ROD PUMPING NEW DRILLS

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ABSTRACT AND SCOPE

Rod Pumping New Drills—sand issues then gas issues--a discussion of rod pump designs for these wells.
As new wells are brought on many times a great deal of sand is coming back through the rod pump. The pump may also experience gas interference then or later on as the fluid level has been drawn down. This paper will discuss several different rod pump designs and why they would be an effective design, a good design, or a poor design for sand and gas producing new drills. It will also discuss some accessories and how that they would add to longer run time before pump failure.

INTRODUCTION AND BACKGROUND

This discussion will only discuss the pump design not screens, gas separators, or other products that may be beneficial with these pumping issues. I will not go into proper pump placement in the well except for stating the obvious. You may be able to place your pump in a position that it doesn't have to handle the sand. You may be able place your pump in a position that it doesn't have to handle the gas. You probably will not be able to do both without proper down-hole gas separation.

RWBC--RHBC

The first pump discussed is a bottom hold-down insert rod pump with a conventional valve rod design. This pump is the most popular pump assembled and in a great number of wells will produce for many years without any trouble. As a pump to handle sand there are some issues that we will step through. This pump can be a good design for gassy wells but can also be designed poorly compounding gas problems. You must design the pump with as little of un-swept area as possible. Where you have an RH designed pump you should not put a lower extension on the barrel. The standard API plunger is the problem in handling sand. As the plunger strokes up the plunger runs over sand particles and the hydrostatic load forces the particles between the barrel and plunger. The basic design of the API plunger funnels the sand between the barrel and plunger with the hydrostatic load adding to it. The sand cuts away at the spray metal on the plunger exposing the softer base material to additional cutting and corrosion. Another sand issue with this pump design is with the bottom hold-down it has a tendency for particulates to get trapped in the annulus between the barrel and plunger. When this occurs it is referred to a pump stuck in tubing and to retrieve the pump from the well the tubing will have to be pulled. This is very expensive and can be a safety and environmental issue.

RHAC

The second pump discussed is a top hold-down insert rod pump with a conventional valve rod design. This pump has nearly the same characteristics as the RWBC—RHBC. Adding the hold-down seal assembly on top of the pump assists in getting the pump unseated in the presence of particulates. Particulates cannot pass by the seal assembly getting trapped between the barrel and tubing like the bottom hold-down. One issue with putting the seal assembly on top of the pump the entire hydrostatic load is on the inside of the barrel. With no pressure on the outside of the barrel it may cause the barrel to split. It is always recommended to use a heavy wall barrel on top hold-down pumps. You should also be careful to keep from over pumping wells with this style pump causing fluid pound. With a conventional API plunger this pump would also have the same issues getting sand caught between the plunger and barrel.

TWO-STAGE HOLLOW VALVE ROD PUMP

This is an effective pump for wells with sand and gas issues. The top valve creates a low pressure area in the pump chamber above the plunger as it starts on the down-stroke. This allows the traveling valve to open sooner, since the top valve assumes the hydrostatic pressure. The top valve also acts as a sand check that is especially helpful in times of shut down. Because this pump has a standard API plunger it has the same problem as the RWB and RWA with sand getting between the plunger and barrel. This is reduced some by the top valve and the turbulence created above the plunger with the discharge of fluid at the ported lower pull tube coupling. This pump is available in a top and bottom hold-down configuration.

PAMPA PUMP—LONG PLUNGER SHORT BARREL

This pump design has a long smooth plunger that extends through a relatively short barrel section. Due to the length of the plunger, the plunger ends do not enter the barrel section at either the top or the bottom of the stroke. The plunger is wiped clean on each stroke and sand is not carried into the barrel section. This pump design is effective for wells with a lot of particulates. However this pump design is not recommended for wells with gas interference because of the additional chamber volume of the lower extension.

VARIABLE SLIPPAGE® PUMP

This pump design is effective for wells with gas interference. This pump has a gradual taper in the upper barrel. As the plunger enters this taper near the top of the upstroke, slippage increases past the plunger, and pressure is equalized above and below the plunger and traveling valve. Therefore when the plunger starts downward the traveling valve opens easily since high pressure in the compression chamber has already been achieved. This pump can be configured in a top or bottom hold-down design. It would be equal to other RH pump designs in handling sand issues. This pump should only be used in wells with all steel rod strings.

SAND-PRO® PUMP

This pump utilizes a unique method of separating produced sand from the pressure-sealing leading edge of the sprayed metal plunger. This design keeps the hard sand particles from the plunger/barrel interface improving run times. This pump has two plungers connected in tandem. The upper soft pack plunger has no pressure across it to force sand into it and wear out the soft packing. The lower sprayed-metal plunger has no sand at its leading edge to damage the plunger. This pump can be configured in the conventional valve rod designs or for gaseous wells in a Two-Stage Hollow Valve Rod design.

The next section deals with accessories that can be added to pump designs to improve the pumps performance in the presence of sand, gas, or in some cases both.

SLIDING TOP VALVE

The addition of the sliding top valve to a stationary barrel pump can be an economical means of improving pump efficiency in gaseous wells. The valve closes at the start of the down stroke, creating a low-pressure chamber above the plunger. Due to this low pressure the traveling valve opens sooner allowing a more efficient displacement of gas and fluid from below the plunger. The valve also acts as a sand check keeping sand from entering the pump chamber. This is especially beneficial during times of shut down. It has similar characteristics as the Two-Stage Hollow Valve Rod Pump but is used with a conventional valve rod pump.

SAND CHECK

Similar to the Sliding Top Valve is the Sand Check. This is a very inexpensive addition to any pump with a conventional valve rod set up. This check keeps sand from settling down on the leading edge of the plunger during periods of down time.

GROOVED PLUNGERS

Pin-end and box-end plungers can be ordered with shallow grooves. These grooves are cut into the plunger about one foot apart before applying the sprayed metal coating. The sprayed metal provides a corrosion barrier in the grooves. As the plunger strokes up sand particles get caught in the first groove instead of cutting the full length of the plunger. Users report longer runs with grooved plungers in abrasive conditions.

SAND-FLUSH PLUNGER

This plunger is designed for RW and RH pumps with valve rod configurations. When operated in sand situations conventional plungers can sustain damage to the upper leading edge from sand particles wedging in between the plunger and barrel. This plunger offers a solution to this problem. The upper part of the plunger is angled so it keeps sand particles from getting between the barrel and plunger. The angled leading edge and the fluid discharge are at the same point preventing sand build up. This plunger is designed to work in a conventional valve rod pump. Coupled with a Sliding Top Valve this plunger can be an effective tool in wells that have the presence of sand and gas.

BOTTOM DISCHARGE VALVE

This accessory is designed for bottom hold-down pumps to direct a portion of the produced fluid into the tubing annulus above the seating nipple and away from the hold-down assembly. With the discharge of this fluid it keeps

the sand in motion keeping it from accumulating above the hold-down resulting in a pump stuck in tubing. The fluid discharge also helps eliminate stagnant fluid between the barrel and tubing, reducing corrosion problems.

TOP SAND SEAL ASSEMBLY

The installation of a Top Sand Seal Assembly will reduce the hazard of sticking a bottom hold-down pump in the tubing due to accumulated particles from the produced fluid on a RWB or RHB design pump. The tool works by expanding a rubber element against the wall of the tubing right below the pump discharge. When the pump is unseated it will relax the rubber element and the pump is removed without the interference of particulates. It has been suggested that once the pump is unseated the rubber should be given time to relax before the pump is pulled up through the tubing. This accessory can only be used with a valve rod pump. Also in 2" tubing you are limited to an 11/16" valve rod.

BRUSH SAND SEAL

Like the Top Sand Seal Assembly the Brush Sand Seal reduces the hazard of sticking bottom hold-down pumps. Unlike the Top Seal Assembly it can be used with a conventional valve rod pump or a two stage hollow valve rod pump. The brush seal creates a barrier right below the pump discharge to stop sand from settling down between the barrel and tubing. Producers should experience less pumps stuck in tubing using this accessory. Coupled with a Two-Stage Hollow Valve Rod pump it is an effective tool for wells that have a presence of both sand and gas.

SUMMARY

Standard API pump designs can be used in producing wells that both produce sand and have gas interference. The run time between pump failures may be improved by one design over another. One design may be beneficial for one problem but have a detrimental effect on the other problem. There are pump designs that are effective for both sand and gas problems. Accessories can be added to the pump to improve run time between pump failures. By increasing run time between pump failures and eliminating pumps stuck in tubing creates the biggest benefit of all—a safer work place.

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