Discussion on Reasonable Flow Pressure in Class I Block of A Oilfield

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Abstract. Reasonable flow pressure is the premise to ensure the maximum production capacity of oil wells. After years of development and adjustment, the adaptability of pump depth and flow pressure needs to be further studied, so as to formulate a reasonable flow pressure under the current development situation. This paper studies the relationship between flow pressure and production in a class of blocks by using theoretical research and data probability distribution method, determines the current reasonable flow pressure system in line with the actual situation, and proposes the test potential wells for adjustment

Key words: Reasonable flow pressure; Probability distribution; Reasonable pump depth.

1. Questions raised

A oilfield belongs to low-ultra-low permeability oilfield. After years of development, the productivity level of the old wells in the oilfield has gradually declined. At present, the reasonable flow pressure at the development stage needs further study. It is necessary to further carry out the research on the reasonable flow pressure at the medium-high water cut stage, gradually carry out the matching and adjustment of the reasonable flow pressure of the oil well, and give full play to the maximum production capacity of the oil well

2. Theoretical method for determining reasonable flow pressure

Well flow pressure is the back pressure of the wellbore fluid column, and its value directly affects the percolation capacity and productivity of the reservoir, pump efficiency and system efficiency. In the early stage of oilfield development, the determination of reasonable flow pressure was deeply discussed, and the determination formula of reasonable flow pressure was given[1].

2.1 Determine the minimum allowable flow pressure of the well

2.1.1 Calculation of relative flow capacity of liquid and oil phases

Due to low reservoir permeability, poor water injection efficiency, low productivity, and well flow pressure lower than saturation pressure, if crude oil is degassed, the flow capacity of oil phase will change. The bottomhole fluid flows as oil, gas and water three-phase, and the relative flow capacity of the oil phase can be expressed as：

$$K_o = \frac{V_o}{V_m} \quad (1)$$

Where $V_m=V_o+V_g+V_w$， When one ton of surface oil is produced, the volume flow of oil, gas and water under bottom hole conditions can be calculated by the following formula：

$$V_0 = B(P_b) - \beta(P_b - P_{wf}) \quad (2)$$

$$V_g = 0.1033 \frac{2T}{293} \frac{a}{D_o p_{wf}} (p_b - p_{wf}) \quad (3)$$

$$V_w = \frac{f_w}{1 - f_w} \quad (4)$$

Where: $B(p_b)$—Volume conversion coefficient of crude oil under saturation pressure， m^3；

β--Change rate of crude oil volume conversion coefficient， m^3/Mpa；

P_b—Saturation pressure， MPa；

P_{wf}—Flow pressure， MPa；

a—Natural gas dissolution coefficient， $m^3/(m^3.Mpa)$；

T—Absolute temperature of oil reservoir， K；

Z—Natural gas compression coefficient；

D_o—Surface crude oil density， t/ m^3；

f_w—Water cut of oil well， decimal.

Substitute (2), (3) and (4) into formula (1)， Then the relative flow capacity of oil phase in the reservoir near the bottom of the well can be obtained：

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$$K_o = \frac{1-f_w}{1+(1-f_w)R} \quad (5)$$

Where: R - gas-oil ratio at the outlet of oil layer near the bottom of the well $R = \frac{V_g}{V_o} = 0.1033 \frac{2T}{293}\frac{a}{D_o p_{wf}}(p_b - p_{wf})/\left[B(pb) - 3(p_b - p_{wf})\right]$, m^3/t.

If the bottom hole pressure is greater than the saturation pressure, then R=0. At the same time, the relative flow capacity of the liquid phase can be obtained:

$$K_L = \frac{1}{1+(1-f_w)R} \quad (6)$$

It can be seen from the analysis of (5) and (6):

① When the crude oil near the bottom of the well is degassed, the relative flow ability of the oil phase will decrease, that is, K_o<1. And with the increase of gas-oil ratio, the decline rate of relative flow ability of oil phase increases. At the same time, the relative flow capacity of the liquid phase also decreased;

② With the increase of water cut in oil wells, the relative flow ability of oil phase decreases and the relative flow ability of liquid phase increases.

2.1.2 Establishment of inflow performance equation of oil well

According to the above analysis, when the bottom hole flow pressure is lower than the saturation pressure, the inflow performance equation of the oil well can be obtained by modifying the initial flow capacity of the oil well with (5) and (6):

For oil phase:

$$q_0 = \frac{J_0(1-f_w)}{1+(1-f_w)R}(P_R - P_{wf}) \quad (7)$$

For liquid phase:

$$q_L = \frac{J_0}{1+(1+f_w)R}(P_R - P_{wf}) \quad (8)$$

Where: J_0—Production index, t/d·MPa;

R—Gas-oil ratio at the outlet of oil layer near the bottom of the well, m^3/t;

P_R—Formation pressure, MPa.

It can be seen from the two formulas (7) (8) that when the flow pressure is lower than the saturation pressure, when it is greater than a certain value, the liquid production will increase with the decrease of the flow pressure; When it is less than this value, the liquid production will decrease with the decrease of flow pressure, which is the minimum allowable flow pressure of the oil well.

2.1.3 Calculation of minimum allowable flow pressure of oil well

Figure 1 is the dimensionless inflow performance curve of oil wells with different water cut based on the calculation results of (7) (8).

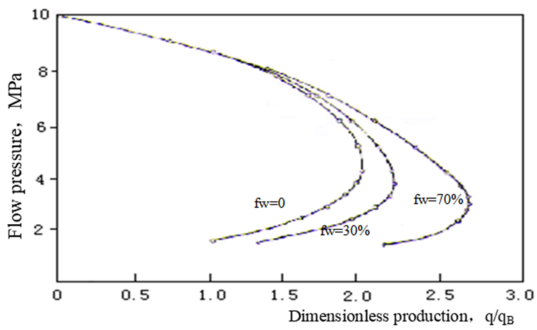

Fig. 1 Inflow performance curve of oil wells with different water cut

The curve can be divided into two parts: straight section and curve section. Within the range of straight section, the relative oil production index is stable and the flow conforms to Darcy's law.

There are two characteristic points in the curve part: the first is the starting point of the straight line starting to bend. The flow pressure at this point is equal to the saturation pressure. After the flow pressure is lower than this point, the oil production index decreases and the production growth rate slows down; The second is the maximum production point. The pressure corresponding to this point can be called the minimum allowable flow pressure of the oil well. After the flow pressure is lower than this point, the output begins to decrease.

The main reason for this situation is that after the flow pressure drop reaches a certain level, there is a three-phase flow of oil, gas and water near the bottom of the well, resulting in a sharp decline in the flow capacity of the oil phase. The contribution of the production pressure difference to the production has been less than the impact of the decline of the production index on the production.

Calculate the first derivative of equation (8) and make it zero to obtain the lowest allowable flow pressure equation:

$$Lp^4_{wfmin} + Mp^3_{wfmin} + Np^2_{wfmin} + Qp_{wfmin} + W = 0 \quad (9)$$

Where: $L=\beta^2 \cdot j_L$

$M=2(a-cf_o)\beta \cdot j_L$

$N=(3bf_o+ap_R)\beta \cdot j_L + (a-cf_o)(a-\beta p_R) j_L$

$Q=2bf_o j_L(a-\beta p_R)$

$W=-bf_o j_L a p_R$

Among the above $c = \frac{a}{D_o}\bar{t}$ $b = \frac{1}{D_o} a p_b \bar{t}$: a= B(pb)-βpb

because $\beta(p_b-p_{wf}) \ll B(p_b)$, so the second item at the right end of formula (2) can be omitted, so that formula (9) can be simplified into the following form:

$$(1-n)p^2_{wfmin} + 2np_b p_{wfmin} - np_b \cdot p_R = 0 \quad (10)$$

The formula for calculating the minimum allowable flow pressure of oil well is obtained by solving the above formula: $\bar{t} = 0.1033\frac{ZT}{293}$

$$P_{wf\ \min} = \frac{1}{1-n}\left[\sqrt{n^2 P_b^{\ 2} + (1-n).nP_b.P_R} - nP_b\right] \quad (11)$$

among: $$n = \frac{\alpha \bar{t}}{B_0}(1-f_w)$$

2.2 Determine the suction inlet pressure of oil extraction pump

Based on the analysis of the working conditions of the pumping unit itself, the minimum allowable flow pressure limit of the oil well is usually described by the bottomhole degassing amount. With the rise of water cut in oil wells, water cut has also become an important factor that cannot be ignored in calculating the minimum allowable flow pressure limit. It can be seen from this that the pressure formula at the suction inlet of the oil well pump is:

$$P_{\lambda} = \frac{M\left(1-f_w\right)}{f_w + B_o\left(1-f_w\right)} \quad (12)$$

$$M = \left(\frac{1}{G}-1\right)\times 3.53\times 10^4 TZ\left(S_{gi}-S_g\right)$$

Where: P_{λ}—Pump suction pressure, MPa;
G—Volume percentage of gas and liquid, decimal;
Sgi—Original dissolved gas-oil ratio, m3/t;
Sg—Dissolved gas-oil ratio of suction pressure, m3/t;

2.3 Determine reasonable flow pressure

For the reasonable flow pressure of the pumping well, it is necessary to ensure the condition of the minimum allowable flow pressure of the reservoir, and to ensure that the pump can work under the optimal suction pressure. Since the pump suction pressure converted to the flow pressure in the middle of the reservoir is less than the minimum allowable flow pressure, the pump suction pressure can be used as the reasonable flow pressure. The calculation formula shall be expressed as follows:

$$P_R = \frac{M\left(1-f_w\right)}{f_w + B_o\left(1-f_w\right)}$$

The calculated average reasonable flow pressure of oilfield A is 2.51MPa (see Table 1 for details).

Table 1-A Calculation table of reasonable flow pressure and reasonable submergence of oil field

classify	Middle depth (m)	Average pump depth (m)	Average pump efficiency (%)	Dynamic fluid level (m)	Submergence degree (m)	Actual flow pressure (MPa)	Reasonable flow pressure (MPa)	Reasonable submergence (m)	Difference between theory and practice: Flow pressure (MPa)	Difference between theory and practice: Submergence degree (m)
Strata 1	494.7	491.1	19.98	458.0	33.1	1.00	1.52	119.1	0.50	86.0
main	1045.6	1039.7	21.3	966.1	73.6	1.31	2.34	205.1	1.00	131.5
S 1-255	1004.9	984.6	17.34	912.2	72.3	1.20	2.72	221.6	1.50	149.3
Wing	1082.2	1032.2	16.25	970.0	62.2	1.32	2.63	190.8	1.30	128.6
Strata 3	1248.9	1156.5	14.19	1068.8	87.6	1.03	2.55	152.9	1.50	65.3
average	1051.5	1003.1	18.31	942.2	60.9	1.30	2.51	169.4	1.20	108.5

3. Study on the relationship between oil production level and flow pressure

Due to the different geological characteristics and development characteristics of various blocks in Oilfield A, whether the actual production level of the oil well is compatible with the reasonable flow pressure system established at the initial stage needs to be further discussed. The following work will be carried out to determine the reasonable flow pressure system of the block by means of data statistics and probability distribution, and adjust the flow pressure by adjusting the pump depth and pumping parameters.

3.1 A-block

Considering the current poor oil production capacity of oil wells, the vast majority of oil wells are in the state of insufficient liquid supply, the distance between the dynamic liquid level and the pump suction is relatively close, or has reached the pump suction, and the criterion of the dynamic liquid level data, the distance between the pump depth and the middle depth of the oil layer is used to calculate the bottom hole flow pressure, and the scatter point of the relationship between the initial production and flow pressure, as well as the scatter point of the relationship between the current production and flow pressure, is established.

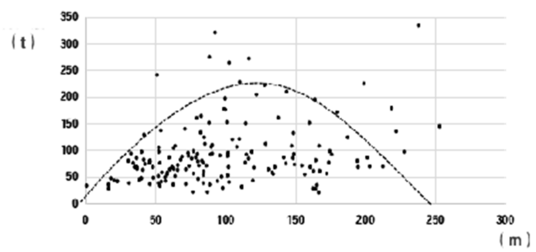

Figure 3-Scatter diagram of relationship between initial liquid production and pump depth - oil layer distance in Block A

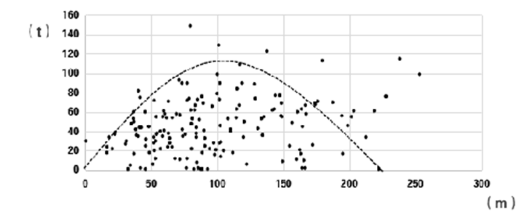

Figure 4-Scatter diagram of relationship between initial oil production and pump depth - oil layer distance in Block A

From the relationship between the initial liquid production of Block A and the distance between the pump depth and the oil layer, when the distance is less than 100m, the liquid production is significantly reduced, which means that too small flow pressure will reduce the liquid production capacity of the oil well, and when the distance is more than 150m, the liquid production has an obvious downward trend, which means that too large flow pressure will cause the oil production capacity of the oil layer to be suppressed. From the perspective of scatter probability, when the distance is 100-150m, the liquid production capacity of the oil well is the largest.

From the perspective of oil production capacity, the oil production capacity is the largest when the distance is 100m-120m. From a comprehensive point of view, when the distance is 100m-120m, the oil well is considered to have the largest production capacity.

At this time, the flow pressure is the pressure generated by the distance between the length of the liquid column and the submergence degree of the liquid column in the middle depth of the oil layer. Generally, the submergence degree is about 40m, the depth of the liquid column is 140m-160m, and the initial water content is calculated as 20%, and the flow pressure is about 1.4Mpa.

Table 2 - Relationship between liquid column depth and flow pressure

containing water(%)	20	20	20	20	20	20	20	20
Liquid column height(m)	100	110	120	130	140	150	160	170
pressure(Mpa)	0.88	0.96	1.05	1.14	1.23	1.31	1.40	1.49

At the current development stage, the comprehensive water content of Class I block is about 65%. Taking Block A as an example, by December 2022, the comprehensive water content of the block will be 67%. The reasonable pumping depth is obtained when the maximum production capacity is obtained by plotting the scattered points of liquid production, oil production and pump depth - medium depth.

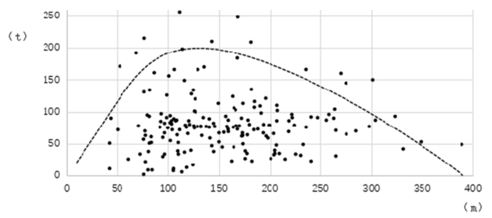

Figure 5-Scatter diagram of the relationship between current liquid production and pump depth - oil layer distance in Block A

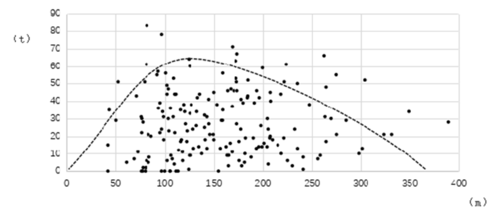

Figure 6-Scatter diagram of the relationship between current oil production and pump depth - oil layer distance in Block A

From the current production capacity and distance of Block A, the maximum production capacity is reasonable depth, which is about 10m smaller than the initial distance, and the reasonable pump depth is 90m-110m. Due to years of development, the formation pressure has decreased, the production pressure differential has decreased, and the oil production capacity of the reservoir has decreased. To maintain a high production capacity, the flow pressure also needs to be adjusted downward to maintain a high production pressure differential.

Table 3 - Relationship between liquid column depth and flow pressure

containing water(%)	67	67	67	67	67	67	67	67
Liquid column height(m)	100	110	120	130	140	150	160	170
pressure(Mpa)	0.94	1.03	1.12	1.22	1.31	1.41	1.50	1.59

According to the submergence of 40m, the liquid column height is 130m-150m, and the reasonable flow pressure is 1.22Mpa-1.41Mpa.

3.2 B-block

According to the current production level of Block B and the scattered points of the relationship between the pump depth and the middle depth of the reservoir, the current reasonable pump depth parameters are obtained.

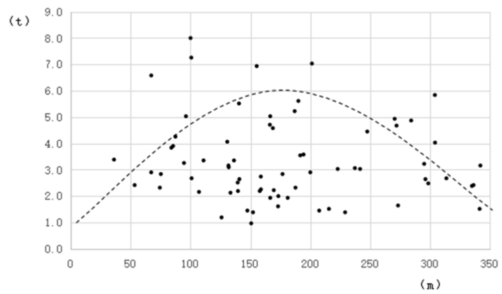

Figure 7-Scatter diagram of the relationship between current liquid production and pump depth - oil layer distance in Block B

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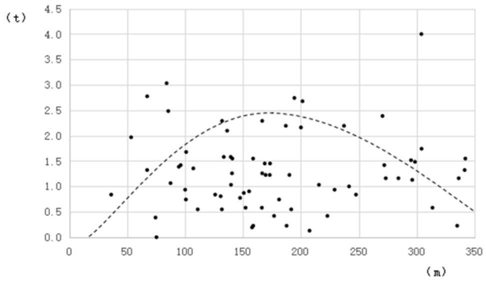

Figure 8-Scatter diagram of the relationship between current oil production and pump depth - oil layer distance in Block B

According to the scattered point relationship, when the distance between the middle depth of the reservoir and the pump depth is 150-200m, the production level of the oil well is the highest.

In Block B, the current comprehensive water content is 61%, and the reasonable flow pressure is estimated according to the submergence degree of 40m.

Table 4 - Relationship between liquid column depth and flow pressure

containing water(%)	61	61	61	61	61	61	61	61
Liquid column height(m)	170	180	190	200	210	220	230	240
pressure(Mpa)	1.58	1.67	1.77	1.86	1.95	2.04	2.14	2.23

The reasonable flow pressure level of Block B is 1.77Mpa - 2.23Mpa, with an average of 2.0Mpa.

3.3 C-block

According to the current production level of Block C and the scattered points of the relationship between the pump depth and the middle depth of the reservoir, the current reasonable pump depth parameters are obtained.

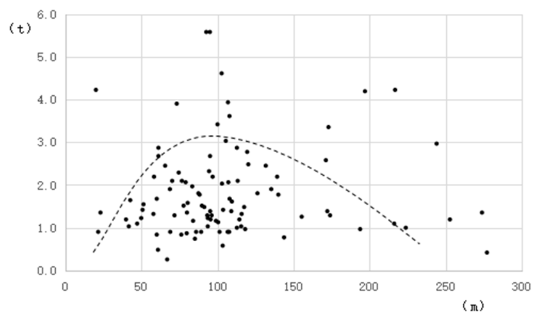

Figure 9-Scatter diagram of the relationship between current liquid production and pump depth - oil layer distance in Block C

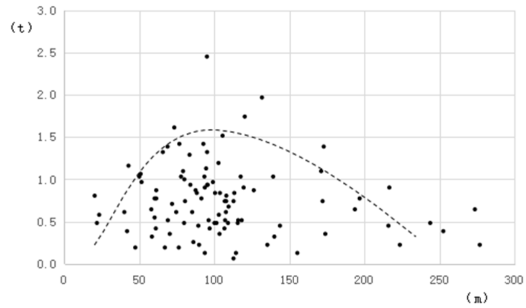

Figure 10-Scatter diagram of the relationship between current oil production and pump depth - oil layer distance in Block C

According to the scattered point relationship, when the distance between the middle depth of the reservoir and the pump depth is around 100m, the production level of the oil well is the highest.

In Block C, the current comprehensive water content is 59%, and the reasonable flow pressure is estimated according to the submergence degree of 40m.

Table 5- Relationship between liquid column depth and flow pressure

containing water(%)	59	59	59	59	59	59	59	59
Liquid column height(m)	100	110	120	130	140	150	160	170
pressure(Mpa)	0.93	1.02	1.11	1.20	1.30	1.39	1.48	1.57

The reasonable flow pressure level of Block C is 1.3Mpa.

3.4 D-block

According to the current production level of Block D and the scattered points of the relationship between the pump depth and the middle depth of the reservoir, the current reasonable pump depth parameters are obtained.

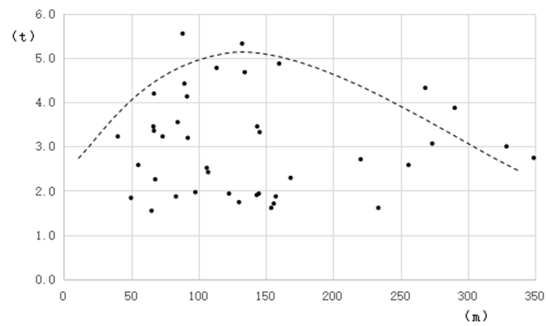

Figure 9-Scatter diagram of the relationship between current fluid production and pump depth - oil layer distance in Block D

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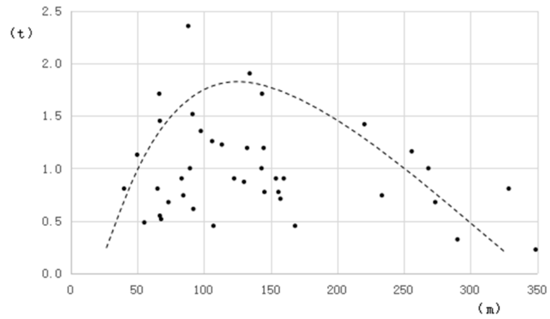

Fig. 10-Scatter diagram of the relationship between current oil production and pump depth - oil layer distance in Block D

According to the scattered point relationship, when the distance between the middle depth of the reservoir and the pump depth is around 120m, the production level of the oil well is the highest.

In Block D, the current comprehensive water content is 67%, and the reasonable flow pressure is estimated according to the submergence degree of 40m.

Table 6- Relationship between liquid column depth and flow pressure

containing water(%)	67	67	67	67	67	67	67	67
Liquid column height(m)	110	120	130	140	150	160	170	180
pressure(Mpa)	1.03	1.12	1.22	1.31	1.41	1.50	1.59	1.69

The reasonable flow pressure level of Block D is 1.5Mpa.

3.5 Total of Class I blocks

According to the current production level of Class I block and the scattered points of the relationship between the pump depth and the middle depth of the reservoir, the current reasonable pump depth parameters are obtained.

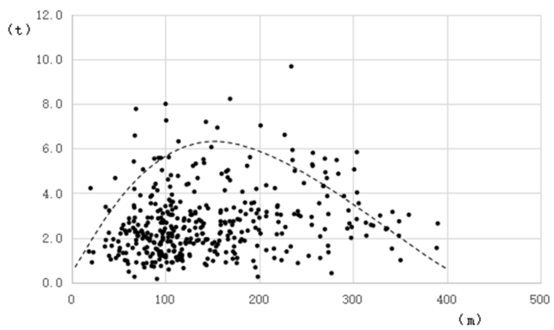

Figure 11 - Scatter diagram of the relationship between current liquid production and pump depth - oil layer distance in Class I block

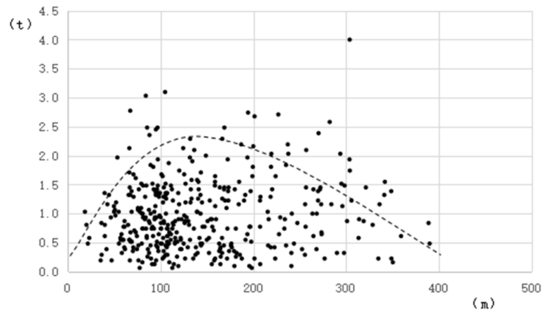

Figure 12 - Scatter diagram of the relationship between current oil production and pump depth - reservoir distance in Class I block

According to the scattered point relationship, when the distance between the middle depth of the reservoir and the pump depth is around 130m, the production level of the oil well is the highest.

In Class I block, the current comprehensive water content is 63%, and the reasonable flow pressure is estimated according to the submergence degree of 40m.

Table 7- Relationship between liquid column depth and flow pressure

containing water(%)	63	63	63	63	63	63	63	63	63
Liquid column height(m)	120	130	140	150	160	170	180	190	200
pressure(Mpa)	1.12	1.21	1.30	1.40	1.49	1.58	1.68	1.77	1.86

The reasonable flow pressure level of Class I block is 1.58Mpa.

4. Current situation of flow pressure in Class I block of oilfield

According to the above research results, there are 395 oil wells in Class I block, with an average flow pressure of 1.81Mpa, which is slightly higher than the reasonable range of flow pressure. From the statistical results of flow pressure classification, the overall adjustment potential is large.

Table 8-A Classification Statistics of Flow Pressure Status in Class I Block of Oilfield

Flow pressure classification	Number of wells	Flow pressure (Mpa)	Daily liquid (t)	Daily oil production (t)	liquid production (%)	oil production (%)	Proportion of wells (%)
(0.0,1.0)	35	0.82	58	27	5.5	7.0	8.9
[1.0, 1.4)	105	1.21	224	107	21.2	27.7	26.6
[1.4, 1.8)	93	1.57	269	85	25.5	22.1	23.5
[1.8, 2.5)	91	2.10	264	90	25.1	23.4	23.0
[2.5, 3.0)	37	2.75	134	41	12.7	10.6	9.4
[3.0,10.0)	34	3.60	104	35	9.9	9.2	8.6
	395	1.81	1053	386	-	-	-

There are 93 wells in the reasonable range, accounting for 23.5% of the wells and 25.5% of the liquid production.

5. Optimization and effect prediction of potential wells for next adjustment test

5.1 Pump hanger deepening potential

Taking Block A as the test area, through screening the medium and low water cut oil wells with too shallow pumping depth, 17 wells with deepening potential are initially selected, and the deepening pumping test will be carried out next, and the flow pressure will be adjusted to 1.3Mpa - 1.4Mpa.

Table 9-Potential wells for flow pressure adjustment in Block A

Potential well	liquid (t)	Oil (t)	fw (%)	Pump depth (m)	Medium depth of oil layer (m)	Dynamic fluid level (m)	Current flow pressure (Mpa)	Adjust pump depth (m)	Deepen the distance(m)	Adjusted flow pressure (Mpa)
A01	1.1	0.6	44.1	802.96	1067.8	747.7	2.90	960	157.04	1.34
A02	1.1	0.9	20.6	720.56	925	679.3	2.15	810	89.44	1.36
A03	1.1	0.4	62.9	801.64	1011.3	755.0	2.39	900	98.36	1.41
A04	1.5	0.7	54.3	601.19	1116.5	565.4	5.07	1000	398.81	1.44
A05	1.5	0.8	45.8	562.75	951.7	517.0	3.95	840	277.25	1.38
A06	1.6	0.6	60.8	833.16	1040	784.0	2.38	933	99.84	1.37
A07	1.7	0.8	52.8	740.22	972.8	700.7	2.50	870	129.78	1.31
A08	1.7	1.1	38.9	900.65	1105.9	862.6	2.19	1000	99.35	1.31
A09	2.0	1.2	38.7	638.53	1134.2	597.1	4.83	1020	381.47	1.39
A10	2.1	1.4	31.3	752.07	1016.9	706.3	2.76	910	157.93	1.31
A11	2.1	0.9	56.9	840.63	1154.7	792.5	3.35	1050	209.37	1.34
A12	2.1	1.4	33.8	600.21	948.9	558.8	3.49	840	239.79	1.33
A13	2.2	1.3	40.3	702.47	921.1	654.0	2.41	810	107.53	1.36
A14	2.4	1.4	41.9	859.88	1129.7	813.8	2.86	1020	160.12	1.35
A15	2.5	1.5	43.0	762.05	1083.4	720.0	3.29	970	207.95	1.39
A16	2.6	0.9	66.3	797.44	1116.4	749.4	3.43	1010	212.56	1.37
A17	2.9	1.3	54.4	700.87	985.8	658.2	3.02	880	179.13	1.34
Av	1.9	1.0	46.8	742.2	1040.1	697.8	3.12	930.8	188.6	1.36

Effect prediction: in Block A, the average formation pressure is 8.1Mpa, the average flow pressure of 17 potential wells is 3.12Mpa, the adjusted average flow pressure is 1.36Mpa, the production pressure difference rises from 5.0Mpa to 6.7Mpa, and the average daily oil production is 1.0t. Under the condition of unchanged oil production index, the average daily oil production of a single well can increase by 0.36t, and the average daily oil production of 17 test wells is expected to increase by 6.1t. According to statistics, there are 129 adjustment potential wells (flow pressure greater than 2Mpa) in Class I block. The current average flow pressure is 2.73Mpa, and the adjusted flow pressure is expected to be 1.6Mpa. At present, the formation pressure is 8.0Mpa, and the production pressure difference is increased from 5.27Mpa to 6.4Mpa. At present, the average daily oil production is 1.1t. With the oil production index unchanged, the average daily oil production of a single well is expected to increase by 0.24t, and the cumulative daily oil production level is expected to increase by 30.4t.

Table 10 - Potential well for flow pressure adjustment in Class I block

Number of potential wells	Liquid (t)	Oil (t)	Fw (%)	Pump depth (m)	Medium depth of oil layer (m)	Dynamic fluid level (m)	Current flow pressure (Mpa)	Adjusted flow pressure (Mpa)	Deepen the distance (m)
129	3.2	1.1	66.8	788	1027	734	2.73	1.60	121

5.2 Pump hanging lifting potential

Take Block C as the potential area for lifting and pumping, select 12 potential wells, and adjust the flow pressure to around 1.3Mpa.

Table 11-Potential wells for flow pressure adjustment in Block C

Potential well	liquid (t)	Oil (t)	fw (%)	Pump depth (m)	Medium depth of oil layer (m)	Dynamic fluid level (m)	Current flow pressure (Mpa)	Adjust pump depth (m)	Lifting distance(m)	Adjusted flow pressure (Mpa)
C01	1.4	1.0	28	957.9	1037.8	926.4	0.99	912.9	45.0	1.46
C02	1.5	1.0	31	945.9	1023.6	907.9	1.03	900.9	45.0	1.45
C03	1.2	1.0	17	1009.5	1059.4	972.5	0.76	949.5	60.0	1.31
C04	0.9	0.5	42	936.3	1005.3	901.3	0.94	891.3	45.0	1.39
C05	1.2	0.9	20	946.2	1030.2	909.5	1.06	901.2	45.0	1.48
C06	1.5	1.0	38	999.0	1050.4	958.8	0.82	939.0	60.0	1.36
C07	0.3	0.2	28	930.4	997.3	902.2	0.84	880.4	50.0	1.39
C08	0.7	0.6	16	927.4	1012.6	893.5	1.04	897.4	30.0	1.35
C09	0.5	0.4	11	936.5	997.4	902.7	0.82	886.5	50.0	1.30
C10	1.3	1.0	20	1008.7	1102.0	970.2	1.15	978.7	30.0	1.43
C11	0.9	0.5	44	909.9	989.7	876.2	1.03	869.9	40.0	1.45
C12	0.8	0.5	35	950.0	1010.1	914.2	0.86	900.0	50.0	1.34
Av	1.0	0.7	27.5	954.8	1026.3	919.6	0.94	909.0	45.8	1.39

Effect prediction: the average daily oil production of potential wells is 0.7t, the flow pressure is increased from 0.94Mpa to 1.39Mpa, and the distance from the middle depth of the reservoir to the pump is increased from 72m to 117m. From the perspective of scatter relationship, the daily oil production is expected to increase by 12%, and the total daily oil production is increased by 1.1t.

6. Sum up

With the adjustment of oilfield development, the flow pressure system established in the early stage of oilfield development gradually cannot adapt to the current production capacity of the reservoir.

First, with the extension of the development period, the formation pressure decreases year by year, and the production pressure difference decreases gradually, and the oil production capacity of the reservoir is not fully developed.

The second is that the depth of the oil well pump is not adjusted in time, and the pump depth is too shallow, resulting in high oil level and high flow pressure, which limits the production capacity of the reservoir; When the pump depth is too deep and the liquid supply capacity of the oil layer is insufficient, the flow pressure drops rapidly, resulting in serious degassing of the near-well oil layer, and the rapid decline of the crude oil flow capacity, resulting in the reduction of the production capacity. Therefore, further reasonable pump depth field tests need to be carried out.

The third is to use the probability distribution analysis of the field data to draw a conclusion that the reasonable level of flow pressure is more suitable for the actual production. The field test can be further carried out to observe the effect of the test well.

Fractures are developed in Class I block of A oilfield, and the adaptability of theoretical flow pressure level needs further study. Based on data statistics and probability distribution, this paper determines the overall reasonable flow pressure level of each small block and a class of blocks. According to the adjustment effect of potential well test, the next promotion work will be carried out step by step. It is the most economical, direct and effective way to improve the production capacity of oil wells by properly adjusting the pump depth and production parameters and matching the reasonable working system. The research and test results can be replicated and popularized in the whole oilfield.

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