Casing Pumps

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Opening Paragraph

Today's casing pump is used to lift large fluid volumes at low cost per well and to eliminate tubing string requirements. It is noted that a casing pump can be adapted to any size casing and the pump may be sized in accordance with volumetric requirements. A noteworthy application of the casing pump is in the production of large volumes of water from supply wells on a water flooding project.

At the start of a water flood project one must consider, in connection with supplying the source water, many factors: the amount of fluid needed, the available power, the depth to which the pump will be set, and the over-all cost of the needed equipment such as the beam unit, rods, pump and cost of power to operate, either gas or electric.

Depth plays an important part in the use of the casing pump, for the load factor on the unit has to be considered. On long stroke large bore pumps it is found that 12 SPM is about maximum; but the pumps do operate satisfactorily at this speed. Also on the large pump, 2000 ft is the safe depth although the maximum depth and fluid volume are limited by the unit gear box capacity.

Until the last few years people had thought that it was almost impossible to beam lift 3000-4000 BPD. However, this idea has been proven wrong.

For example, in a typical North Texas operation natural gas was present and the operator found that he could save approximately $1000 a month over the cost of electricity. If the flood lasted six years, he could save the unit approximately $72,000.

Another factor was that, by using a beam type unit installation, at the end of the flood the salvaged equipment would be more negotiable and valuable than would be equipment remaining from other types of installation. Listed below is the North Texas operator's installation data:

(1) 640,000 Gear Box Unit, 30,000# Beam with 10,785# Counter Balance
(2) 115 hp Gas Engine
(3) 144 in. Stroke Unit
(4) 4-3/4 Bore Flexite Insert Casing Pump
(5) 7 in. Casing Pump Packer
(6) 1725 ft - 1-1/8 in. Sucker Rods
(7) 6 - 1-1/2 in. x 22 ft Polished Rods (800#)
(8) 6 - 7 in. Flexite Rod Guides
(9) 11-1/2 SPM
(10) Production on 24 hr basis was 4254 BPD

(The above information was supplied by Ratcliff Operating Company, James Skidmore, Engineer, Bowie, Texas.)

The method of setting a casing pump is very simple. The pump with packer attached is run on the sucker rods. When the proper depth is reached, the rods are turned a quarter of a turn to the right and the pump is set. The hydrostatic load on the pack off element will hold the pump down and seal off. A drain device is made in the packer so that when the pump is pulled the hydrostatic load above the pump is equalized (Fig. 1).

In the outline of equipment were listed six 1-1/2 in. polished rods weighing 800 lb. These were run at the bottom of the rod string right above the pump to keep the rods in tension because on the downstroke the rods try to compress and lie to the side of the casing. A 12 in. long plastic sucker rod guide is used on the pull rod at the top of the pump and another is spaced at the top of the last polished rod. Rod guides are then spaced evenly up the entire rod string; thus the rods are properly guided, and wear on the casing is minimized. The added weight of the polished rods assists in forcing the plunger to fall and give stability to the pumping motion.

It has also been proven in casing pumps that valve cages with extra long lift give better service along with

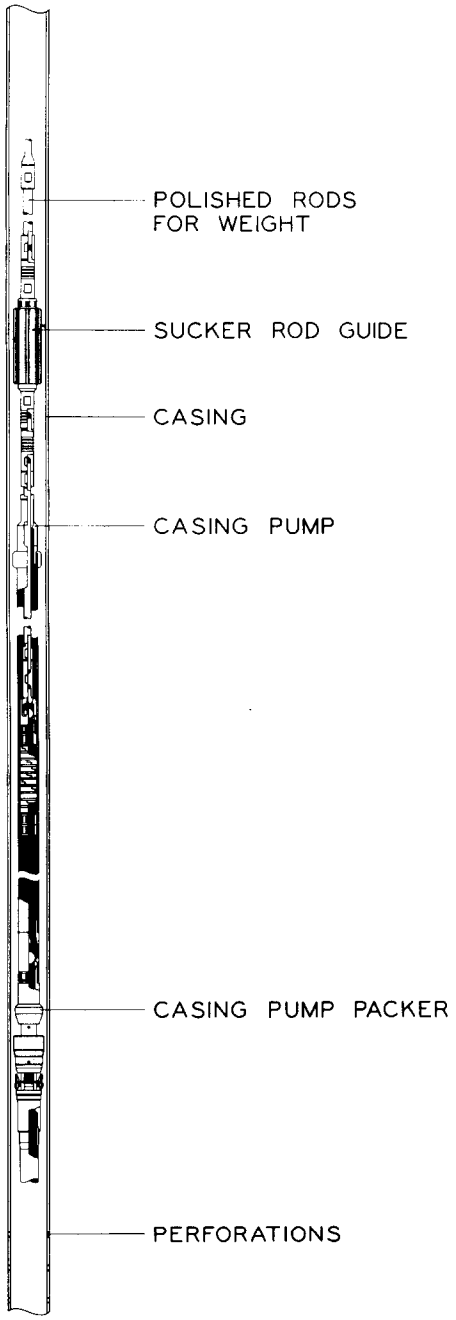

FIG. 1

drops and seats instead of balls and seats. The drop affords more guide surface and less weight. The long lift cage allows more fluid passage and cuts down on fluid restriction. This reduction is important with a long, fast stroke.

Several times the question has been asked about the slips on a packer cutting the pipe. On the new improved types now being used, slips hold up the element and almost all hydrostatic load is on the rubber. However, it is always better if the pipe is cemented behind the point where the packer is set, but in several hundred installations this has never been a problem.

Because of the tremendous increase in waterflooding, packers for the specific use with casing pumps have been developed by the leading packer manufacturers, and their service people are thoroughly familiar with the installation of casing pumps.

There are many pros and cons about casing pumps; but, if they are correctly installed and the surface equipment is properly sized, they will perform satisfactorily.

The selection of a casing pump is not a difficult matter if all the information needed is at hand or can be secured. The weight and size of casing to be set in are the first important factors. The bore of the pump to be used should be the smallest that will provide the necessary fluid to obtain the well production using the longest and slowest stroke possible (Fig. 2). The pump can be equipped with several types of plungers.

The types of plungers used in the pump can be of alloy metal, chrome plated, valve cup, fabric ring and plastic ring. Of these, chrome plated barrels usually will give longer life when used with non-metallic material; and experiences with improved sucker rods and pumping units in several hundred wells have shown that the plastic ring plunger gives very satisfactory performance and by its free falling characteristics has proven beneficial to the rods and pumping unit. But these performances all depend on the well condition. The length of the plunger should be in accordance with the depth of pump setting.

Casing pumps are not adaptable to and should not be used where large quantities of sand may settle on top of them during shut downs and where fluids leave a calcium or sulphate deposit on the casing wall.

TYPICAL PLUNGER DISPLACEMENT, Barrels per day:

INSTALLATION	NOMINAL PUMP BORE			
	2-3/4"	3-1/4"	3-3/4"	4-3/4"
1000' Depth				
14 - 84" SPM				
7/8" Rods	1016	1406		
1" Rods			1871	2949
1500' Depth				
10 - 120" SPM				
7/8" Rods	1032	1416		
1" Rods			1885	3007
12 - 120" SPM				
7/8" Rods	1238	1714		
1" Rods			2281	3641
2000' Depth				
10 - 144" SPM				
7/8" Rods	1217	1662		
1" Rods			2212	3495
12 - 144" SPM				
7/8" Rods	1471	2009		
1" Rods			2675	4103
2500' Depth				
6 - 180" SPM	925	1210		
7/8" Rods			1623	2462
1" Rods				

FIG. 2