Casing Pumps

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A casing pump is a large rod pump that is run in the well casing instead of in the tubing. It is composed of four principal parts. The packer assembly, the anchor assembly, the rod assembly and the pump assembly.

The function of the packer assembly is to make the seal between the casing and the pump. This assembly will be the same in a given size casing for any pump assembly that is used.

The function of the anchor assembly is to anchor the pump in the casing, and it too remain the same in a given size casing regardless of the size pump used.

The function of the rod assembly is to connect the pump plunger to the rod string through the packer and anchor assemblies. This assembly is changed to fit the length pump assembly that is used.

The pump assembly does the pumping. It may be of any size or type that is required to pump the well in which it is being used. It is limited in size only by the inside diameter of the casing in which it is used, and by the availability of surface equipment and rods to operate it.

Some of the advantages of casing pumps are, that they can be run without the use of tubing, which usually results in a saving in material cost and in the servicing of the pump. The casing pump can be pulled and re-run (when it is necessary to service the pump) quicker than the tubing pump. This also saves shut-down time.

The casing pump being sealed off in the casing, relieves the formation of all the fluid weight above the pump as soon as the pump becomes operational. This permits the formation fluids to enter the well more freely. This seal causes all the formation gases to mingle with the production fluid, which lightens the fluid being pumped and results in a lessening of the polished rod load.

Many of the larger casing pumps are being run on 2 1/2" tubing. They are run on tubing principally for the following reasons: Where pumps are run in crooked wells, rod wear on the casing would be a hazard. They are run on tubing in wells where the largest pump possible to be run has to be run at a high speed. At high speed the rods buckle, causing rod breakages. The rod boxes slap the casing, causing wear. It has been found that the tubing guide will prevent the rod wear on the casing and that it will eliminate a large percentage of the rod breaks, and due to the rods falling straight will cause the pump plunger travel to more closely approximate that of the polished rod at the top of the hole. This too, will help the pump efficiency.

This type installation is used extensively where the corrosive qualities of the fluid being pumped requires that chemical treatment down the hole be used to prevent rod embrittlement. Where the well is treated, the chemical is injected into the tubing and pumped out through the annulus. The treating fluid should giive better results with a casing pump than with a tubing pump because the chemical protects the rods first.

Where a casing pump is run on tubing, the installation is made in the following manner. The packer assembly is connected to the tubing string by means of a slip-joint which permits the pump to be anchored in the casing on the anchor assembly, with the full weight of the tubing string suspended from the well head, the pump plunger being connected to the rod string by means of an on or off attachment. The on or off attachment permits the rods to be fished after a break without removing the pump. This saves considerable time in repairing a rod break as well as considerable wear and tear on the packer assembly and anchor.

In the oil field, casing pumps are used to produce water wells where large quantities of water are needed for water flooding, drilling new wells and other operating purposes.

They are used extensively to produce oil wells, especially wells where large quantities of water have to be produced to obtain the wells oil production.

The selection of a casing pump is not a difficult matter if all the information needed is at hand or can be secured. The packer assembly and the anchor assembly will be of a size that will fit the well casing. The weight of the casing is necessary, as different weights of the same sized casing require different packer elements and different slip assemblies on the anchor.

The pump assembly may be of several different types, such as a cup-plunger in a common working barrel, a ring type plunger in a common working barrel, or a metal to metal pump. All of these pumps are being used on casing pump installations and the local well conditions is the best guide as to which is best.

The bore of the pump to be used should be the smallest that will provide the necessary fluid to secure the wells production at the longest and slowest stroke consistent with the efficient operation of the prime mover, the pumping unit and the rod string. The length of the plunger should be in accordance with the depth of the well. The length of the barrel should be the over-all length of the plunger plus the length of the stroke, plus the spacing requirement for the depth the well is to be pumped from. The casing pump will require the same space at the top of the stroke as at the bottom of the stroke.

The accepted formula for determining the size of a tubing pump to handle a given quantity of fluid used for

A Report On Several Casing Pumps Used To Produce Water For Water-Flooding.

TABLE I

AREA	WELL 1 Lea County NeW Mexico	WELL 2 Ector County Texas	WELL 3 Wichita Falls Texas	WELL 4 South Burbank Oklahoma	WELL 5 Wichita, North Texas
Formation		San Rosa			
Depth Well	5206	1250			
Size Casing	5 1/2" OD	9" OD	7" OD	5 1/2" OD	7" OD
Depth Pump	3018'	1028'	1450'	2920'	1800'
Size Pump	3 3/4" x 12"	4 3/4" x 12"	4 3/4" x 12'	3 1/4" x 12'	4 3/4" x 12'
Type Pump Assembly	4 cup and common wkg. barrel	4 cup and common wkg. barrel	Ring	Cup	Hard ring
Average Life of Plunger	Still running 3 years	2 months			
Average Life of Barrel	Still running after 3 years	2 months			
Length Stroke	64"	74"	34"	72"	81"
Strokes Per Minute	12	12	14	14	12
Barrels Per Day Fluid	950	2000	980	1050	3800
Size Rods	1"	1"	1"	7/8"	1"
Rod Break Frequency	None in 3 years	1 in 2 months	None in 15 months	1 in 18 months	None in 2 years
Type Pumping Unit	Conventional	Conventional	Conventional	Conventional	Conventional
Gear Box Torque	228000	320000			
Beam Capacity	25000	27000			
Type Prime Mover	Single Cylinder	Multiple Cylinder		Electric Motor	Multiple Cylinder
Size Prime Mover	11" x 14"	4 5/8" x 6		20 HP	
Length Time Pump in Service	3 years	2 months			

he casing pump, except that it is not necessary to consider tubing stretch, as there should be none.

The fit of a metal plunger should be determined by the kind of fluid that is to be pumped. Plungers in a casing pump installation should fall as free as is possible without permitting slippage on the lifting stroke. The type of rings used in a casing pump assembly should be determined by the well conditions, hard or synthetic rings being used where abrasives are not present and composition rings where abrasives are present. Cups on a cup pump should be fitted as carefully as a metal plunger. Cups are available in base, base-plus or base minus, which ever be needed.

Drops and seats are used extensively in the larger casing pump installations where gas and sediment will not prevent their use, being lighter than a ball of the same size, they do not beat out the seat. Where drops cannot be used, a ball will have to be used. In pumps 2 3/4" or smaller, balls and seats have given better service as a rule.

The rod assembly is governed by the type packer assembly, the type anchor assembly and the type pump assembly. It is usually provided with a safety device to permit unscrewing from the plunger in case the plunger should become frozen in the barrel. In most casing pumps, this permits the removal of the pump from the well without a fishing job.

Casing pumps may be operated at any depth that a rod string will efficiently operate the plunger. In this respect, they are no different than any other pump which operates by means of rods.

Casing pumps are not well adapted to the production of small quantities of fluid from a low level well. They do not work well in small fluid wells with a high gas fluid ratio. It is not advisable to use them in wells where large quantities of sand may settle on top of them while shut down. They should not be used in wells where well fluids and gases leave a calcium or sulphate deposit on the casing walls, unless in this type of well, a tubing guide is used and chemical is injected to prevent the deposit. In this event, it should be determined if a chemical is available that will prevent the deposit before installation of the pump.

SEE TABLE 4 ON PAGE 166

Report Of Conventional Casing Pump Installations

TABLE II

AREA	WELL 1 Lea County New Mexico	WELL 2	WELL 3 Wichita Falls Texas	WELL 4 Andrews Texas	WELL 5 Andrews Texas
Field	Jal Mat	Russel	Jay Field	Deep Rock	Deep Rock
Formation	Middle Yates	Devonian		7 Rivers	Ellenberger
Depth Well	3434'			12375'	12365'
Size Casing	8 5/8" OD	5 1/2" OD		5 1/2" OD	5 1/2" OD
Depth Pump	2500'	2775'	2800'	4500'	4400'
Size Pump	2 3/4" x 12'	3 3/4" x 16'	3 1/4" x 16'	2 3/4" x 20'	2 3/4" x 16'
Type Pump	Hard Ring	Hard Ring	Hard Ring	Ring & Cup	Ring & Cup
Average Life of Plunger	21 months				
Average Life of Barrel	5 1/2 years				
Length Stroke	52"	85"	74"	120"	74"
Strokes Per Minute	16	9 1/2	16	8	12
Barrels Per Day Fluid	336	1170	980	790	852
Barrels Per Day Oil	15	90	20	182	315
Size Rods	7/8"	1"	1"	7/8" & 1"	7/8" & 1"
Rod Break Frequency	None in 11 years	1 in 2 months	None in 14 months	None	None
Type Pumping Unit	Conventional	Air Balance	Conventional	Conventional	Conventional
Gear Box Torque	22800			456000	320000
Beam Capacity	19100			32400	29500
Type Prime Mover	Single Cylinder	Multiple Cylinder	Multiple Cylinder	Single Cylinder	Single Cylinder
Size Prime Mover	8 1/2" x 10"	40 HP	40 HP	11" x 14"	8 1/2" x 10
Length Time Pump in Service	11 years	3 months		2 months	3 months

Report On 4 Wells Using Tubing Guide Only

TABLE III

AREA	WELL 1 Lea County New Mexico	WELL 2 Lea County New Mexico	WELL 3 Winkler County Texas	WELL 4 Winkler County Texas
Field	Jal Mat	Eaumont	Hendrick	Hendrick
Formation	Queens Lime	San Andreas	Hendrick Reef	Hendrick Reef
Depth Well		3970'	2820'	2920'
Size Casing	5 1/2" OD	5 1/2" OD	9" OD	9" OD
Depth Pump	2500'	2500'	1800'	1700'
Size Pump	3 3/4" x 12'	3 3/3" x 10'	4 3/4" x 12'	4 3/4" x 12'
Type Pump	Cup	Cup	Cup	Cup
Average Life of Plunger	3 years	24 months	9 months	2 years
Average Life of Barrel	9 1/2 years	24 months	18 months	11 years
Length Stroke	54"	52"	64"	64"
Strokes Per Minute	14	11	13	18
Barrels Per Day Fluid	963	600	1900	4650
Oil	13	40	29	20
Size Rods	7/8"	1"	7/8" - 1"	7/8"
Tubing Guide	2 1/2"	2 1/2"	2 1/2"	2 1/2"
Treating Down Tubing	No	No.	No	No
Breaks Before Using Guide	1 per month			
Breaks After Using Guide	None in 9 years	None in 2 years	1 in 3 months	1 in 2 years
Gear Box Torque	124000	320000	320000	22800
Beam Capacity	15000	29500	27000	20700
Prime Mover Type	Single Cylinder	Single Cylinder	Multi Cylinder	Single Cylinder
Prime Mover Size	7 1/2" x 10"	8" x 10"	4 5/8" x 6"	10 1/2" x 13"
Length Time Pump in Service	9 1/2 years	2 years	18 months	21 years

Report On 6 Wells Using Tubing Guide And Down-Hole Treatment

TABLE IV

AREA	WELL 1 Andrews County	WELL 2 Winkler County	WELL 3 Winkler County	WELL 4 Winkler County	WELL 5 Crockett County	WELL 6 Winkler County
Field	Shafter Lake	Hendrick	Hendrick	Hendrick	Noel Rodman	Hendrick
Formation	Ellenberger	Hendrick Lime	Brown Lime	Brown Lime	Greyburg	Hendrick Reef
Depth Well	9000'	2975'	3000'	3000'	1800'	2932'
Size Pump	3 3/4" x 19'	5" x 12'	4" x 12'	5" x 12'	4" x 10'	4 3/4" x 12'
Size Casing	7" OD	7" OD	5 1/2" OD	7" OD	7" OD	9" x OD
Depth Pump	3500'	1875'	2211'	1526'	1500'	1800'
Type Pump	Metal to Metal –005 fit	Cup	Cup	Cup	Cup	Cup
Average Life of Plunger	18 months	5 months	18 months	18 months	3 months	7 months
Average Life of Barrel	18 months	5 years	4 years	3 years		2 years
Length Stroke	120"	64"	84"	74"	34"	64"
Strokes Per Minute	8	22	17	16	22"	22"
Barrels Per Day Fluid	1300	3200	2448	2718	1200	3450
Oil	60	10	24	19	25	18
Size Rods	1"	1"	1" - 7/8"	1" –7/8"	7/8"	7/8"
Tubing Guide	2 1/2"	2 1/2"	3"	3"	2 1/2"	2 1/2"
Treating Down Tubing	Yes	Yes	Yes	Yes	Yes	Yes
Breaks Before Using Guide	3 per month				2 per week	
Breaks After Using Guide		2 per week				
Rod Breaks Before Treating			20 per year	26 per year		
Rod Breaks After Treating	1 per month	None in 5 months	None in 14 months	None in 8 months	None in 2 1/2 months	5 in 2 years
Gear Box Torque	456000	320000	352000	352000	40300	228000
Beam Capacity	324000	27000	30000	30000	9300	20700
Prime Mover Type	Single Cylinder	Single Cylinder	Multi Cylinder	Multi Cylinder	Electric Motor	Multii Cylinder
Prime Mover Size	11" x 14"	10 1/2" x 14"	69 HP	60 HP	15 HP	4 1/4" x 5"
Length Time Pump in Service	4 years	5 years	22 years	22 years	2 years	5 years