

# Tubing Size Selection for Variation Percentages Water Cut in Well X Field Y

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## ABSTRACT

Crude oil water cut is the percentage mass of water in all the liquids, i.e. increase of water in crude oil. Water cut is the significant parameter along with the Gas Oil Ratio (GOR) for the crude oil to surely indicate the water content in the reservoir fluids. Water cut is commonly expressed in percentage, this paper describes a method of determining water cut percentages with tubing variations (inch), in order to have an applicable tubing size in water cut wells. There are several ways to determine the well's performance, single way is the tubing performance relation curve, also known as the tubing performance curve (TPR/TPC). The TPC is used with the inflow performance relationship (IPR) to predict the performance of specific well, with aim to decide the performance of oil well before well optimization conducted, Inflow Performance Relationships (IPR) curve is used. The curve illustrated relation between well production rates (Q) to bottom-hole pressure (P). The IPR method calculation based on fluid phase that flowing in the well through the conduit to surface. The result variation water cut percentages optimizing with an appropriated tubing size (Inch) for wells. Thus, the effect of tubing size could be optimized the production rate that will be produced.

**Keywords:** Water Cut, TPR & IPR, Tubing size Variations.

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## 1. Introduction

Oil and gas production is an activity where, lifts fluid from the formation to the surface through production facilities. Production activities can be classified into three stages such as primary production, secondary production and tertiary production (fanchi et al. 2017). In the primary production stage, the production activities use natural flow and artificial lift production methods. Although natural flow production there are some wells or new fields, most of them have production problems such as water cut problems, as a result of incorrectly determining the perforation point at the time of well completion. According to (Timothy, 2020). In addition to completing completion, water cut problems can also occur due to the long production time in reservoir conditions where the driving force is water drive. The water cut problem is a very important problem from a technical and environmental point of view. Excess water cut can cause a drastic reduction in oil production. (Bailey et al, 2000). Excessive water production does not pose a risk to the profitability of oil and gas producing wells but also reduces the sweep efficiency and final recovery of the oil reservoir. According to (Botermans et al. 2001) prevention of water production is more effective than treatment.

Not only maintaining assets in the field by preventing the increase in water cut, but the amount of water cut greatly affects the selection of tubing sizes. Tubing is a series of production pipes covered with steel with variations in inside and outside sizes from 2,025 inch – 7 inch (API 5 CT). Not all tubing sizes can be used in production activities, but there are various parameters that must be considered, one of which is fluid properties. (Bariakpoa, 2018). the effective tubing size must be based on the amount of fluid production and the life time of production, but not all wells and oil fields can produce

as expected, this is due to the condition that the surface and boundaries of production facilities are indicators of failure in the production plan (quantity and life time of production). In previous studies using the nodal analysis method for the selection of performance tubing. However, this study focused on how far the selection of tubing size (inch) in the field with the assumption of a different percentage of water cut, initially an experiment was conducted to determine the effect of tubing size on the amount of water cut percentage and each number of presentations on variations in tubing size through nodal analysis.

## 2. Literature Review

In the reservoir condition high water cut wells make some bad impact in the production stages (Afi et al., 2017). Water-production problems can vary from (1) leaks in casing, production tubing or packers; (2) flow behind casing; (3) water coning (or water cresting in horizontal wells); (4) direct communication from injector to producer through natural or induced fractures (Vasquez, 2015). Problems identification for water cut are: high permeability streaks; Bottom Water and Coning and Near Wellbore Problems (Al-dhafaeri, 2012). Usually because of the strong aquifer in the reservoir where water underlying the oil zone and this can cause water cut during production phase. Water breakthrough in the formation sometimes is common in intervals with high permeability streaks causing the water cut to increase substantially, thus affecting the oil producing zones. Besides the onset of water, additional decline results from high pressure drawdown and high clay content (including Kaolinite) in the formation. Therefore, when production is conducted in formation with

high permeability streaks it can cause water breakthrough during early production due to the difference between upper formation and lower formation (Boucher, 2011) and the study was conducted on subject reservoir is a leading example where the upper layer (Upper Sand) permeability is in the range of 100 Milli-Darcy and contains approximately low percentage of the total oil in place.

The lower flow unit, (Lower Sand) has permeability approximately 10 to 50 times higher than the upper flow unit, contain the bulk of the oil. In addition, inter-bedded zones have higher permeability in each sand of the three sands the upper, middle and the lower sand. In such a case, fluid flow preferentially through the lower zone and very little of it was diverted into the upper or the low permeability inter-bedded zones accelerating the water production (Al-dhafeeri et al., 2012).

Problems of excessive water production associated to the reservoir, commonly are water conning (in vertical wells) and water cresting (in horizontal wells) both of them are originated by an excessive reduction of the well bottom hole flowing pressure, this cause the water of an adjacent zone to flow towards the completion and this usually happens in formations with high vertical permeability along with high water-oil mobility ratio (Gasbarri, 2008).

(Al-dhafeeri et al., 2012) also states that several wells especially the vertical ones are examples for suffering for water coning problem because of high permeability. Coning problem in water is bottom water infiltrates the perforation zone in the near-wellbore area and reduces oil production or affects cumulative production, operation costs and cause environmental problem (Jafari, 2012) and water forms cones more vigorously through the permeable channels with the increase in hydraulic fracture conductivity (Prasun, 2018). It is important to consider that coning is normally associated with high production rates, when the theoretical critical rate is exceed a deformation of gas or water contact will occur (Espinola, 2016).

Poor cement bonding could be caused of water channeling behind casing which is one of the most serious problem to increase water production (Moawad, 2013) or bottom water is produced by two different mechanisms either poor quality completion (cement channels, casing leaks, etc.) or coning (fazal, 2019). In addition, wrong and improper intervals just near the bottom water or the above gas or adjacent to a conductive fault cause water breakthrough resulted from water movement (Al-dhafeeri et al., 2012). Pulling high rate from the reservoir or quest for high production performance through high rate thus high drawdown have cause some wells to cut water early in their producing life therefore initiating early extra cost for water handling and water shut-off activities (Oyakhire, 2017). High water cut might be caused by lateral water breakthrough from an offset injection well, coning or channeling behind casing from an underlying or overlying aquifer (Ali & Ahmed, 2017) Apart from this, common problem of water breakthrough associated to the near-wellbore is flow behind the casing in which flow channels may be developed through the cement behind the casing through the life of the well, being more

prone to happen immediately after the well is completed or stimulated (Gasbarri, 2008). High water cut is attributed to poor sweep efficiency due to preferential movement of water from conventional injector to producer through high permeability streaks/thief zones in the crested area (Majhi, 2015).

There is a consistent and almost immediate response between injection rates and water cut, the cause of high injection rates results in a fast rise in water (Al-murayri, 2019). In general, mature fields are oil fields that have been producing for a long period of time, as a reservoir mature there is almost inevitable increase in water cut (Thiruthonder, 2020) & (Tiwari, 2016). Early water breakthrough in many of the recently drilled rapid development wells in the East and West accumulation was caused by fractures lead to high water production (Sivrikoz, 2018).

Tubing is one of the important component parts in the production system of a flowing well and is the main channel for oil and gas field development. The pressure drop for the fluid lifting from the bottom hole to the surface can be up to 80% of the total, the pressure drop of the oil and gas system. Any oil well system has an optimum tubing size. Undersized tubing will limit the production rate due to the increased friction resistance caused by excessive flow velocity. Contrarily oversized tubing may lead to an excessive liquid phase loss due to slippage effect or an excessive down-hole liquid loading during lifting. Therefore, sensitivity analysis of tubing size should be carried out using the nodal analysis method. A well production is dependent on mechanical configuration of the wellbore, the fluid properties the reservoir conditions and several others factor. There are several ways to determine the well's performance (Gromotka, 2015). One way is the tubing performance relation curve, also known as the tubing performance curve (TPR/TPC).

A mathematical tool used in production engineering to assess the performance of the completion string by plotting the surface production rate against the flowing bottom hole pressure. The fluid composition and behavior of the fluid phases in the specific completion design will determine the shape of the curve. The TPC is used with the inflow performance relationship to predict the performance of specific well (Guo et al, 2008).

The TPR curve is a combination of all possible steady state production conditions for the well, given certain conditions. To determine the actual or natural production conditions the characteristics of the reservoir need to be taken into the well. In many circumstances, the conditions of surface flow line cannot be determined in advance and the first method cannot be used for the sensitivity analysis of tubing size. Thus, the tubing size is optimized by setting wellhead tubing pressure or PWH. The fluid flow in tubing during flowing production can be analyzed in accordance with the aforementioned vertical flow rule in tubing. The most sensitive factors affecting the pressure gradient distribution of multiphase vertical flow in tubing include tubing size, production rate, gas liquid ratio, viscosity, and water cut are basically in a range, where the production rate can be controlled and changed. In accordance with the theory of

multiphase flow in tubing, each production rate value corresponds to the optimum tubing size so that the pressure gradient (or pressure depletion) in tubing can be the minimum. The effect of change in tubing size is often analyzed using the coordinate diagram of pressure P and production rate Q. The optimum tubing size is generally determined using the nodal analysis method.

### 3. Research Methodology

This research is carried out in stages, the initial stage is calculating the data from the number of water cut presentations; 10%, 20% and 30% for one type of tubing size in one well condition, with the aim of knowing the effect of the amount of water cut when producing a certain tubing size through nodal analysis. The second stage determines the effective tubing size based on the production rates at each water cut presentation for different wells condition.

Field X is a field that has three production wells (D1, D2 and D3). When there are completions of the three wells, the water cut was detected. Due to the limited size of tubing in the field, it is recommended to determine the effective tubing size for each well that has a different amount of water cut presentation. D1 well is a well that has 10% water cut, well depth 6900 fit, reservoir pressure 4300 psi/fit, qtest 680 bbl/d, D2 well has 20% water cut, well depth 6900 fit, reservoir pressure 4300 psi/fit, qtest 680 bbl/d and well D3 has 30% water cut, well depth 6900 fit, reservoir pressure 4300 psi/fit, qtets 680 bbl/d.

### 4. Result and Discussion

Results of the study in fluids production system from the well using the nodal analysis method through the, inflow performance relationship (IPR) and tubing performance

relationship (TPR) curves. The IPR and TPR curves can describe the ability of the well to drain fluid from the reservoir based on the sum of the reservoir pressure and the bottom flow pressure of the well.

#### 4.1. Water Cut Effect Amount the Production.

Production problems that often occur when production activities are running in addition sand, paraffin, scale and water cut problems. According to (Thiruthonder, 2020) & (Tiwari, 2016) this production problem can occur based on the production time in an oil well which is the basic driving force in the reservoir in the form of water. There are also other studies which say that the problem of water cut is not only based on production time but also the permeability factor and the amount of production produced that does not match well conditions can trigger the number of water cuts to increase.

The water cut problem has a significant impact on production wells, especially the amount of production. Figure 1 shows the effect of the amount of water cut on the production rate through nodal analysis, and the 2.093 inch tubing is the tubing used for testing variations in the amount of water cut. At the water cut, 10% of the well is able to produce liquid of 1.580,32 bbl/day, WC20% produced 1.623,37 bbl/day, and WC30% produced 1.664,60 bbl/day. If the amount of water cut is not much, the production rates are greater. This phenomenon occurs as a result of the pressure gradient in the tubing, because the smaller the water content in the oil, the lighter the fluid density in the tubing, when compared to the large amount of water content. If the pressure in the tubing (outflow) is much smaller than the reservoir pressure, the production rate will be even greater. The same thing was expressed, that the bottom flow pressure of the well has a significant effect on the amount of production rate that will be produced (Kermit & Brown, 1985).

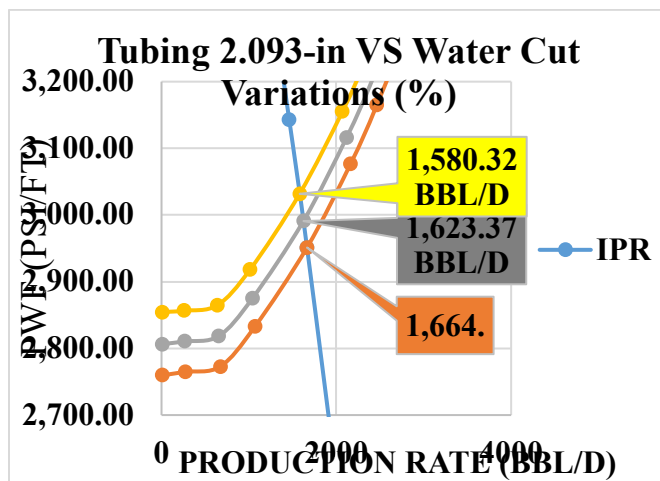


Figure 1. Effect of Water Cut Quantities Amount Production.

**4.2. Tubing Size Selection in Water Cut Production.**

Tubing is a production facility that is used to drain fluid from the bottom of the well up to the surface. The tubing itself has various sizes on the inside and outside diameter, according to API 5 CT the smallest inside diameter size is 1,278 inches and the largest is 3,958 inches, but you can also use casing as a substitute for tubing if the condition of the well allows it to be used. The function of tubing is not only to flow fluid but also as

the most important factor in determining the amount of production rate and length of production time. According to the production limit recommended by Kermit and Brown, the production rate for the natural flow method is between 30%-70% of the pump's maximum production rate, while for artificial lift it is between 40%-60%, the purpose of this limit is to maintain formation stability, wells, avoiding well production and profitability problems.

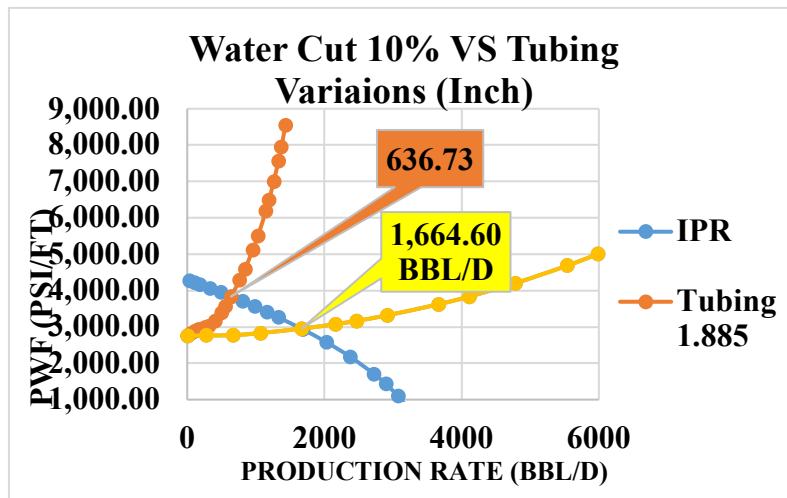


Figure 2. Water Cut 10%

(Inch) VS Tubing Variation

Figure 2 The graphic IPR identified using available data and used in the current simulation model for water cut 10% VS tubing variation (inch) such as; tubing 1.885", tubing 2.093" and tubing 2.664". In addition, the production rates for the TPR at nodal points such as; tubing 1.885" produces 636,737 Bbl/day, with the Pwf is amount 3.833,52 Psi/ft, the tubing 2.093" produces

1.664,60 Bbl/day, with the Pwf is amount 2.951,26 Psi/ft and the tubing 2.664" produces 1.664,60 Bbl/day with the Pwf is amount 2.951,26 Psi/ft. This optimization production well could be the tubing size 2.093" with the same high production rates as 2.664" however, it has the smaller size.

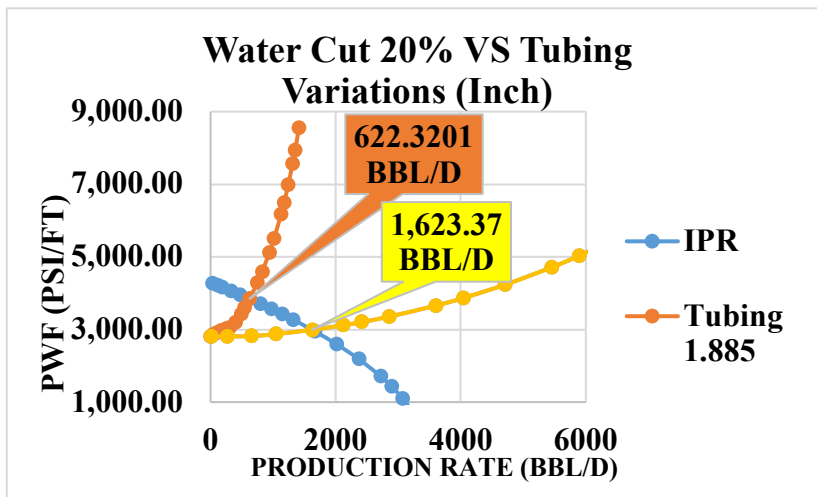


Figure 3. Water Cut 20% VS Tubing Variation (Inch)

Figure 3. The graphic IPR illustrated using available data and used in the current simulation model for water cut 20% VS tubing variation (inch) such as; tubing 1.885", tubing 2.093" and tubing 2.664". Additionally, the production rates for the TPR at nodal points such as; tubing 1.885" produces 622,3201 Bbl/day, with the Pwf is amount 3.844,63 Psi/ft, the tubing 2.093" produces

1.623,37 Bbl./day, with the Pwf is amount 2.990,90 Psi/ft, and the tubing 2.664" produces 1.623,37 Bbl./day, with the Pwf is amount 2.990,90 Psi/ft. This optimization production well could be the tubing size 2.093" with the same high production rates as 2.664" however, it has the smaller size.

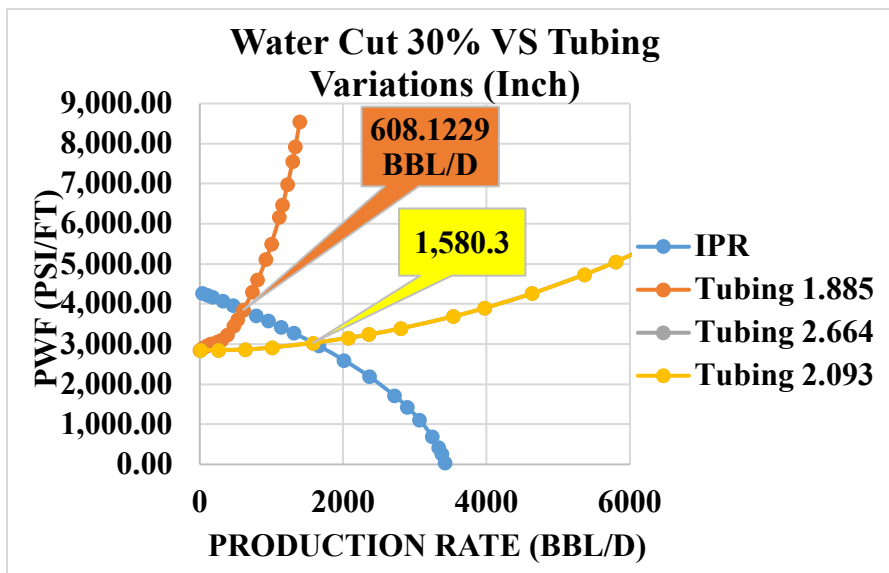


Figure 4. Water Cut 30% VS Tubing Variation (Inch)

Figure 4 The graphic IPR showed using available data and used in the current simulation model for water cut 30% VS tubing variation (inch) such as; tubing 1.885", tubing 2.093" and tubing 2.664". Furthermore, the production rate for the TPR at nodal points such as; tubing 1.885" produces 608, 1229 Bbl/day, with the Pwf is amount 3.855,54 Psi/ft, the tubing 2.093" produces 1.580,32 Bbl/day, with the Pwf is amount 3.031,82 Psi/ft, and the tubing 2.664" produces 1.580,32 Bbl./day, with the Pwf amount 3.031,82 Psi/ft. This optimization production well could be the tubing size 2.093" with the same high production rate as 2.664" however, it has the smaller size.

impact on production wells, especially the amount of production.

- b) The 2.093-ID is the tubing size used for testing variations in the amount of water cut. This tubing is the optimum tubing in optimizing production rates, at the water cut, 10% of the well is able to produce liquid of 1.664,60 bbl/day, with the Pwf is amount 2.951,26 Psi/ft, the WC20% produces 1.623,37 bbl/day, with the Pwf is amount 2.990,90 Psi/ft, besides this, the WC30% produces 1.580,32 bbl/day, with the Pwf is amount 3.031,82 Psi/ft. If the amount of water cut is not much, the production rates are greater. Water cut with the high percentages can cause to the production quantity decrease, additionally, the larger tubing size is absolutely affect the production rates increase.

**5. Conclusion and Recommendation**

**5.1. Conclusion**

The conclusion of the result of this study as the following:

- a) Water cut production problem can occur based on the production time in an oil well which is the basic driving force in the reservoir in the form of water. There are also other studies which say that the problem of water cut is not only based on production time but also the permeability factor and the amount of production produced that does not match well conditions can trigger the number of water cuts to increase. The water cut problem has a significant

**5.2 Recommendation**

Due to water cut problem in producing crude oil which is prevention of water production is more effective than treatment. Take detail control when production is conducted in formation with high permeability streaks it can cause water breakthrough during early production due to the difference between upper formation and lower formation. It's accurate if the pressure in the tubing (outflow) is much smaller than the reservoir pressure, the production rate will be even greater. It's

more effective when tubing size is smaller but the production rate is higher rather than the tubing size is bigger however, the production rate is lower at each water cut presentation for different wells condition.

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## Appendix

Table 1. Well X and Field Y, tubing 2.093" VS Water cut Variations (%)

Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (P <sub>sia</sub> )	Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (P <sub>sia</sub> )	Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (P <sub>sia</sub> )	Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (P <sub>sia</sub> )
Inflow: WCUT	Inflow: WCUT	Outflow: IDIAMETER = 2.093 in	Outflow: IDIAMETER = 2.093 in	Outflow: IDIAMETER = 2.093 in	Outflow: IDIAMETER = 2.093 in	Outflow: IDIAMETER = 2.093 in	Outflow: IDIAMETER = 2.093 in
34,1861	4.276,10	9,4671	2.759,58	9,3371	2.806,49	9,2176	2.854,45
136,0871	4.204,16	274,2888	2.764,90	267,5826	2.810,50	260,5945	2.856,56
237,9882	4.131,10	671,5213	2.772,82	654,9509	2.818,52	637,6598	2.864,70
339,8892	4.056,89	1.068,75	2.832,71	1.042,32	2.875,44	1.014,73	2.918,46
441,7902	3.981,45	1.664,60	2.951,26	1.623,37	2.990,90	1.580,32	3.031,82
645,5923	3.826,68	2.163,96	3.076,96	2.117,05	3.116,07	2.069,11	3.155,06
849,3944	3.666,20	2.463,58	3.165,19	2.413,26	3.203,39	2.362,38	3.241,41
1.053,20	3.499,36	2.913,00	3.317,89	2.857,57	3.354,64	2.802,29	3.391,21
1.257,00	3.325,31	3.662,04	3.622,12	3.598,09	3.656,30	3.535,47	3.690,38
1.460,80	3.143,04	4.111,47	3.835,73	4.042,40	3.868,28	3.975,38	3.900,80
1.664,60	2.951,26	4.785,60	4.203,69	4.708,87	4.233,78	4.635,24	4.263,97
2.103,10	2.497,82	5.534,64	4.682,28	5.449,38	4.709,57	5.368,42	4.737,13
2.322,36	2.243,52	5.984,07	5.006,76	5.893,69	5.032,27	5.808,33	5.058,23
2.541,61	1.963,48	6.658,21	5.553,75	6.560,16	5.576,74	6.468,19	5.600,73
2.760,86	1.647,85	7.107,63	5.960,74	7.004,47	5.982,03	6.908,10	6.004,02
2.980,11	1.278,16	7.781,77	6.630,55	7.670,94	6.647,21	7.567,96	6.663,74
3.199,36	810,6455	8.051,42	6.915,96	7.937,53	6.927,86	7.831,90	6.941,98
3.308,98	500,7329	8.455,90	7.359,43	8.337,41	7.368,11	8.227,82	7.378,07
3.363,80	304,0125	8.860,38	7.821,11	8.737,29	7.826,97	8.623,74	7.833,60
3.418,61	44,1862	9.467,11	8.552,21	9.337,11	8.552,20	9.217,61	8.552,21

Table 2. Well D1 Water Cut 10% VS Tubing size 1.885”, 2.093” and 2.664”.

Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (Ppsia)	Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (Ppsia)	Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (Ppsia)	Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (Ppsia)
Inflow: W/CUT	Inflow: W/CUT	Outflow: IDIAMETER = 1.885 ins	Outflow: IDIAMETER = 1.885 ins	Outflow: IDIAMETER = 2.093 ins	Outflow: IDIAMETER = 2.093 ins	Outflow: IDIAMETER = 2.664 ins	Outflow: IDIAMETER = 2.664 ins
34,1909	4.276,10	1,4328	2.760,51	9,4671	2.759,58	9,4671	2.759,58
109,5092	4.223,03	42,0923	2.811,03	274,2888	2.764,90	274,2888	2.764,90
184,8274	4.169,36	103,0815	2.872,66	671,5213	2.772,82	671,5213	2.772,82
335,464	4.060,14	164,0707	2.922,65	1.068,75	2.832,71	1.068,75	2.832,71
486,1005	3.948,26	255,5545	2.986,53	1.664,60	2.951,26	1.664,60	2.951,26
636,737	3.833,52	316,5437	3.025,97	2.163,96	3.076,96	2.163,96	3.076,96
810,634	3.697,19	408,0275	3.153,25	2.463,58	3.165,19	2.463,58	3.165,19
984,531	3.556,33	499,5113	3.388,51	2.913,00	3.317,89	2.913,00	3.317,89
1.158,43	3.410,45	554,4016	3.565,75	3.662,04	3.622,12	3.662,04	3.622,12
1.332,33	3.258,96	636,737	3.833,52	4.111,47	3.835,73	4.111,47	3.835,73
1.680,12	2.936,23	764,111	4.287,12	4.785,60	4.203,69	4.785,60	4.203,69
2.027,91	2.580,26	840,5353	4.593,35	5.534,64	4.682,28	5.534,64	4.682,28
2.375,71	2.178,03	955,1719	5.113,04	5.984,07	5.006,76	5.984,07	5.006,76
2.723,50	1.704,77	1.031,60	5.507,79	6.658,21	5.553,75	6.658,21	5.553,75
2.897,40	1.425,82	1.146,23	6.185,97	7.107,63	5.960,74	7.107,63	5.960,74
3.071,29	1.100,02	1.192,09	6.493,25	7.781,77	6.630,55	7.781,77	6.630,55
3.245,19	690,6254	1.260,87	6.999,47	8.051,42	6.915,96	8.051,42	6.915,96
3.332,14	422,557	1.329,65	7.568,59	8.455,90	7.359,43	8.455,90	7.359,43
3.375,61	255,2282	1.370,92	7.938,94	8.860,38	7.821,11	8.860,38	7.821,11
3.419,09	41,4013	1.432,82	8.552,20	9.467,11	8.552,21	9.467,11	8.552,21

Table 3. Well D2 Water Cut 20% VS Tubing size 1.885”, 2.093” and 2.664”.

Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (Ppsia)	Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (Ppsia)	Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (Ppsia)	Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (Ppsia)
Inflow: W/CUT	Inflow: W/CUT	Outflow: IDIAMETER = 1.885 ins	Outflow: IDIAMETER = 1.885 ins	Outflow: IDIAMETER = 2.093 ins	Outflow: IDIAMETER = 2.093 ins	Outflow: IDIAMETER = 2.664 ins	Outflow: IDIAMETER = 2.664 ins
34,1903	4.276,10	1,4136	2.807,42	9,3371	2.806,49	9,3371	2.806,49
107,7065	4.224,30	41,1516	2.856,32	267,5826	2.810,50	267,5826	2.810,50
181,2227	4.171,94	100,7586	2.914,89	654,9509	2.818,52	654,9509	2.818,52
328,2552	4.065,42	160,3657	2.961,88	1.042,32	2.875,44	1.042,32	2.875,44
475,2876	3.956,38	249,7762	3.022,46	1.623,37	2.990,90	1.623,37	2.990,90
622,3201	3.844,63	309,3832	3.060,48	2.117,05	3.116,07	2.117,05	3.116,07
797,1141	3.707,95	398,7937	3.191,48	2.413,26	3.203,39	2.413,26	3.203,39
971,9082	3.566,72	488,2043	3.419,33	2.857,57	3.354,64	2.857,57	3.354,64
1.146,70	3.420,45	541,8506	3.591,84	3.598,09	3.656,30	3.598,09	3.656,30
1.321,50	3.268,57	622,3201	3.844,63	4.042,40	3.868,28	4.042,40	3.868,28
1.671,08	2.944,99	748,9231	4.291,47	4.708,87	4.233,78	4.708,87	4.233,78
2.020,67	2.588,09	824,8849	4.594,70	5.449,38	4.709,57	5.449,38	4.709,57
2.370,26	2.184,79	938,8275	5.110,24	5.893,69	5.032,27	5.893,69	5.032,27
2.719,85	1.710,26	1.014,79	5.502,87	6.560,16	5.576,74	6.560,16	5.576,74
2.894,64	1.430,55	1.128,73	6.178,08	7.004,47	5.982,03	7.004,47	5.982,03
3.069,44	1.103,84	1.174,31	6.483,93	7.670,94	6.647,21	7.670,94	6.647,21
3.244,23	693,262	1.242,67	6.990,94	7.937,53	6.927,86	7.937,53	6.927,86
3.331,63	424,3557	1.311,04	7.560,14	8.337,41	7.368,11	8.337,41	7.368,11
3.375,33	256,4534	1.352,06	7.935,06	8.737,29	7.826,97	8.737,29	7.826,97
3.419,03	41,7734	1.413,59	8.552,20	9.337,11	8.552,20	9.337,11	8.552,20

Table 4. Well D3 Water Cut 30% VS Tubing size 1.885”, 2.093” and 2.664”.

Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (Psia)	Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (Psia)	Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (Psia)	Stock-tank Liquid at NA point (STB/d)	Pressure at NA point (Psia)
Inflow: WCUT	Inflow: WCUT	Outflow: IDIAMETER = 1.885 ins	Outflow: IDIAMETER = 1.885 ins	Outflow: IDIAMETER = 2.093 ins	Outflow: IDIAMETER = 2.093 ins	Outflow: IDIAMETER = 2.664 ins	Outflow: IDIAMETER = 2.664 ins
34,188	4.276,10	1,3953	2.855,45	9,2176	2.854,45	9,2176	2.854,45
105,9299	4.225,56	40,2258	2.901,93	260,5945	2.856,56	260,5945	2.856,56
177,6717	4.174,48	98,4717	2.957,80	637,6598	2.864,70	637,6598	2.864,70
321,1554	4.070,62	156,7175	3.002,24	1.014,73	2.918,46	1.014,73	2.918,46
464,6392	3.964,37	244,0863	3.060,28	1.580,32	3.031,82	1.580,32	3.031,82
608,1229	3.855,54	302,3321	3.097,27	2.069,11	3.155,06	2.069,11	3.155,06
783,7903	3.718,52	389,7009	3.229,63	2.362,38	3.241,41	2.362,38	3.241,41
959,4577	3.576,94	477,0697	3.450,94	2.802,29	3.391,21	2.802,29	3.391,21
1.135,13	3.430,31	529,491	3.613,50	3.535,47	3.690,38	3.535,47	3.690,38
1.310,79	3.278,04	608,1229	3.855,54	3.975,38	3.900,80	3.975,38	3.900,80
1.662,13	2.953,65	734,0642	4.297,76	4.635,24	4.263,97	4.635,24	4.263,97
2.013,46	2.595,86	809,629	4.598,67	5.368,42	4.737,13	5.368,42	4.737,13
2.364,80	2.191,55	922,9761	5.109,89	5.808,33	5.058,23	5.808,33	5.058,23
2.716,13	1.715,83	998,5409	5.500,41	6.468,19	5.600,73	6.468,19	5.600,73
2.891,80	1.435,42	1.111,89	6.172,49	6.908,10	6.004,02	6.908,10	6.004,02
3.067,47	1.107,88	1.157,23	6.476,86	7.567,96	6.663,74	7.567,96	6.663,74
3.243,13	696,2645	1.225,24	6.983,84	7.831,90	6.941,98	7.831,90	6.941,98
3.330,97	426,6682	1.293,24	7.552,42	8.227,82	7.378,07	8.227,82	7.378,07
3.374,88	258,3285	1.334,05	7.931,27	8.623,74	7.833,60	8.623,74	7.833,60
3.418,80	43,0735	1.395,26	8.552,20	9.217,61	8.552,21	9.217,61	8.552,21