УДК

РАЗРАБОТКА МЕТОДИКИ ПЕРЕСЧЕТА ЗАБОЙНОГО ДАВЛЕНИЯ С ГЛУБИНЫ МАНОМЕТРА ДО ОПОРНОЙ ГЛУБИНЫ

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THE DEVELOPMENT OF BOTTOMHOLE PRESSURE RECALCULATION METHOD FROM PRESSURE GAUGE TO THE REFERENCE DEPTH

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Аннотация. Основным и наиболее надежным способом оценки забойного давления является его непосредственное измерение с помощью манометра на необходимой глубине. Часто, в соответствии с условиями эксплуатации скважины, датчик не может быть размещен на необходимой глубине. В этом случае давление на опорной глубине пересчитывается из аналитических зависимостей на основе измеренного давления.

Ключевые слова: забойное давление, манометр, остановленная скважина, обводненность, продуктивная скважина.

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Annotation. The main and most reliable way to assess bottomhole pressure is to directly measure it with a pressure gauge at the required depth. Often, according to the operating conditions of the well, the gauge cannot be placed at the required depth. In this case, the pressure at the reference depth is recalculated from the analytical dependencies based on the measured pressure.

Keywords: bottomhole pressure, gauge setting depth, shut in well, water cut, production well.

INTRODUCTION

The dynamic of reservoir pressure change is the main parameter of oil and gas field development monitoring. And the main method of determining this parameter is a well test. In the process of well test the reservoir pressure (bottom hole pressure in shut in well) is measured at the gauge depth.

There are various methods for recalculating bottomhole pressure, but they all have their own features and shortcomings [1]. Taking into account all the features of multiphase flow in the wellbore requires either a complex analytical approach or specialized software.

In this work the simplified semi-empirical methodology is considered for bottomhole pressure recalculation from gauge to the reference depth in two options: for production wells and shut in wells with a watercut more than 1 percent. This work is based on actual well tests which were conducted in Iraq.

MATERIALS AND METHODS

For the production wells a feature of the calculation by this technique is the assumption that the density of the mixture in the wellbore does not change in depth. The density of the mixture depends on the water cut and the water source (Fig. 1).

In a shut well, fluid redistribution occurs along the wellbore. For the correct determination of the phase separation depth at each well test, the inflow profile should be determined with a phase separation (Figure 2).

Based on the proposed method, the bottomhole pressures (BHP) were recalculated to a reference depth. For recalculation, all well tests in wells with a water cut of more than 1 % were selected. The results are presented (Figure 3, Figure 4).

As can be seen from Figure 3, the maximum bottomhole pressure difference for production wells, recalculated by different methods (12.3 bar), corresponds to the maximum water cut value. With a decrease in water cut, the difference value decreases. The dependence on water cut is non-linear, since the pressure gauge setting depth and the density of water from different sources, influences the value of the recalculated BHP. With a water cut of less than 7 %, the difference between recalculated BHP is less than 1 bar.

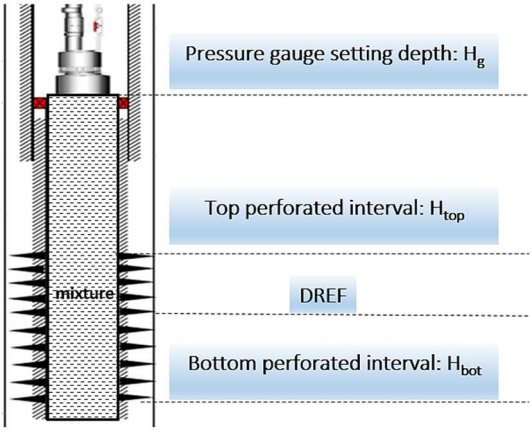

Figure 1 – The recalculation of BHP in the production well

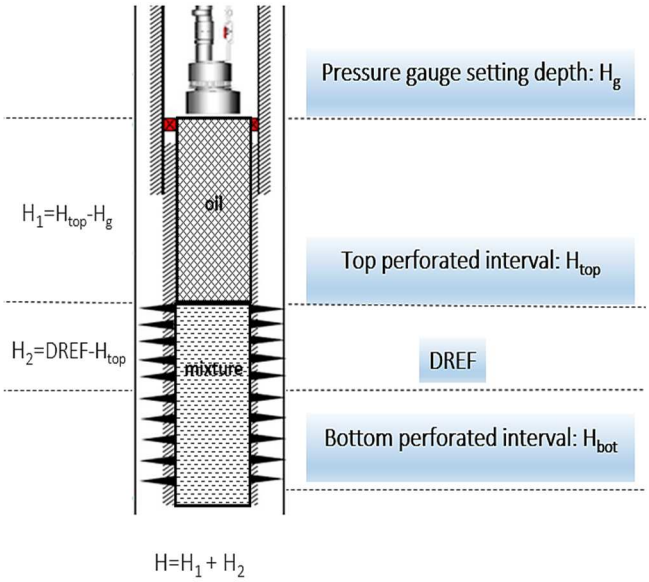

Figure 2 – The recalculatiuon of BHP in the shut in well

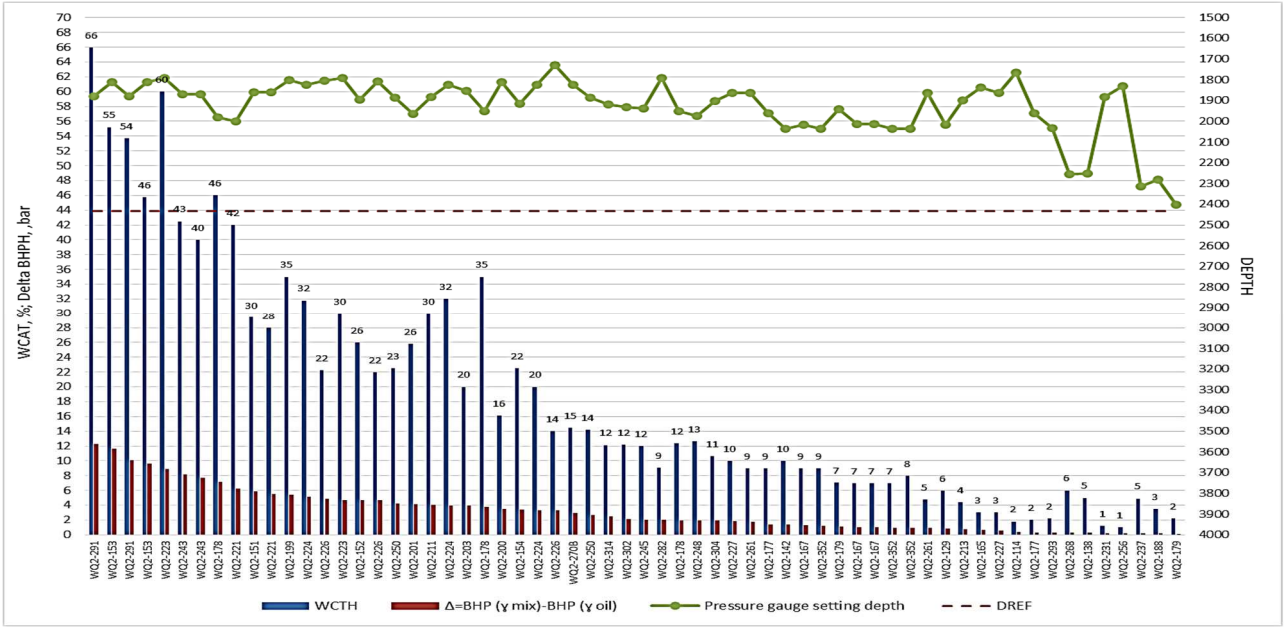

Figure 3 – The difference between recalculated BHP in working wells using different methods

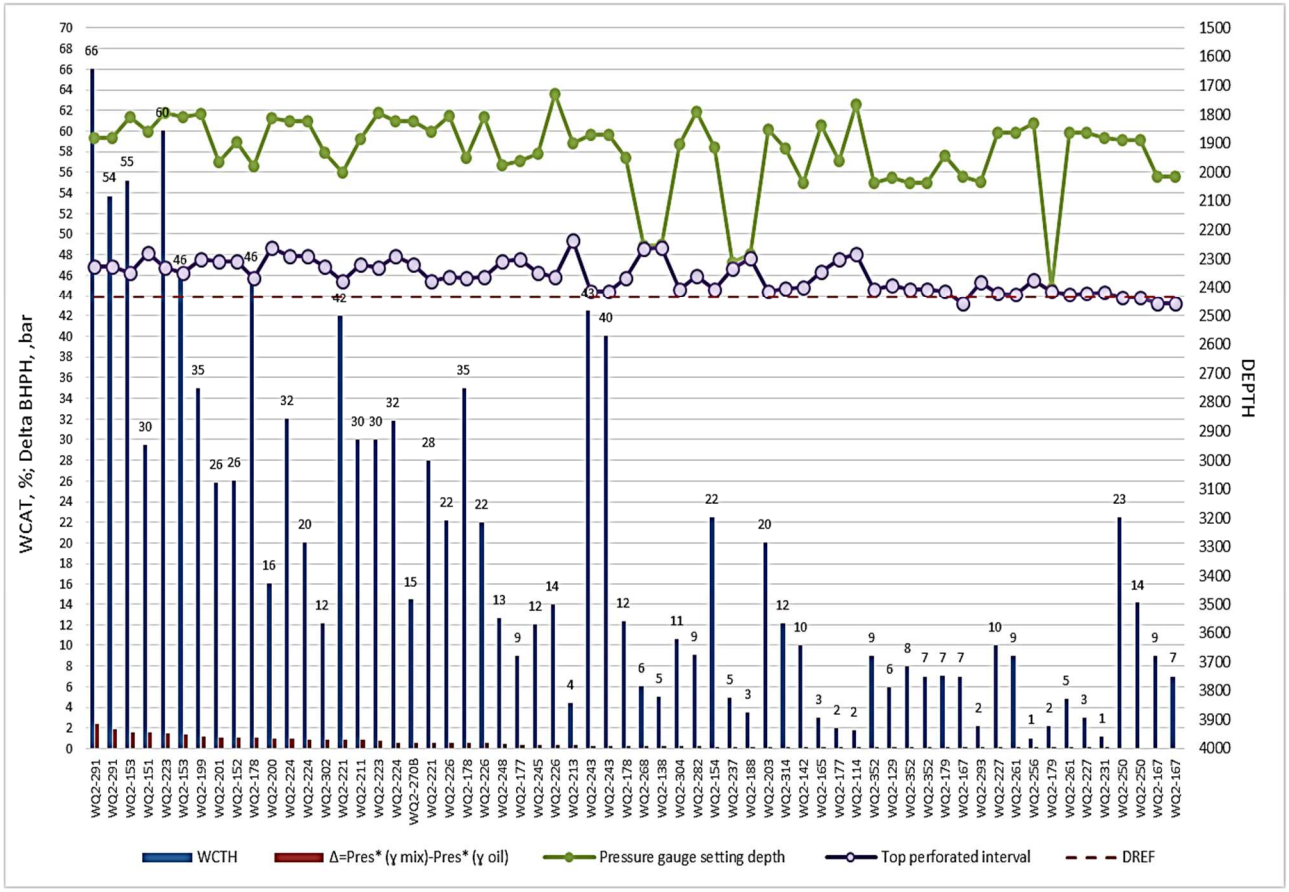

Figure 4 – The difference between recalculated BHP in shut wells using different methods

According to Figure 4, the maximum difference between recalculated BHP in shut wells is 2 bar. In this case, the difference between recalculated BHP in shut wells depends on from both the water cut and top perforated interval. The difference between the pressures recalculated by different methods decreases with similar values of water cut in the case when the top perforated interval is located closer to the reference depth.

As can be seen (Figure 5), for wells with a difference between the reference depth and the pressure gauge setting depth more than 400 m, the difference between recalculated BHP using different methods is a function of the water cut [2].

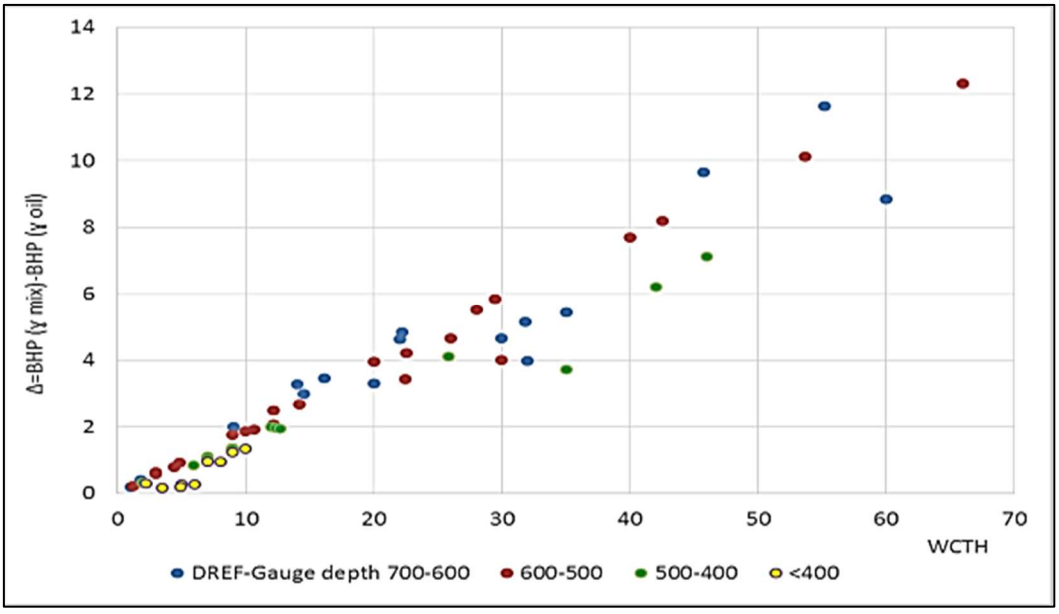

Figure 5 – Dependence of the difference between recalculated BHP in production wells on water cut

RESULTS

The correctness of the proposed method can be checked by comparing the recalculated BHP (bottomhole pressure) with the actual measurements at a depth close to the reference. Simultaneous measurements of pressure at a gauge setting depth and at depth below top perforated intervals were carried out in wells X, Y, and Z.

The results of the comparison of recalculate BHP for bottomhole depth for oil density and for mixture density are presented (Table 1).

Table 1 – The results of the bottomhole pressure recalculation in the production wells

Well	Actual BHP, bara	Recalculated BHP (oil density), bara	ΔBHP (oil density), bara	Recalculated BHP (mixture density), bara	ΔBHP (mix density), bara
X	153.7	149.6	4.1	151.3	2.4
Y	154.6	154.3	0.4	154.4	0.2
Z	156.3	154.2	2.1	155.0	1.3

CONCLUSION

1. The value of recalculated BHP obtained using the proposed method by the density of the mixture is well correlated with well tests in the wells X, Y, Z.

2. The difference between recalculated bottomhole pressure in shut wells depends on from both the water cut and top perforated interval.

3. For further verification of the proposed method, it is necessary to conduct well tests with simultaneous measurement at the pressure gauge setting depth and at the bottomhole. Such well tests are possible at wells with decentralized (lateral) location of electrical submersible. It is recommended to conduct well tests on all wells that meet this requirement.

Литература / References

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