

POLISHED ROD FAILURE PREVENTION

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ABSTRACT

The polished rod carries the weight of the entire rod string plus the fluid load and the imposed dynamic loads. This paper will show that polished rod failure is caused by fatigue-type stress due to improper installation. It will also review how to recognize the alignment problems and what steps can be done to prevent polished rod failure.

INTRODUCTION

It is my belief there is more that can happen to cause polished rod failures than rod, tubing, and pump failures. If these items are not addressed, then polished rod failures can increase your failure rate significantly and affect your production as well. In addition to the production loss and the cost of repair, a parted polished rod can cause additional damage to the rod string, tubing, and pump. When the part happens at the top of the stroke, then the entire rod string drops the length of the stroke coming to rest on top of the pump. That shock is then transferred through the pump to the seating nipple and the tubing. Another important factor is, if you are using fiberglass rods, this puts those rods into compression damaging them.

Nearly all polished rod failures can be attributed to some type of misalignment. There is a long list of items that can cause a bending moment in the polished rod. If the polished rod is not centered over the well bore, then the rod is bending during the pumping cycle. When the polished rod is at the top of the stroke, the misalignment is spread over the entire length of the polished rod between the carrier bar and the stuffing box. As the carrier bar gets closer to the stuffing box, this bend is concentrated immediately in the area below the polished rod clamp. That is why nearly every polished rod failure I have investigated has occurred at or very near the polished rod clamp.

DISCUSSION

Some of the obvious problems with alignment are, the wellhead installed incorrectly and improper setting of the pumping unit or the pumping unit settling after it is set. However, there are many more things to look for and I will step you through those; identify what to look for, and what can be done to correct them.

In addition to the pumping unit not being set in the proper place in relationship to the well bore, other problematic alignment issues occur because of the pumping unit. I have learned that a pumping unit can be installed properly and in a few months the ground below the base of the pumping unit settles. One producer that had an active drilling program instituted this best practice when they set a new pumping unit. They would have their contractor return to the previously pumping unit set and check the alignment of that pumping unit. Also, keep in mind when you do pumping unit swaps to go back and check the alignment after the base has had a chance to settle in.

Another problem area is the pumping unit horse head. When they are removed and replaced for well service, sometimes they are improperly installed. Proper training of the well service employees can eliminate this problem. Another problem area related to the horse's head is the bridle. Sometimes bridles are installed improperly causing misalignment; this happens when they have more length on one side than the other. Also, a bridle can start fraying and weakening on one side causing misalignment. The carrier bar at the bottom of the bridle will lean to the weaker side and this causes a bending moment in the polished rod. On the front of the horse's head, you can see bridle marks that occur in the normal pumping of the well. Look to see if these marks are uniform or do they look like they were in one area and are now on another area. This is an indicator that something has shifted and could soon have a polished rod part. The carrier bar can also become worn over time where the polished rod clamp sits. It will form a dished out spot on the carrier bar causing the clamp to sit uneven bending the polished rod as the load is applied. A pumping unit repair company can usually repair this in their machine shop. If you have to repack your stuffing box due to repetitive leaks or the packing wears excessively on one side is a good indicator of alignment issues.

Pump Off Controller load cells can also cause a problem. Sometimes the hole in the carrier bar is larger than the load cell. The load cell then sits down into the hole on one side bending the polished rod. Placing a leveling plate below the load cell, which spreads the load across the carrier bar, can eliminate this.

The pumping unit has other areas that wear and cause the polished rod travel to not be straight up and down over the well. Saddle bearing and tail bearing wear or a damaged walking beam can cause misalignment possibly causing a failure.

Another item to be aware of is the over tightening of the polished rod clamp. Each manufacture has a recommended torque to apply to the clamp bolts. You should make sure the service company employees are adhering to these recommendations. The best way to ensure this will be done is, to furnish them torque wrenches and make sure they use them. When installing the polished rod clamp, it along with polished rod and carrier bar, should be free from dirt and grease where they contact each other. Another important point about the clamps is, to make sure they are manufactured properly. The bore of the clamp and the bottom of the clamp should be manufactured in a way that there is no stress put on the polished rod when the load is applied. For producers using a spray-metal polished rod, a common error regarding the placement of the polished rod clamp is, putting it on the spray metal portion of the polished rod. The spray metal applied to the outside diameter of the polished rod is very hard. The base material underneath is relatively soft so when you put the clamp on the spray metal it cracks and can cause a failure at that spot. It is very common for spray metal polished rods to have four-foot of bare polished rod for the polished rod clamp. I have found it to be a lot better to use a spray metal polished rod with six-foot of bare rod on the top end for clamping. This helps keep the contractors from clamping on the spray metal and gives you more area to space out your well. One other benefit of the six-foot of bare polished rod, is a lower cost than the one with four-foot of bare polished rod.

Sucker Rod Rotator manufacturers supply different size washers for the size of polished rod you are using. Be sure that they are used to center the polished rod through the rotator and carrier bar.

If you use polished rod liners they are secured to the polished rod with setscrews. If these are over tightened, the polished rod can incur a stress riser and possible part. They should be just tight enough to keep the liner from slipping on the polished rod.

One often-overlooked problem with polished rods is its connection to the rod string. Many times failures occur when a regular sucker rod coupling is used instead of a polished rod coupling to connect to the rod string. Some producers design their polished rod pin thread size so that a combination coupling must be used to connect to the rod string. API Specification 11B 7.2.1.3 Specification for Sucker Rods, calls for all sub couplings manufactured for connecting different sizes of sucker rods have a polished rod thread. Be sure you are using a coupling designed for a polished rod thread.

One final item to make sure your contractor is doing, is to check the polished rod for corrosion. If you are running a liner, corrosion could be formed under the liner and missed if it not checked. Anytime the well is pulled, the polished rod should be inspected for pitting.

The awareness of all of these possible scenarios is the first step to preventing polished rod failure. Follow through with your company and contractor employees to make sure they are aware of all the different reasons a polished rod can fail. The following are some guidelines and illustrations to refer to for Polished Rod Failure Prevention.

Below is a list of items that a producer employee can check:

- ☐ From the side of the pumping unit, look to see if the polished rod is tracking straight up and down. See figure 1.
- ☐ From the front of the pumping unit, look to see if the polish rod is in the center of the horses head. Also, look at where the bridle marks are on the horse's head. Are they in the same place, or does it look like the wear pattern has moved indicating a problem with alignment? See figure 2.
- ☐ Make sure the bridle is installed correctly and is not damaged. Also check that there is the correct amount of free bridle recommended by the pumping unit manufacturer. Check the carrier bar with a spirit level; look for uneven bridle length causing the carrier bar to be uneven. See figure 3.
- ☐ Stop the unit at the top and bottom of the stroke, using a spirit level; check the polish rod for vertical plumb from the front and the side.

If any of these appear to be wrong, have the pumping unit inspected to see what is causing the misalignment.

Below is a list of best practices a service company should follow:

- ☐ Follow manufactures' specifications for tightening polished rod clamp bolts.
- ☐ Do not over tighten polished rod liner bolts.
- ☐ Ensure that the pumping unit horses head is reinstalled correctly after well service.
- ☐ Install the bridle where both sides are pulling evenly on the carrier bar. Also look for wear on the bridle.
- ☐ Look at the top of the carrier bar. Is it worn? See figure 3.
- ☐ If there is rod rotators make sure that the proper size washer is used to center the polished rod.
- ☐ Make sure leveling washers and leveling plates are installed for the POC load cell.
- ☐ Look for corrosion on the polished rod when the well is pulled.
- ☐ Be sure and use a coupling that is designed to use on a polished rod connecting to the rod string. These are either polished rod couplings or combination couplings, not sucker rod couplings. See figure 4.

REFERENCES

1. Harbison-Fischer Product Information Letter #66, May 13, 1983, Bob Cox, POLISHED RODS-MIS-ALIGNED PUMPING UNITS AND FAILURES
2. Harbison-Fischer Product Information Letter #68, August 19, 1983, Bob Cox, POLISHED ROD COUPLINGS FOR POLISHED ROD PINS
3. API SPECIFICATION 11B TWENTY-SIXTH EDITION, January 1, 1998.

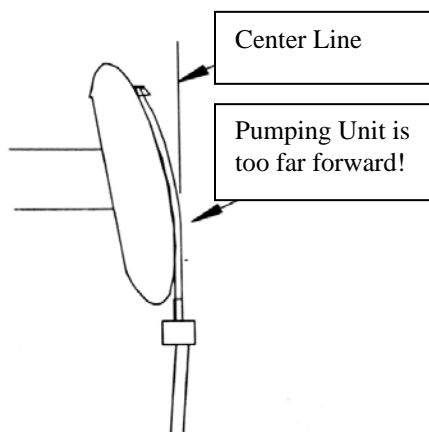


Figure 1

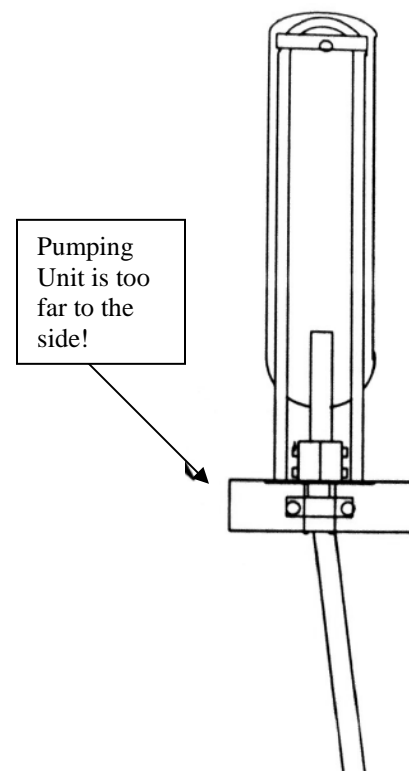
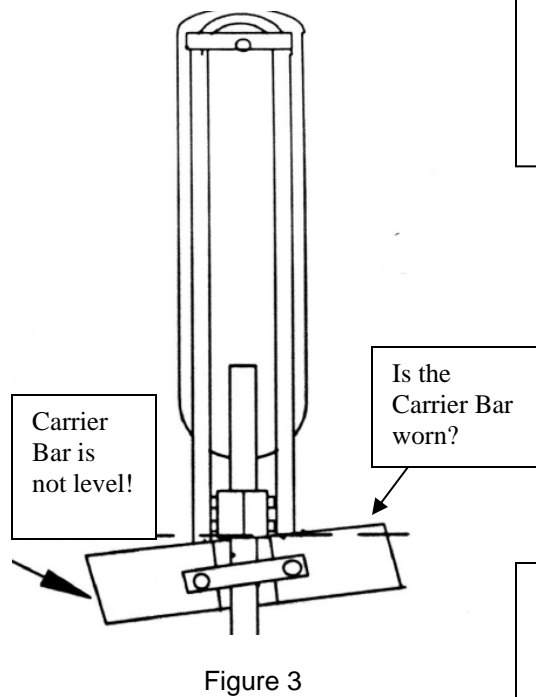
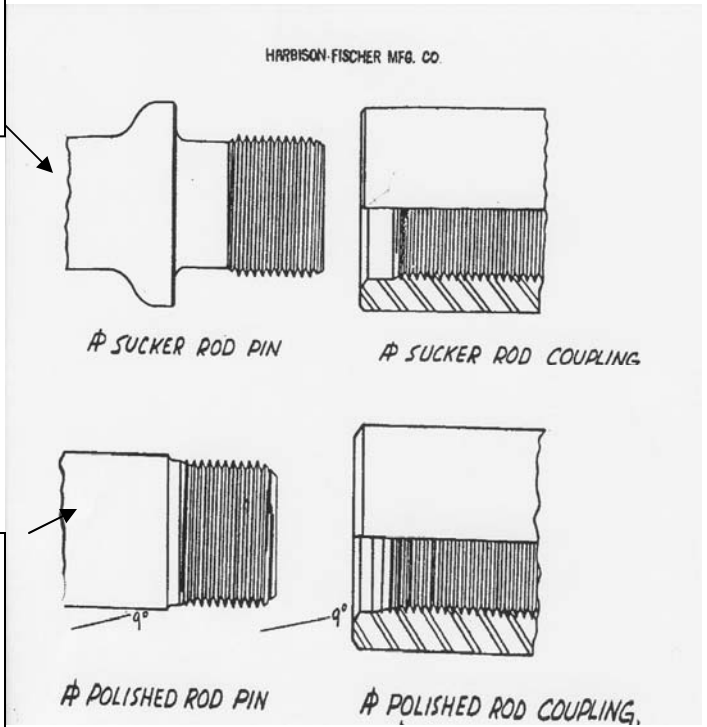


Figure 2



Don't use a sucker rod coupling!



Use a coupling designed for a polished rod!