

Dual Completions

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INTRODUCTION

The term "dual completion" refers to a method of producing two zones through the same well bore without co-mingling of fluids. A dual completion is one that promises greater economy. During recent years the percentage of such completions has been greatly accelerated, due to mounting development costs. Because of the success of dual completions and the favorable economic aspect, there is no reason to predict a downward trend. Equipment manufacturers are constantly redesigning and improving their equipment to meet the demands of equipment applications.

The purpose of this paper is to discuss various types of dual completion installations, beginning with the very basic type and progressing to the later types, which are becoming more commonly used.

BASIC DUAL USING ONE PACKER

The basic dual completion consists of two producing zones with a packer set between them. The bottom zone is produced through the tubing, and the top zone through the annular area between the tubing and the casing.

One of the most commonly used packers on this type of completion is a retainer type production packer. This packer is a permanent type made of drillable material which can be set in the casing on tubing or electric line. It is of the differential type and provides an effective seal between the packer body and the casing due to opposing slips and a packing element backed up on either end with expanding lead and ductile rings. The bore of the packer is built to accommodate a set of seal nipples which are run on the bottom of the tubing string. When these seals are in position in the packer bore, separation of the two zones is accomplished. The seals may be picked up out of the bore of the packer for displacing purposes and then resealed. Most seal nipple assemblies are of the locator type, which allow part of the tubing string weight to be applied to the seal nipples to hold them positioned in the packer bore when high differential pressures from below are encountered. Seal nipple assemblies of the latching type are also used. These allow positive engagement of the nipples to the packer body, but they may be released by rotation.

In some cases, retrievable type packers are used on this type of dual completion. Depending on the zones, the packer may be a differential or non-differential type packer. In most cases, to provide as much flexibility as possible, a differential type packer is used. Quite frequently, accessory equipment exclusive of the packer may be run in the tubing string to provide greater flexibility on displacing operations and selective

treating and testing operations on either zone.

DUAL COMPLETIONS USING TWO PACKERS AND CROSS-OVER EQUIPMENT

In many cases, the characteristics of the two producing zones may be such that it would not be possible to complete them as a basic dual, or it may be desirable to produce the top zone through the tubing and the bottom zone through the annular area between the tubing and the casing.

It is necessary on an installation of this type to isolate the top zone by setting a packer below and above it, and, by the use of accessory equipment in the tubing string, to selectively flow, test, or treat either zone.

Two retainer type production packers are commonly used on this type completion. A special head is attached to the seal nipples that seat in the top packer, and an inner-tube extends from the inside of the head down through the inside of the top seal nipples. The outside of the bottom end of the tube is sealed off by "O" Rings in relation to the bottom end of the top sealing nipples. Sufficient between packers tubing, with seal nipples for the bottom packer, extends below the top packer seal nipples. Due to predetermined spacing of the packers when set, the bottom seals are automatically in the bottom packer when the seals for the top packer are located. By positioning on a wire line various types of chokes that seat in the special head, flow control of the zones is accomplished.

As in the case of the basic dual, two retrievable packers can be used on this installation. Also, the use of a retainer type packer as the bottom one and a retrievable packer as the top one are quite common.

DUAL COMPLETIONS USING ONE PACKER AND PARALLEL STRINGS OF TUBING

One of the greatest disadvantages of the two previously discussed types of dual completions is the fact that the well bore casing is exposed to the production of the zone that is being produced between the annular area of the tubing and casing. Also, artificial lifting techniques have not been considered. The use of one packer and parallel strings of tubing presents a partial solution to both problems, and their use, as such, has become quite common.

A retainer type packer set between zones, is quite commonly used and the initial installation is similar to the basic dual. A second string of tubing can be run and hung and each zone produced through a separate string of tubing. If desired, this installation can be made in such a manner that either string can be pulled selectively.

This installation can also be used when both zones are nonflowing and require pumping. The basic installation would be the same, except that in some cases a receptacle is run as an integral part of the primary string, and the seal nipples, which are run on the primary string, are latched into the packer. A latching device, which can be released by rotation, is run on the bottom of the secondary string and latched into the receptacle that was run with the primary string. This arrangement would allow both strings of tubing to be left in tension as desired. If this feature is not desired, then the initial installation, with the addition of seating nipples to each string of tubing, will suffice.

As in the other installations, a retrievable packer can be used.

DUAL COMPLETIONS USING TWO PACKERS AND PARALLEL STRINGS OF TUBING

The use of two packers and parallel strings of tubing eliminates many of the undesirable features of a dual completion; the primary advantage is that both zones are confined to individual strings of tubing, and the well bore casing above the top packer is not exposed to the production of either zone. Also, artificial lift methods, such as gas lift valves, can be employed.

As mentioned before, the top zone is isolated by a packer below and one above. By using a special receptacle run on the primary string or special twin bored top packer, the bottom zone can be produced through the primary string. The secondary string is then run and sealed off in either the special receptacle or remaining bore of the twin bore packer.

Two retainer type production packers are used quite extensively in this type installation. The top packer is special, in that it has a bore which has two different ID's; the top portion of the bore is the larger ID. A special flow tube with a seal nipple on the bottom end to seal off in the large ID of the top packer, and an inner-tube extending from the top of the flow tube down to the bottom packer with seals for the bottom packer, is made up on the primary string. The packers are set at predetermined depths, and, when the flow tube is landed in the top packer, the seals for the bottom packer are automatically in place. The secondary string, with seal nipple on the end, is then run and positioned in a bore in the receptacle in the top of the flow tube. The top zone is produced through the annulus between the outside of the inner-tube and inside of the flow tube, up through the secondary string. As mentioned previously in regard to seal nipples, the flow tube and secondary string seal may be located or latched, depending on the differential pressures exerted across the top packer.

The use of a twin bored retrievable top packer and a retainer type bottom packer are also used extensively

in this type completion. The retrievable packer may be of the differential type, depending on the differential pressures exerted across it.

Both types of installations are basically made the same. The retrievable packer is made up on a primary string with between packers tubing and seals for the bottom packer made up below it. When the bottom packer is located with seals positioned in place, application of set down weight will cause the retrievable packer to seat and pack off. The secondary string, with seal nipple for the second bore in the retrievable packer made up on the bottom end, is then run and seal positioned in the secondary bore. This completes isolation of the top zone; the bottom zone is produced through the primary string and the top zone through the secondary string.

By the use of circulating sleeves and gas lift valves, greater flexibility may be attained, as is necessary.

TRIPLE COMPLETIONS USING THREE PACKERS AND THREE STRINGS OF TUBING

Although triple completions using three packers and three strings of tubing are still somewhat rare, triple string installations will become more common in the near future, due to the success of parallel installations.

Three retainer type production packers can be used on this type installation; the top packer is the same type used as the top packer for the parallel string completion it has a bore of two ID's; the middle packer has a smaller ID bore than the smallest ID of the top packer; and the bottom packer has a smaller ID bore than that of the middle packer. The flow tube, which is run on the primary string and lands in the top bore of the top packer, has an innertube extending from the top of the flow tube to the middle packer, and another tube inside of it extending from the top of the flow tube to the bottom packer. Both tubes have seals on the end to seal off the respective packers. All three are set at predetermined depths, and the primary string with flow tube is run and seated in the top packer; this automatically positions the seals for the middle and bottom packer in place. Seal nipples of different OD's are made up on the remaining two strings of tubing. They are run selectively and seated in their appropriate bores in the top of the flow string, the middle zone through the intermediate short string, and the top zone through the short string.

CONCLUSION

It has not been the purpose of this paper to cover all types of dual completions. The ones covered are the most basic, but a working knowledge of the basic types will enable variations to be incorporated, as needed, to fit the more specialized dual completions.