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CALCULATION OF GAS LIFT LIFTS AT THE ALTYGUYI FIELD

***Abstract**: The article presents calculations for a periodic gas lift, in relation to the operating conditions of the Altyguyi field, where it is recommended to equip wells with a single-row replacement chamber with a packer and a check valve installed in the lower part of the tubing. The method of designing gas lift lifts is presented.*

This technique includes the arrangement of starting and working valves in accordance with standard ones, taking into account the properties of reservoir fluids and projected well flow rates.

Based on the results of the calculations carried out, the justification for the dual completion (DC) in the wells of the Altyguyi field was carried out.

***Key words**: Filter opening, oil density, liquid extraction, gravity, liquid lifting height, specific flow rate, gas lift valve, reservoir fluid.*

***Language**: English*

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Introduction

The calculation of continuous gas lift lifts is reduced to determining the length, diameter of lifting pipes and specific gas consumption.

The choice of the diameter of the lift pipes of the gas lift well is carried out in accordance with the volume of the filtered liquid in the area of the optimal operating mode of the lift. Practice shows that, depending on the flow rate of wells, the optimal sizes of lifts correspond to the data given in Table 1.

Table 1. Optimal sizes of lifts

Well flow rate, t/day	20-40	40-60	60-200	200-300
Lift diameter, mm	40,3	50,3	62	76

In field conditions, from the point of view of technological and mechanical characteristics, pipes of the "M" brand with a bore diameter of 62 mm have an unlimited scope of application. It is recommended to use a universal lift scheme that provides both periodic and continuous lifting of liquid (Fig. 1.).

The above scheme is used in wells with a gas inlet depth of up to 3000 m. In wells with a depth of up to 4000 m or more, the lift layout shown in Figure 2 is used.

For maximum fluid extraction, it is necessary to create minimum pressures at the bottom. Therefore, the depth of the descent of the lifting pipes should be maximum, i.e.

$$L = H - (20:30)m$$

where H is the distance to the upper filter holes, m.

For an annular system (the working agent - gas is injected into the annular space), the required specific gas consumption during continuous lifting is determined from the expression:

$$R = \frac{0{,}388[Lpg - (P_1 - P_2)]}{d^{0,5}(P_1 - P_2)Lg\frac{P_1}{P_2}}, m^3/t$$

where: P_1 is the working pressure, Pa (the working pressure is 8.5; 10.0; and 12 MPa);

P_2 is the wellhead pressure (the minimum allowable under operating conditions), we take it to be equal to $P_2 = 1.2x10^6$; $1.5x10^6$ Mpa;

ρ -the density of oil is assumed to be equal to 861 kg/m^3;

g-acceleration of gravity (9.81 m/sec^2);

d - diameter of lifting pipes, m;

L is the lifting height of the liquid, m.

The specific flow rate of the injected gas, taking into account the solubility of the gas, is determined from the expression:

$$R_{inj.} = R_{req} - \left[G_0 - \alpha \left(\frac{P_1 + P_2}{2} \right) \right] (1 - \frac{n_w}{100}), m^3/t$$

where: G_0 is the gas factor (for oil), m^3/t;

α is the solubility coefficient of gas in oil,

α = 0.4031 m^3/t. atm.

n_w is the water content of products, %.

The optimal specific flow rate of the injected gas calculated at an input depth of 2700, 3000m and 3500m (P_{work}= 8.5; 15.0 MPa) is, respectively, 200, 300 and 500 m^3/t and at a gas input depth of 3000 - 3500m (P_{work} = 10; 15 MPa) is, respectively, 150 ÷ 400 m^3/t.

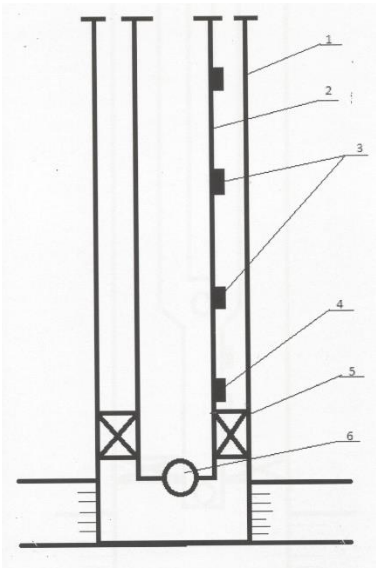

Fig. 1. Diagram of a universal gas lift
1- operational column; 2- elevator pipes; 3- starting valves; 4- working valve; 5- packer; 6- check valve.

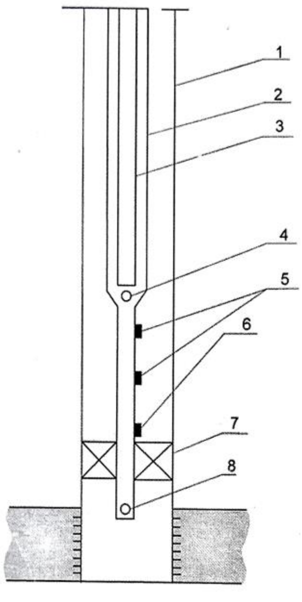

Fig. 2. Diagram of a stepped gas lift
1- operational column; 2- intermediate column; 3- upper stage of the elevator; 4, 8 – check valves; 5- starting valves; 6- working valve; 7- packer.

Calculation of the installation of a periodic gas lift with a replacement chamber

For periodic gas lift, in relation to the operating conditions of the Altyguyi deposit, it is recommended to equip wells with a single-row replacement chamber with a packer and a check valve installed in the lower part of the tubing (Fig. 3). In this case, the annular space between the tubing and the casing acts as a replacement chamber [1, 2, 3, 4].

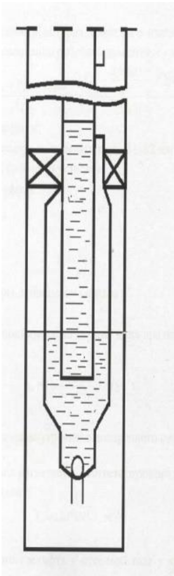

Fig. 3. Diagram of a lift for periodic lifting of a liquid with a replacement chamber

Reducing the pressure of the injected gas for purging the liquid is provided by installing starting valves on the tubing string, and the lower (working) valve acts as a shut-off device that reduces the specific gas consumption [5, 6, 7, 9].

The working pressure of the injected gas is determined from the expression:

$$P_{work} = \frac{h\gamma_{oil}}{10} - P_{pip} + P_{w.h}, \text{kgf/sm}^2$$

The height of the column of liquid that can be forced into the lifting pipes with full use of the working pressure will be:

$$h = \frac{(P_{work} - P_{pip} - P_{w.h})10}{\gamma_{oil}} = \frac{(P_{work} - \frac{0{,}0064L}{d^{0,5}} - P_{w.h})10}{\gamma_{oil}}, m$$

where: L is the length of the lift, m;

d is the inner diameter of the lifting pipes, d = 62 mm (2.5")

P_{work}, $P_{w.h.}$ - working and wellhead pressure, at;

γ_{oil} - the specific gravity of oil.

Camera Length:

$$\ell_c = \frac{d^2}{d_{1c}^2} h$$

where dc is the diameter of the camera, we take it equal to 4".

The volume of liquid raised in one cycle at the optimal flow rate of the injected gas:

$$q_{cyc.} = \left(h \frac{0{,}5\sqrt[3]{L^2}}{d^{0,5}\gamma} \right) f\ \gamma, t$$

where d = 0.003 m is the area of the inner cross-section of 2.5" pipes.

The gas consumption during the injection period corresponding to the minimum specific consumption will be:

$$V_0 = 1{,}1 d^2 \sqrt[3]{L^2}, m^3/h$$

For a periodic gas lift with a gas cut-off at the chamber, the amount of gas required for one cycle, reduced to normal conditions, is determined from the expression:

$$V_c = f(L + h - \ell_c)\frac{P_{work}}{P_o}, m^3$$

Duration of the gas injection period:

$$T_1 = \frac{60V_c}{P_o}, m^3$$

Duration of the full cycle:

$$T = \frac{q_{cyc.}1440V}{Q}, min$$

where: Q is the flow rate of the liquid, t/day

Duration of the liquid accumulation period:

$$T_2 = T - T_1, \text{ min.}$$

Number of cycles per day:

$$n = \frac{1440}{T}$$

Specific gas consumption per 1 ton of liquid:

$$R_0 = \frac{V_c}{q_{cyc.}}, m^3/t$$

The calculated values of the parameters of the periodic gas lift for wells with a lifting height from depths of 2500, 3000, 3500 m are given in Table 2.

The design of gas lift lifts, including the arrangement of starting and working valves, should be carried out in accordance with standard methods [8, 12, 13, 14], taking into account the properties of reservoir fluids and projected well flow rates.

Bellows valves of the G-38 and G-38R, G-25 and G-25R types, installed in the pockets of downhole chambers KT 73-25 and KT 73-38, K60-25 and K60-38, are recommended as gas lift valves. The minimum required number of valves per well is 5÷6 [10, 11, 15].

Table 2. Calculated parameters of the periodic gas lift

L, m	d, mm	Ppip, MPa	P_{work}, MPa	$P_{w.h}$, MPa	h, m	1_c, m	q_{cyc}, t	V_0, m^3 /h	Vc m^3	T_1 min	T min	n_{cyc}, cycle	Q, t/day	R_o, m^3/t	V, m/day
2500	62	1,01	8,4	1,5	695	271,7	1,62	1266	884	41,89	116,6	12,35	20	546	10920
3000	62	1,21	10,0	1,5	898	350,7	2,12	1430	1064	44,65	152,6	9,4	20	501	10022
3000	62	1,42	12	1,5	1115	435,7	2,66	1584	1504	57,0	191,5	7,52	20	565	11314

References:

1. Panfilov, M.B., & Panfilova, I.V. (n.d.). *Osrednennye modeli filtracionnyh processov s neodnorodnoj vnutrennej strukturoj*. Moscow.
2. Muravev, V.N. (1973). *Ekspluataciya neftyanyh i gazovyh skvazhin.* (p.449). Moscow: Nedra.
3. Muslimov, R.H., Shavaliev, A.M., Hisamov, R.B., et al. (1995). *Geologiya, razrabotka i ekspluataciya Romashkinskogo neftyanogo mestorozhdeniya:* v 2-h t. Moscow: VNIIOENG.
4. Lysenko, V.D. (2000). *Innovacionnaya razrabotka neftyanyh mestorozhdenij*. (p.517). Moscow: Nedra.
5. Zotov, G.A., & Aliev, E.S. (1980). *Instrukciya po kompleksnomu issledovaniyu gazovyh i gazokondensatnyh plastov i skvazhin*. -M.: Nedra.
6. (1975). *Instrukciya po issledovaniyu gazokondensatnyh mestorozhdenij na gazokondensatnost*. Moscow: Nedra.
7. Efremov, E.P., Yashin, A.N., & Halimov, E.M. (1981). Vliyanie sovmestnoj razrabotki na nefteotdachu mnogoplastovyh obektov. *NH*, № 8, pp. 32-36.
8. Deryaev, A.R. (2022). *Raschet gazliftnyh podemnikov*. Sbornik statej VII Vserossijskoj nauchno-prakticheskoj konferencii “Nauka, obshestvo, kultura: problemy i perspektivy vzaimodejstviya v sovremennom mire”. (pp.82-90). Petrozavodsk: Nauchnoe izdanie: MCNP “Novaya nauka”.
9. Deryaev, A.R. (2022). *Trebovaniya k konstrukciyam gazovyh skvazhin dlya osvoeniya ih metodom odnovremenno razdelnoj ekspluatacii*. Sbornik statej nauchno-prakticheskoj konferencii “Nauchno-tehnicheskij progress: informaciya, tehnologii, mehanizm”. (pp.57-60). Ufa: Nauchnoe izdanie: NIC “Aeterna”.
10. Deryaev, A.R. (2022). *Vybor vnutriskvazhinnogo oborudovaniya dlya odnovremenno razdelnoj ekspluatacii neskolkih gorizontov*. Sbornik statej po itogam Mezhdunarodnoj nauchno-prakticheskoj konferencii “Sovremennye problemy i perspektivnye napravleniya innovacionnogo razvitiya nauki”. (pp.96-102). Sterlitamak: Nauchnoe izdanie: “Agentstvo mezhdunarodnyh issledovanij”.
11. Deryaev, A.R. (2022). Osnovnye trebovaniya i osobennosti tehnologii bureniya skvazhin dlya odnovremenno razdelnoj ekspluatacii neskolkih gorizontov. *Estestvennonauchnyj zhurnal «Tochnaya nauka»*, vypusk №136 - Kemerovo: Izdatelskij dom: «Pluton», pp.24-26.
12. Deryaev, A.R. (2022). Vybor konstrukcii ekspluatacionnyh skvazhin dlya razrabotki mnogoplastovyh mestorozhdenii metodom odnovremennoj razdelnoj ekspluataciej. *Zhurnal ob estestvennyh i tehnicheskih naukah «Mirovaya nauka»*, vypusk №7 (64) - Saratov: Nauchnoe izdanie: «IUSER», pp.56-62.

13. Deryaev, A.R. (2022). *Kontrol za tehnologicheskim rezhimom skvazhin i skvazhinnogo oborudovaniya.* Sbornik statej V Mezhdunarodnoj nauchnoj - prakticheskoj konferencii “Innovacionnyj diskurs razvitiya sovremennoj nauki i tehnologij”. (pp.19-25). Petrozavodsk: Nauchnoe izdanie: MCNP “Novaya nauka”.
14. Deryaev, A.R. (2022). *Raschet gazliftnyh podemnikov na mestorozhdenii Altygujy*. Sbornik statej Mezhdunarodnoj nauchno-prakticheskoj konferencii “Mezhdisciplinarnost nauchnyh issledovanij kak faktor innovacionnogo razvitiya”. (pp.40-45). Ufa: Izdatelstvo OOO “Omega sajns”.
15. Deryaev, A.R. (2022). *Konstrukciya gazokondensatnyh skvazhin i meropriyatiya po obespecheniyu trebuemyh rezhimov raboty skvazhin.* Sbornik statej mezhdunarodnoj nauchno-prakticheskoj konferencii “Rol innovacii v transformacii i ustojchivom razvitii sovremennoj nauki”, chast 1. (pp.29-33). Ufa: Nauchnoe izdanie: NIC “Aeterna”.