

Production Operations Wear Prevention Solutions

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Sucker rod and production tubing wear is an accepted reality of oilfield operations. This wear is the result of corrosion, erosion and equipment operations and contributes to between 50% and 85% of production well-service related expenses. The movement of produced fluids, rods and rod couplings within the production tubing result in wear; however, there have been several new technology enhancements to substantially reduce this wear.

Most common causes of wear:

- 1.) Up and down movement of rods against the tubing in a reciprocating pump completion cause wear to rods, couplings, tubing. There is also some up and down movement of the tubing resulting from the pump action which results in wear between the tubing and the casing.
- 2.) Rotational movement of rods and the harmonic oscillation of a Progressing Cavity Pump completion cause wear of rods, couplings and tubing.
- 3.) Produced fluid will cause erosion wear in the tubing and fluids containing abrasives cause significantly more wear.
- 4.) Corrosive chemicals present in produced fluid contribute to wear of the production system and is accelerated by heat created when rod and tubing elements rub one another at contact points.

Traditional corrective actions include:

- ◆ Visually inspect the rods coming out and replace any which appear suspect.
- ◆ Replace any tubing joints that are worn through and two joints above and below with new tubing.
- ◆ Move the remaining tubing joints strategically up or down in the tubing string to attain optimum life.

Technological advancements include:

- ◆ Advanced chemical treatment designs to reduce corrosion.
- ◆ Continuous rods, eliminating the rod coupling to reduce tubing wear.
- ◆ Rod Guides and Rod Rotators to reduce the wear of rods, rod couplings and tubing.
- ◆ Tubing Rotators, in conjunction with rotating tubing hangers and down hole tubing swivels, to allow for rotation in neutral, tension or compression positions.

Tubing and rods eventually wear to failure. Workovers are costly, requiring pulling and replacing the tubing and rods. "Wear Prevention Solutions" are instrumental in extending the intervals between workovers. Fewer well service jobs throughout the producing life of a well results in cost savings and increased revenues from reduced days of "lost production".

The bottom line effect is staggering in many cases. The attached data from specific wells in Canada produced with progressing cavity pumps show average costs and the effective savings of installing only a tubing rotator. The savings benefits for Reciprocating Beam or Hydraulic Pumps is estimated to be greater than that of Progressing Cavity Pump completions.



TUBING ROTATOR EFFECTIVENESS

Company	Region/Field	Well ID (LSD)	Failures Before Rotator	Effectiveness		Tubing Failures Since Rotator	Average Workover Cost (\$) (1)	Cost Savings To Date	Estimated Tubing Life (days)	Running % Operating Increase	Current Minimum Estimated Savings (2)	Notes
				Average Before Rotator	Tubing Life After Rotator							
Company A	Pembina	16-06	3	255	729	1	\$8,000	\$22,871	730	286%	\$114,510	Running/1 Failure
Company B	Consort	10A-21	1	112	567	0	\$6,500	\$32,906	784	506%	\$211,830	Running
		10B-21	1	219	1130	0	\$6,500	\$33,539	1533	516%	\$108,333	Running
		11C2-21	1	113	302	0	\$6,500	\$17,372	791	267%	\$209,956	Running
		15B-21	1	149	698	0	\$6,500	\$30,450	1043	468%	\$159,228	Running
		5A2-35	1	141	684	0	\$6,500	\$31,532	987	485%	\$168,262	Running
		4A-11	1	153	773	0	\$6,500	\$32,840	1071	505%	\$155,065	Running
Company C	Tangleflags	A12-17	2	110	426	0	\$8,200	\$31,756	770	387%	\$272,091	Running/1 Failure
Company D	Eyehill Creek	103/13-11	3	74	432	0	\$5,333	\$30,996	520	581%	\$261,883	Running
		104/14-11	3	62	222	0	\$5,949	\$21,416	432	360%	\$352,116	Running
		106/14-11	2	51	578	0	\$5,550	\$62,900	357	1133%	\$397,206	Running
		102/15-11	4	150	155	0	\$8,500	\$ 8,813	1047	104%	\$207,525	Running
		100/03-14	1	260	670	1	\$8,000	\$20,615	1820	258%	\$112,308	Running/1 Failure
		102/03-14	3	84	751	0	\$6,267	\$56,250	586	898%	\$273,386	Running
		103/05-14	3	84	632	0	\$10,867	\$81,759	588	752%	\$472,183	Running
		102/06-14	2	125	381	1	\$7,375	\$22,569	872	306%	\$216,215	Running
102/08-14	5	72	799	0	\$6,120	\$67,915	504	1110%	\$310,250	Running		

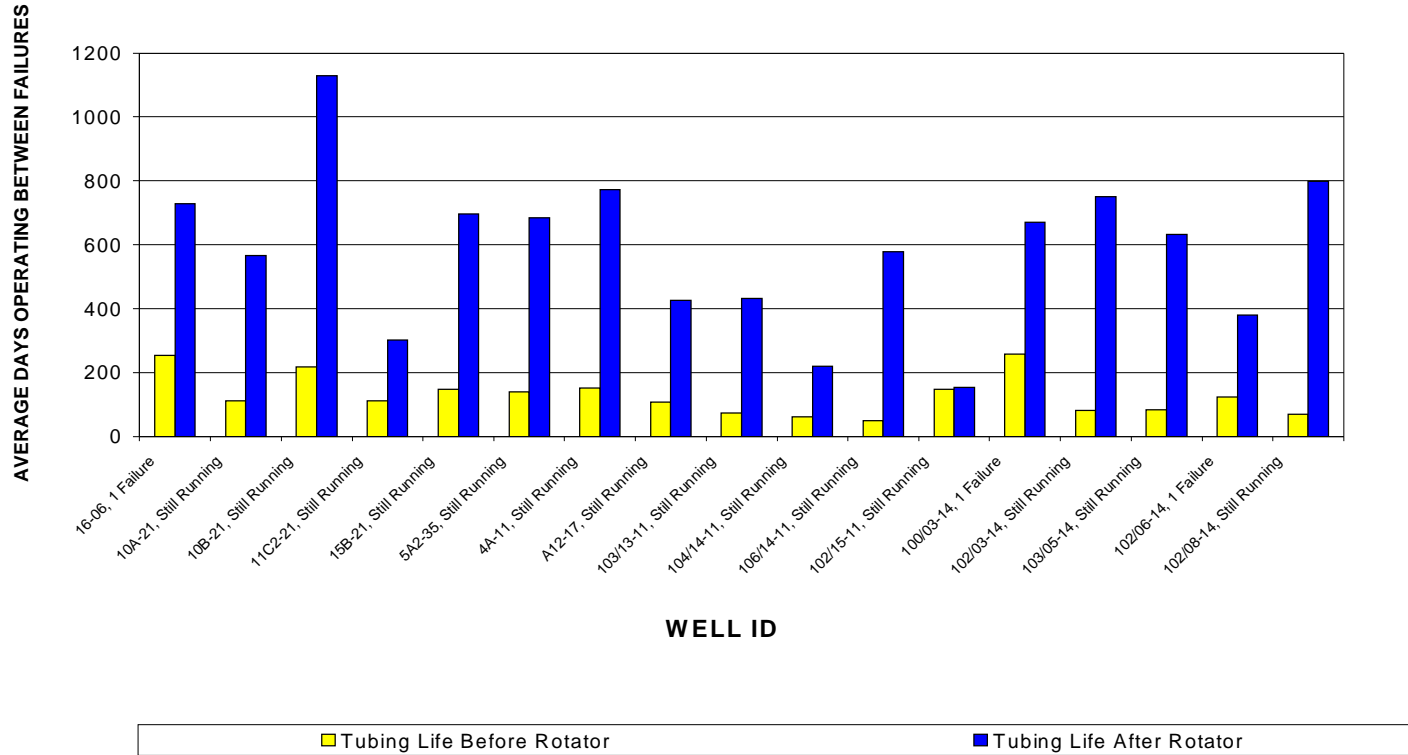
(1) Estimated average cost of local services, cost of replacement tubing. Excluding cost of Tubing X-Ray, lost production.

(2) Based upon 10 year operating life. Excluding lost production.



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TUBING ROTATOR OPERATING EFFECTIVENESS



R & M Energy Systems™ is the industry leader in “Wear Prevention Solutions”, including;

1. **NewEra™ and Patco® Rod Guides:**

Minimize the force of the rod coupling against the tubing by centralizing the rods and reducing contact points of rods lying against tubing.

2. **Hercules® Rod Rotators:**

Spread wear around the outer circumference rods and rod couplings Designed for reciprocating beam pumps, rod rotators rotate rods slightly with every stroke.

3. **ABI™ and RODEC™ Tubing Rotators, Rotating Tubing Hangers and Down Hole Swivels:**

Spread wear around the inner circumference of tubing. The various types, design, application and drive mechanisms (manual, mechanical or electrical) rotate the tubing as slowly as one half (180 degrees) rotation per day.

Rotation of rods and tubing spread wear around the circumference of the elements to:

- ◆ Refresh contact surfaces
- ◆ Minimize heat build up at the contact point.
- ◆ Expose the entire circumference of the rod and tubing to chemical treatment.
- ◆ Allow the surfaces to be lubricated by produced oil contributing to extended wear.

“Wear Prevention Solutions” increase the production cycle from two to twenty times. Historical data indicates; longer initial average run-time realizes a lower percentage run-life increase. For example: an initial average run of one year may experiences an increase to two years (100%), where a six week initial average could increase to eighteen months (1300%).

The financial benefit of applying “Wear Prevention Solutions” has proven to increase bottom line profits. R&M Energy Systems’ package of wear prevention products can effectively reduce field operating costs and increase well productivity.



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