

## CALCULATION OF FLUID INFLOW TO A MULTILATERAL HORIZONTAL WELL.

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### **Annotation**

The article deals with the analytical calculation of the inflow to the bottomhole of the MHW. The purpose of this work is to indicate a comparative analysis of the productivity of horizontal and multilateral horizontal wells, all other things being equal.

The comparison showed the advantage of MHW compared to horizontal wells, namely, by comparing the results obtained in accordance with the Borisov-Pilatovsky-Tabakov method, it was revealed that the increase in the value of flow rates is almost 40%, which indicates the effectiveness of the use of MHW.

**Key words:** steady flow, flow rate, horizontal well, multilateral horizontal well.

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## РАСЧЁТ ПРИТОКА ФЛЮИДА К МНОГОСТВОЛЬНОЙ ГОРИЗОНТАЛЬНОЙ СКВАЖИНЕ.

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### **Аннотация**

В статье рассматривается аналитический расчет притока к забою МГС. Целью данной работы можно указать сравнительный анализ производительности горизонтальных и многоствольных горизонтальных скважин при прочих равных условиях.

Сравнение показало преимущество МГС по сравнению с горизонтальными скважинами, а именно посредством сравнения полученных в соответствии с методикой Борисова-Пилатовского-Табакова результатов

выявлено, что прирост в значении дебитов составляет почти 40%, что свидетельствует об эффективности применения МГС.

**Ключевые слова:** установившийся приток жидкости, дебит, горизонтальная скважина, многоствольная горизонтальная скважина.

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### **Calculation of fluid inflow to a multilateral horizontal well.**

The practice of operating MHL (multilateral horizontal wells) includes a wide range of methods for mathematical modeling of their productivity, which include such indicators as the inflow of formation fluid to the bottom of the wells, the shape of the area covered by the drainage process. Among others, it should be noted such calculation techniques as the method of Yu.P. Borisov, V.P. Pilatovsky, V.P. Tabakova, V.G. Griguletsky, V.P. Merkulov and B.A. Nikitin.

The earliest dependence that describes the inflow to the MHS is the Borisov-Pilatovsky-Tabakov technique [1-4], represented by the following equation.

$$Q = \frac{2\pi kh(P_k - P)}{\mu \left[ \ln R_k - \ln \frac{l \sin \alpha}{x(n)} + \frac{h}{\ln} \ln \frac{h \sin \alpha}{2\pi r_c} \right]} \quad (1)$$

где

$k$  - permeability index,  $\text{mkm}^2$ ;

$h$  - the value of the effective thickness of the reservoir, m;

$\mu$  - viscosity index of the fluid saturating the reservoir,  $\text{Pa}\cdot\text{sec}$ ;

$l$  - length of the horizontal section, m;

$P_k$  - value of contour pressure, Pa;

$P$  - bottom hole pressure, Pa;

$R_k$  - the value of the contour radius, m;

$\alpha$  - an indicator of the angle of deviation of the trunk from the vertical direction,

$n$  - the number of trunks;

$r_c$  - indicator of the radius of the horizontal section.

According to the data given in Table 1, the productivity indicators of horizontal and multilateral wells are compared in accordance with the condition for the formation of the studied field.

Table 1  
Initial calculated data

Well Parameter/No.	1
Seam number	Yak 3-7
Effective length of a horizontal well - L, m	800
The radius of the circular feed loop - Rk, m	1500
Well radius - rc, m	0,0786
Effective formation thickness - hef, m.	19,1
Reservoir permeability -k, 10 <sup>-3</sup> μm <sup>2</sup>	480
Reservoir pressure - Pr., MPa	15,9
Downhole pressure - Pwh, MPa	10
Δp MPa	5,9
Reservoir fluid viscosity - μ, MPa*s	8,9
The ratio of horizontal to vertical permeability - β	4,5
Volumetric coefficient - b, m <sup>3</sup> /m <sup>3</sup>	1,12
Saturation pressure	27,1

For this case, the value of the skin factor is assumed to be zero, i.e., S=0. In addition, a multilateral horizontal well is represented by shafts with a length (Lo) of 800 meters.

Next, a theoretical calculation is made in accordance with formula (1) for the case of horizontal and multilateral wells. It should be noted that the possibility of drilling a multilateral horizontal well with two sidetracks as an alternative to a horizontal one is considered for the case of a steady flow of fluid. Neglecting frictional pressure losses, flow rates (Q) are calculated.

For a horizontal well:

$$Q = \frac{2\pi kh(P_k - P)}{\mu \left[ \ln R_k - \ln \frac{l \sin \alpha}{x(n)} + \frac{h}{\ln} \ln \frac{h \sin \alpha}{2\pi r_c} \right]} =$$

$$= \frac{2 \cdot 3,14 \cdot 480 \cdot 19,1 \cdot 5,9}{8,9 \left[ \ln 1500 - \ln \frac{800 \cdot \sin 90}{4} + \frac{19,1}{800} \ln \frac{19,1 \cdot \sin 90}{2 \cdot 3,14 \cdot 0,0786} \right]} =$$

$$= 198,6 \text{ m} / \text{cym}$$

For a multilateral horizontal well:

$$Q = \frac{2\pi kh(P_k - P)}{\mu \left[ \ln R_k - \ln \frac{l \sin \alpha}{x(n)} + \frac{h}{\ln} \ln \frac{h \sin \alpha}{2\pi r_c} \right]} =$$

$$= \frac{2 \cdot 3,14 \cdot 480 \cdot 19,1 \cdot 5,9}{8,9 \left[ \ln 1500 - \ln \frac{800 \cdot \sin 90}{4} + \frac{19,1}{800 \cdot 2} \ln \frac{19,1 \cdot \sin 90}{2 \cdot 3,14 \cdot 0,0786} \right]} =$$

$$= 283,1 \text{ m / cym}$$

The result of the calculation is shown in table 2.

Table 2

Flow rates of horizontal and multilateral horizontal wells

$Q_{hw}$ , t/d	MHW, t/d	$Q_{MHW}$ - $Q_{HW}$ , t/d
198,6	283,1	84,5

According to the table above, it can be concluded that in the case of a multilateral horizontal well, the flow rate is much higher compared to a horizontal one. In particular, as can be seen from the calculation, this increase is about 40%, which indicates the feasibility of using MHS.

The technology of drilling multilateral horizontal wells allows for a significant reduction in the cost of produced hydrocarbons, an increase in the economic and technological efficiency of the development process.

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