PLUNGER LIFT FOR HORIZONTAL WELLS

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ABSTRACT

With the increase of horizontal drilling for oil and natural gas, the problem of keeping liquids removed from the well bore becomes more evident. Several methods of artificial lift have been implemented to resolve this problem with varying results.

This paper will discuss the use of plunger lift to resolve this problem and the mechanical requirements associated with plunger lift.

INTRODUCTION

For the past several years the development of horizontal drilling for oil and natural gas has produced wells with very high production volumes. In the case of the horizontal gas wells as with conventionally drilled gas wells, sooner or later the problem of liquid loading will occur. To resolve the problem of liquid loading, producers have tried several types of artificial lift, depending on well depth and production volumes, with varying results.

When rod pumps, gas lift, or submersible pumps are considered to remedy the liquid loading problem, the producer must take into account the economics. If any of these types of artificial lift are implemented the cost could be as much as $200,000, which could become uneconomical for that particular well. Whereas, plunger lift systems and all associated procedures should not cost more than $15,000.

HISTORY

Several companies in the Permian Basin started looking into the possible use of plunger lift to alleviate the liquid loading problems encountered with horizontal wells to reduce the initial and long term operating cost. BP Permian has been a leader in horizontal drilling in the Permian Basin, with significant discoveries in the Devonian and Penn formations, and also some wells that were not as strong. A solution needed to be found for liquid loading in both types of wells, and plunger lift has been the most successful. Initially rod pump and submersible pumps had been tried, with problems of gas locking and pump bum up.

Some of the earliest experiments with plunger lift occurred in the BP Permian Midland County leases. While working with these first plunger lift wells some discoveries were made regarding how the tubing was installed in the well. The first discovery was that the well responded better to plunger lift with a packer in the well bore with no assistance from the annulus. The theory being that with the annulus open with the horizontal leg, it becomes necessary to unload the annulus and the horizontal leg, which becomes very difficult with the amount of fluid being produced. While swabbing a well without the packer in the well we could not get the well to kick off. After one week of swabbing, the decision was made to pull the tubing and install a packer. After installing the packer we were able to swab the well and kick it off in one day, and begin plunger lifting the well. Since this initial kick off of the well it has needed to be swabbed only once. This technique has been tried in a total of 7 wells in the field with similar results.

Another discovery, was when installing the tubing string, the end of the tubing should be landed above the turn to horizontal so the production is coming from the entire horizontal section. This also allows the gas to break out of the liquids and rise to the vertical section to assist the plunger to the surface. If the tubing is landed with a section of tailpipe below the packer and extending into the horizontal section of the well, the production from the front of the zone must U-tube to the end of the tubing in the rear of the horizontal section, thus causing backpressure on the formation.

When operating a horizontal well on plunger lift the optimization period may require more time and information gathering than with conventional wells. The reason for this is with conventional wells the amount of producing zone is limited to the near well bore area, whereas the horizontal wells have a much larger area of the formation to produce from.

TRAINING

Field personnel who are familiar with plunger lift will have an advantage over personnel with no plunger lift experi-

ence, but will need further training as well. Training is a vital clement in any plunger lift program and even more so with horizontal wells due to the different way they react and the amount of fluid the well is capable of producing.

RESULTS

Wells converted to plunger lift to replace rod pump, sub pump or as an initial installation have proven to increase production, or at the least, return the well to profitable production status.

Four wells with plunger lift installed realized an increase of 60% - 80% over natural flow. Prior to plunger lift these wells would be shut in for 3-4 days and then opened to sales. After plunger lift was installed the wells have not been shut in or swabbed and are returning to their natural decline curve.

OVERVIEW

1) End of tubing location is critical for the success of a plunger lift system.
2) Wells with packers arc more successful than wells without packers..
3) Plunger lift training is a vital element for the success of any plunger lift program.

REFERENCES

Listiak, S. and Phillips, D. " How to optimize production from plunger lift systems, Part I and II, World Oil, April 1995.