 and 5 for individual failure history for each of these wells.

The Polybar installation date was used as a common reference point for each well. Failure history was recorded in one (1) year increments on both sides of the installation date. This organization of failure history established a baseline for comparing both individual well and group performance. Listed below is a tabulation of this Polybar performance documented through 12-22-2000*.

Well Performance of Polybars from 03-03-1998 through 12-22-2000

Tubing Leaks, Rod Parts and Pump Repairs Recorded as Failures

**Tubing leaks recorded if tubing leak is in tubing protected by Polybars.

<u>Recording Year</u>	<u>Tubing Leaks**</u>	<u>Rod Parts</u>	<u>Pump Repairs</u>	<u>Total Failures</u>
Prior 3rd	4	0	4	8
Prior 2nd	4	6	2	12
Prior 1st	9	5	4	18
Year 1	0	2	0	2
Year 2*	0	1	1	2

Well Performance of Polybars from 03-03-1998 through 12-22-2000

Tubing Leaks, Rod Parts and Pump Repairs Recorded as FPWPY

**Tubing leaks recorded if tubing leak is in tubing protected by Polybars.

<u>Recording Year</u>	<u>Tubing Leaks**</u>	<u>Rod Parts</u>	<u>Pump Repairs</u>	<u>Total Failures</u>
Prior 3rd	0.80	0.00	0.80	1.60
Prior 2nd	0.80	1.20	0.40	2.40
Prior 1st	1.80	1.00	0.80	3.60
Year 1	0.00	0.40	0.00	0.40
Year 2*	0.00	0.20	0.20	0.40

CONCLUSION FROM 2.8 YEARS OF FIELD TESTING WITH POLYBARS

- * No tubing leaks have occurred in tubing protected by Polybars
- * A total of six (6) tubing leaks have occurred during **this** test
- * Five (5) tubing leaks occurred above Polybars and one (1) occurred at **an** unknown depth
- * Two (2) wells have not experienced a tubing leaks since installation of Polybars

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