Pumping Unit Gear Reducer Failures
Data from Before and After Repairs

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Introduction

• Presentation will show data acquired before repair and after repair to multiple pumping unit gear reducers.

• Gear reducers were identified as damage to the point of failure and required repairs to return to proper operation.

• Gear reducer failures tend to occur gradually over an extended time period.

• Proper design, utilization, and routine maintenance of pumping units in rod pump systems can prevent these failures.
Before And After Representative Data Will Be Presented Including:

1. Surface and Pump Dynamometer Cards
2. Existing and Inbalance Net Gear Box Torque Signature
3. Pictures of damaged and repaired gear reducer parts
Gear Reducer Life Curve from Lufkin

Reduced Gear Life Relative to % Overload

Life, years

Percent Overload

100% 105% 110% 115% 120% 125% 130%

12-J Before

B #1 After

178% After

1-F
Balanced is More Uniform Torque Loading Throughout Stroke

Mechanical/Torque (in-lbs) or Electrical/Power (kW) Signatures for a Unbalanced or Balanced Pumping Unit:
Use Surface Dynamometer Card And Torque Factors Together With Counterbalance Moments From The Crank And Weights to Determine Net Gearbox Torque Loading.

**Rating**

- Gearbox: 114000 in-lb
- Peak Balanced: 117286.6 in-lb
- Peak Existing: 129701.5 in-lb

**Counter Balance Change:**

- Decrease For Balance: 12635.6 in-lb

**Weight Of Counterweights To Be Moved:** 3652 lb

**Move Counterweights:** IN 3.5 in

From Their Present Location To Balance Unit.
Use Input Motor Power, Motor and Drive Efficiencies and The Pumping Unit Speed to Determine Net Gearbox Torque Loading
Weight Heavy Need to Move Weights in 18 Inches

Permissible Load (K-Lbs) vs Position (in)

PRT 1206

Net Torque (K-in-Lbs) [Balanced]

Net Torque (K-in-Lbs) [Existing]

Rating | Peak Balanced | Peak Existing
--- | --- | ---
Gearbox | 228000 | 143523.2 | 212843.5 in-lb

Counter Balance Change:
- DECREASE
- For Balance: 69973.6 in-lb

Weight Of Counterweights To Be Moved: 3956 lb

Move Counterweights: IN 17.7 in

From Their Present Location To Balance Unit

12 J

Stroke: 34

Overlay Power Data

Page Up | Page Down
Need to Move 3956 Lbs Weights IN 18 Inches
Before Gearbox Loaded 165% of 228 Rating

<table>
<thead>
<tr>
<th>Rating</th>
<th>Peak Balanced</th>
<th>Peak Existing</th>
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<tbody>
<tr>
<td>Gearbox</td>
<td>228000</td>
<td>377254.7</td>
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<tr>
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<td>221386.3</td>
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Counter Balance Change:
- INCREASE
- For Balance 157015.5 in-lb

Weight Of Counterweights To Be Moved 1542 lb

Move Counterweights OUT 101.8 in

From Their Present Location To Balance Unit
After Gearbox Loaded 178% of 228 Rating

Overloaded Pumping Unit
Can’t be balanced with current Counterweights,
Requires additional CW to balance with current stroke - pumping off
Consider re-stroking to 74” – CW

Net Torque (K-in-lbs) [Balanced]

Net Torque (K-in-lbs) [Existing]

Counter Balance Change:
- INCREASE For Balance 176479.3 in-lb
- Weight Of Counterweights To Be Moved 1542 lb
- Move Counterweights OUT 114.4 in

From Their Present Location To Balance Unit

Rating
- Gearbox 228000
- Peak Balanced 233390.4
- Peak Existing 406151.3

in-lb
Gearbox Loading OK, But Permissible Load Exceeded When Fluid Level is Lowered

36 J After

<table>
<thead>
<tr>
<th>Gearbox</th>
<th>Rating</th>
<th>Peak Balanced</th>
<th>Peak Existing</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>228000</td>
<td>207686.0</td>
<td>226628.0</td>
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</table>

Counter Balance Change:
- INCREASE For Balance 21774.4 in-lb

Weight Of Counterweights To Be Moved: 3302 lb

Move Counterweights OUT 6.6 in
From Their Present Location To Balance Unit
Pumping the Well Down will cause the Gear Reducer to be Overloaded

36 J After
Old Gears in Case
New Intermediate Gears
High Speed Shaft

Old Shaft

New Shaft
Gear Wear
High Speed and Intermediate
Out of Balance Gearbox Loading

Dynamometer Cards Appear to be OK
Normal 7 SPM Slows to 3 SPM Due to Rod Heavy Imbalance
Conclusions

• All wells that are produced with beam pumping units should be evaluated regularly to prevent serious gear reducer damage and failure.

• Proper planning and operating practices can prevent gear reducer failure.

• Eliminate Overloads to Reduce Operating Expenses.

• Move Weights to Minimize Torque Loading on Gear Reducers and Not Exceed Gear Reducer Load Rating.

• Balanced Operation Minimizes Energy Cost.

• Balanced Operation Minimizes Prime Mover Requirements.
QUESTIONS?
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