Application of Molded and Field Installed Sucker Rod Guides

Sucker Rod and Tubing Wear Prevention
Why Is Rod and Tubing Wear Prevention Important?

50% to 85% of well maintenance costs are the result of sucker rod and production tubing wear

Well down-time results in lost fluid production
Causes of Rod and Tubing Wear

Reciprocating Rod Pump Systems

- Deviation
- Up and down movement of rods against tubing in reciprocating pumps
- Buckling & Compression (Tubing & Rods)
- Improper Rod Guide Design and/or Spacing
- Erosion from abrasive fluids
- Corrosive chemicals in the produced fluid
Deviated Tubing

Dogleg-Increasing Angle

Dogleg-Decreasing Angle

Inclined Tubing

National Oilwell Varco Tuboscope
Dogleg and Inclination

Dogleg Severity (DLS) = 6°/100 ft

Inclination

Dogleg Severity (DLS) = 5.7°/100 ft

Wellbore Trajectory

47°

14°

Note: Even though no sideload would be predicted for this section, rod guides would be recommended due to high inclination angle.

National Oilwell Varco Tuboscope
Rod Buckling
The Effect

It’s possible to have a Rod Box laying on the tubing the day you go in the hole with new Rod Guides.

**IMPROPERLY PLACED**

- Down Stroke Sucker Rods Falling
- Too Great of Distance
- Rod Box
- Compression Forces cause Rod to Flex
- Rod Guide OD close to ID of Tubing
- Rod Guide acts as FULCRUM
- Causes Rod Box to Ride Tubing
- Sucker Rod

**PROPERLY PLACED**

- Down Stroke Sucker Rods Falling
- Compression Forces cause Rod to Flex
- Rod Guide
- Rod Box
- Rod Guide
- 12"
- 12"

National Oilwell Varco Tuboscope
Buckled Tubing

Unanchored Tubing

Tubing Anchor / TAC

Buckled Tubing

Production Tubing

Upstroke

Pump

Anchor Above Pump

Unanchored Tubing

(T straight or deviated Wells)

National Oilwell Varco Tuboscope
History of Sucker Rod Guides

- Metal scrapers for down hole paraffin control
- Scraper / rod guide manufactured with engineered plastics that can be molded on to the sucker rod.
- Extended tapered end guide to reduce turbulence and corrosion.
- Reduced hydraulic drag force designs
- Wide vane designs for maximum bearing surface
- Rotating guides for use with PC pumps
**Erodible Wear Volume**

EWV = AMOUNT OF ROD GUIDE MATERIAL OUTSIDE THE O.D. OF THE ROD COUPLING.

- INCREASE GUIDE LIFE
- MINIMIZE ROD LATERAL MOVEMENT
Design Considerations

STAND OFF

2-1/2” Nominal Tubing

.406” Stand-Off

.314” Stand-Off (23% Less)

.221” Stand-Off (46% Less)

3/4” Sucker Rod Full Size Coupling (1.625” Dia)

7/8” Sucker Rod Full Size Coupling (1.813” Dia)

1” Sucker Rod Slim Hole Coupling (2.000” Dia)

National Oilwell Varco Tuboscope
Design Considerations

Hydraulic Drag Force

**DRAG FORCE on 2-1/2” Rod Guides x 7/8” Rods in 2-1/2” Tubing**

Test Media: Fresh Water @ Ambient Temperature

**Table:**

<table>
<thead>
<tr>
<th>Vmax (Ft/Min)</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke Length at 10 SPM (in)</td>
<td>76</td>
<td>115</td>
<td>153</td>
<td>191</td>
</tr>
</tbody>
</table>

**Test Nos.:** DT1011954, DT1012952, DT1011957, DT1012951, DT1011958, DT1011956

National Oilwell Varco Tuboscope
Design Considerations

Sucker Rod Guide Calipering

Production Tubing Wellhead Inspection

National Oilwell Varco Tuboscope
Sucker Rod Guide Spacing
Design Considerations
Rod Guide Spacing

Effects of Spacing on Drag Force

STANDARD vs. NEW ERA SPACING

MAXIMUM POLISHED ROD VELOCITY - Vmax (ft/min)

DRAG FORCE (lbs)

2 NEXXTB - Std
2 NEXXTB - New Era

National Oilwell Varco Tuboscope
Materials of Construction

**Materials**
Manufactured using thermoplastics
Plastics common to the auto industry
- Valve covers
Comes in small pellets
Useable temperatures from 140°F - 500°F
Find the right material for each application.
Shop Installed Rod Guides

- Low Fluid-Drag
- Wider Vanes for increased EWV
- Wear Indicators
- Wide Range of Materials
- Wide Range of Designs
- Excellent Bond Strength
Paraffin is a natural waxy substance that breaks out of oil during production. Paraffin commonly restricts flow lines and reduces production rates. In some instances paraffin can lead to mechanical failure such as sucker rod parts.
Paraffin Control

BEFORE

AFTER

National Oilwell Varco Tuboscope
Reciprocating Rod Guides

Field Installed Rod Guides

Benefits
- Field Installed
- Economical
- Immediate Availability
Reciprocating Rod Guides

Field Installed Rod Guides

- Higher Temperature
- Two piece Snap On Design
- Increased Holding Power
- Lower Hydraulic Drag

National Oilwell Varco Tuboscope
PC Pump Rod Guides

Progressing Cavity Pump Systems

- Rotational movement of rods against tubing and harmonic oscillation
- Erosion from abrasive fluids
- Corrosive chemicals in the produced fluid
- Aggravated by deviated wells
Molded On Rotating Rod Guide

Benefits

- Greater Fluid By-Pass
- Reduced Torsion
- High Rod Bond Strength
- Protects Rod Coupling & Body

PC Pump Rod Guides
National Oilwell Varco Tuboscope
Benefits

- Field Installed
- Low Wear Rate
- Keeps Couplings off of Tubing
- Immediate Availability
Rod Rotators

Benefits

• 360 DEGREE WEAR ON RODS AND COUPLING

• 360 DEGREE WEAR ON PUMP BARREL AND PLUNGER EXTENDING PUMP LIFE

• CONTINUOUS TIGHTENING OF THE ROD STRING MINIMIZING RODS UNSCREWING
Questions?