



ROD PUMPING FAILURE ANALYSIS



Problem: Tubing splits

Cause: Rod wear against tubing

Solution:

- (1) Tubing rotation
- (2) Polyethylene lined tubing
- (3) Rod guides
- (4) Slow SPM
- (5) Sinker bars (if wear near bottom)
- (6) Continuous rods



Problem: Corrosion hole from wear

Cause: Corrosion inhibitor worn off by rod string (rod boxes, guides or body). Corrosion occurs over 20% circumference with rest of tubing in good condition.

Solution:

- (1) Manual tubing rotation
- (2) Polyethylene lined tubing remedy for rod corrosion due to wear:
 - * rod rotators
 - * spray metal alloy boxes



Problem: External corrosion hole from wear over 20% of tubing

Cause: Tubing wearing against casing wipes off corrosion inhibitors, allowing corrosion to increase tubing external wear rate.

Solution:

- (1) Tubing anchor
- (2) Manual tubing rotation

Note: Corrosion from oxygen entry (shown) helped by stopping oxygen entry into wellhead (casing vent lines, rubber packing, etc.)



H₂S Corrosion

Problem: Corrosion pitting around circumference of tubing or rods

Cause: Corrosion due to poor inhibitor film. Uniform pitting around circumference suggest wiping inhibitor off isn't the issue (unless automatic rotator used).

Solution:

- (1) Change chemical program (type, frequency or circulation time)
- (2) Minimize corrosion causing elements (oxygen entry, bacteria, etc.)
- (3) Fiberglass tubing/rods
- (4) Manual tubing rotation with proper chemical program (batch after rotation)

Common Corrosion Types

Oxygen = Large, shallow, flat bottomed pitting with pit edges gradually sloping and running into each other

Hydrogen Sulfide = Pits small and cone shaped with steep sloping sides and round edges on metal surface. Generally, pits are not connected and may contain wide, sharp fatigue cracks. Surface may have iron sulfide scale (black, sticky, and rotten egg odor).

Carbon Dioxide = Round-bottomed pitting with sharp sides and normally connected with other pits. Surface may have iron carbonate scale (gray).

Tubing Saver Rotators (patented TSR) reduce rod pumping failures

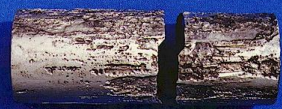
General Problem: Tubing Splits, Carbon Steel rod couplings wearing thin till failure, and Tubing Corrosion Holes due to wear

General Solution: Use TSR and rotate tubing once/month, batch inhibitor after rotation & use spray metal alloy couplings

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ROD PUMPING FAILURE ANALYSIS

Corrosion rod box break

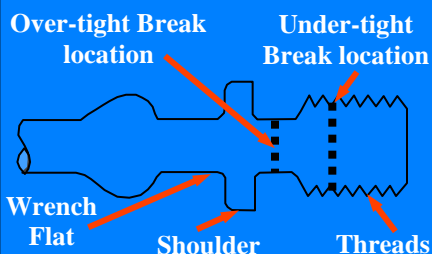


Problem: Rod box or body failures due to corrosion around entire circumference

Cause: Corrosion around entire rod box or rod body circumference from inadequate or no corrosion inhibition program

Solution:

- (1) Spray metal alloy rod boxes for box failures
- (2) Improve/implement chemical program (type, frequency or circulation time) for rod boxes and bodies



Problem: Pin breaks due to make-up

Cause: Over or under-tightening connections

Solution:

- (1) Proper make-up

Under-tight pin break



Problem: Rod body failures due to fatigue

Cause: Tension or compression failures as indicated by horizontal lines on the rod body (Compression has cracks on one side of body, whereas tension has lines around entire circumference)

Solution:

- (1) Redesign to reduce rod stresses (SPM, pump size, sinker bars, stroke length, etc.),
- (2) Wheeled rod guides reduce friction on up and down stroke (helps tension & compression),
- (3) Remove some rod guides that may be increasing stress on rods

Fatigue cracking



Box with slight wear and then re-run with severe wear



Problem: Rod box or rod body failures due to wear

Cause: Wear or corrosion from wiping off inhibitor on one side of rod box or rod body

Solution:

- (1) Spray metal alloy rod boxes for box wear
- (2) Rod rotator for box or rod body wear
- (3) Rod guides
- (4) Continuous rods

Pump with solids abrasion



Problem: Worn pumps

Cause: Wear over time or solid abrasions (sand, scale or pump chrome after acid jobs)

Solution:

- (1) Mud anchors
- (2) Raise pump depth
- (3) Change pump type
- (4) Tubing rotation should spread wear/abrasion around pump to extend life
- (5) Gravel packs, etc.

Tubing Saver Rotators reduced failures by 76% in field tests

Acknowledgements: Thanks is given to Baker Petrolite and Omega Technologies for photos and material.

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