Pump Selection for Abrasive Type Production

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CHOOSING CORRECT PUMP

Problem pumping often means high lifting costs. Excessive down-time because of premature subsurface pump remedial work can be reduced by proper pump specifications.

The correct type of pump to be used when encountering a problem condition is half the battle toward a satisfactory solution. Proper metallurgy of the pump components is the other half.

Abrasion, of course, results in excessive wear of seal components, i.e., plunger and liner, ball and seat. Material should be selected which is compatible with each other. For example, a chromium plated plunger operating within a chromium plated barrel would have an affinity. The two similar materials would have a tendency to "grab", heat is generated and a welding action will take place - resulting in a galled plunger and barrel. Now, a chromium plated plunger operating within a chromium alloy barrel would not have this galling tendency. Cast iron against chromium or hardened steel is good. Similar materials, one being heat treated, would also provide the dissimilarity required.

Galling can, and often does, occur between dissimilar materials - but for an entirely different reason. The selected plunger may not provide sufficient clearance within the pump barrel. Crude oil cannot migrate down past the plunger O.D.; consequently, lubrication is lacking between the two surfaces and seizure takes place.

A minus three fit plunger in one area may not be practical in another field. Subsurface temperature may differ — greater expansion of plunger to barrel takes place. Or the water cut may be sufficiently high to effect a water wet plunger and barrel surface — again improper lubrication.

This is only one of the very many problems requiring a solution, on a daily basis, in order to reduce the lifting costs.

Abrasion due to Sand

The unavoidable production of sand along with the crude constitutes a major problem. Increasing production of wells by means of "Sand fracing" often results in excessive pump problems, until the excess sand is produced and depleted.

Pumps have been designed specifically for the production of these sandladen wells. One of the most popular types of pump is the 3-tube variety. According to the API designation, this pump would be of the RWT type or traveling type insert with a barrel rather than a liner column.

In operation, two tubes reciprocate over a stationary tube. All tubes are extremely loose, having 12 to 16 thousandths of an inch clearance. Wear of these tubes by sand does not constitute a problem. It is believe that the majority of the sand particles are smaller than the tube clearance; consequently, sand grains cannot simultaneously contact two surfaces. A severe abrading action is thus avoided.

These pumps are not considered as efficient as the standard plunger-liner assembly. However, fluid slippage losses are reduced by lengthening the pump.

Still, another method of handling sand may be considered as being directly opposite the 3-tube approach. Rather than utilizing extremely loose fitting components, much success has been garnered in selectively fitting a plunger to one or more liners. This type of pump utilizes a traveling liner assembly with a stationary plunger. The operational fit of the liners to the plunger is only a matter of 2 to 3 ten thousandths of an inch. Sand is not permitted to enter the annular space between the liner and the plunger. Eliminating sand from the sealing surfaces avoids premature wear.

The success of this assembly is not entirely attributed to the closeness of plunger fit; in addition, the two working surfaces are extremely compatible and will within themselves provide a minimum amount of self-wear. The best material combination to date has been the chromium plated plunger and a hard chromium alloy centrifugally cast liner (Duax).

Only one liner is required when operational depths do not exceed 3000 feet. An additional liner is required for each 1500 foot increment of depth beyond 3000 feet.

Although the final plunger fit is measured in ten-thousandths of an inch, consideration must be made for material expansion. Temperatures in excess of 124 degrees must be compensated for in the initial pump assembly. Sometimes 1/2 to 1 thousandth clearance must be made. However, when the assembly is down-hole, expansion reduces this initial fit.

Often, these pumps were originally specified for "clean-up" after a sand frac job. Frequently, they perform so well they are maintained in the well thereafter. High volumetric efficiencies may be expected from it.

One further feature of this pump is that it is a traveling type, i.e., jacket and liner assembly move while the plunger remains stationary. The fluid surrounding the pump is kept in constant agitation; no sand will accumulate around this outer annulus.

Sizes for both the 3-tube and "Sandpump" are tabulated below.

Tubing Size	3-Tube Bore	"Sandpump" Bore
2''	1-1/4''	1-1/16'' 1-1/4''
2-1/2''	1-3/4''	1-1/2'' 1-3/4''
3''	2-1/4''	2-1/4'

Gyp

An entirely different condition exists from that of abrasive pumping. Many oil wells contain minerals in addition to hydro-carbon products. Frequently, these calcium deposits begin to accumulate on all stationary or nonwearing surfaces.

Pump design is extremely important where this condition exists. The "stroke-thru" pump should always be used. By "stroke-thru", we mean a pump which has a barrel or liner column sufficiently short to allow the plunger to extend out of each end during the up and down portion of the cycle. A collar of gyp is thus not allowed to form within the barrel assembly.

When utilizing a pump of this nature, it is of course mandatory to use extension spacers at each end of the barrel. Gyp will eventually accumulate in these extensions and in time will require pump remedial work.

It is suggested that when using an insert pump, a top hold-down be incorporated rather than a bottom hold-down. The lower, outer portion of the assembly will be emersed in a static, low pressure fluid. Of course, where fluid depths exceed 6500 feet, the bottom hold-down should be used.

Should a tubing pump be used and a "stroke-thru" operation is not assured, an unlatching device should be adapted to the sucker rod string, just above the pump.