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Gas-Lift Method of Oil Production and Safety Precautions During the Operation of Gas-Lift Wells

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Abstract: Compressor gas-lift uses compressors to compress associated gas, while non-compressor gas lift uses pressurized gas from a gas field or from other sources.

Keywords: capital intensity and metal consumption, gas lift, high pressure gas pipelines

In gas-lift operation, the missing energy is supplied from the surface in the form of compressed gas energy through a special channel.

Gas lift is subdivided into two types: compressor and compressorless. Compressor gas lift uses compressors to compress the associated gas, while compressorless gas lift uses pressurized gas from a gas field or from other sources.

Gas lift has a number of advantages in comparison with other mechanized methods of well operation:

1. the possibility of withdrawing significant volumes of liquid from great depths at all stages of field development with high technical and economic indicators;
2. simplicity of borehole equipment and ease of maintenance;
3. efficient operation of wells with large borehole deviations;
4. operation of wells in high-temperature formations and with a large gas-input factor without complications;
5. the ability to carry out the entire range of research work to control the operation of the well and the development of the field;
6. full automation and telemechanization of oil production processes;
7. long overhaul periods of wells against the background of high reliability of equipment and the entire system as a whole;
8. Possibility of simultaneous-separate exploitation of two or more layers with reliable control over the process;
9. simplicity of combating wax deposition, salts and corrosive processes;
10. simplicity of work on underground maintenance of a well, restoration of serviceability of underground equipment for lifting well production.

The disadvantages of gas lift are traditionally considered to be high initial capital investments, capital intensity and metal consumption. These indicators, in many respects depending on the adopted scheme of the field arrangement, slightly exceed the indicators for pumping production.

The largest number of elements in the gas lift system and more complex equipment are used in the case of compressor gas lift. The modern gas-lift complex is a closed hermetically sealed high-pressure system (Fig. 1).

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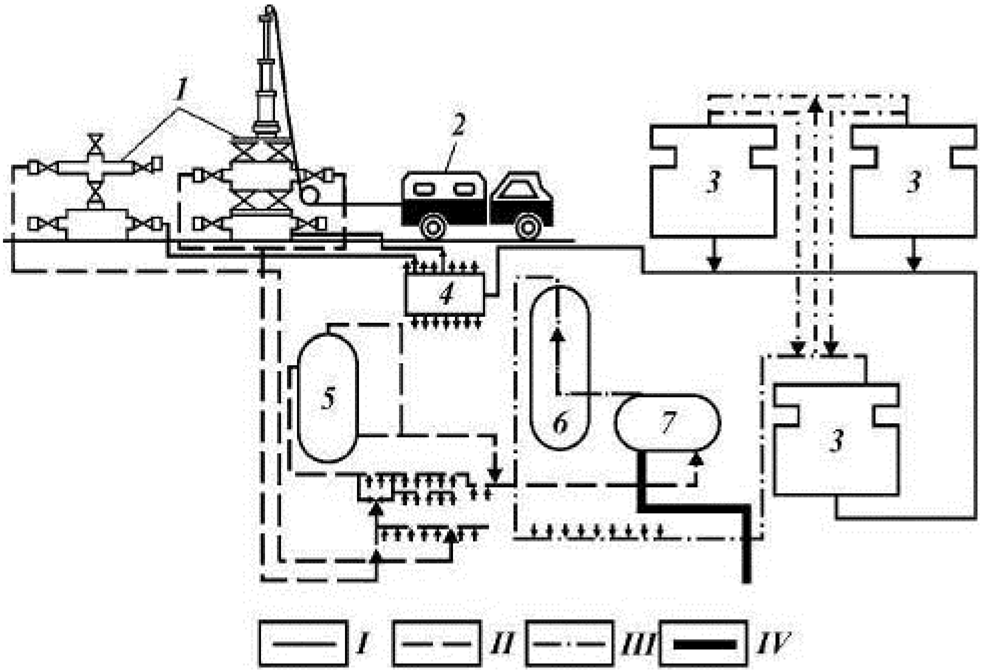
The main elements of this scheme are: wells 1, compressor stations 3, high pressure gas pipelines, pipelines for gathering oil and gas, separators for various purposes 7, gas distribution battery 4, group metering units, gas purification and drying systems with ethylene glycol regeneration 6, booster pumping stations , oil gathering station,



Rice. 1. Scheme of a closed cycle of a gas-lift complex

As a result of solving the problem of optimal distribution of the compressed gas for each well, a certain mode of gas injection is assigned, which must be maintained until the next change in the mode. The parameter for stabilization is the pressure drop across the measuring washer of the differential pressure gauge installed on the working line of gas supply to the well.

The choice of the type of gas lift unit and equipment that ensures the most active well operation depends on the mining and geological and technological conditions for the development of production facilities, the design of wells and the specified mode of their operation.

There is no strict classification of gas-lift installations, and they are grouped on the basis of the most general design and technological features.

There are different types of systems depending on the number of rows of pipes lowered into the well, their relative position and the direction of movement of the working agent and the gas-liquid mixture.

1.Single-row hoist of ring and central systems

2.Double-row elevator of the circular and central systems One and a half-row elevator usually of the circular system

The listed gas lift systems have advantages and disadvantages. In this regard, the rationale for the feasibility of their use is carried out taking into account the mining, geological and technological features of a particular development object.

According to the degree of connection of the tubular and annular space with the bottom of the well, gas lift installations are divided into open, semi-closed and closed.

The experience of developing oil fields in Western Siberia has shown that the most rational system is

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in which compressed gas is taken from wells equipped for gas production and borehole execution. Borehole gas lift is the most efficient way of lifting liquid. It is carried out by bypassing gas from the overlying (possibly from the underlying) gas reservoir through a special borehole regulator.

The use of borehole gas lift makes it possible to exclude the construction of onshore gas pipelines for the collection and distribution of gas and gas distribution points, gas treatment plants (drying, removal of part of liquid hydrocarbons, purification from hydrogen sulfide). In connection with the injection of high-pressure gas into the hoist closer to the tubing shoe, a high thermodynamic efficiency of the flow in the hoist is ensured. If with compressorless and compressor gas lifts under the best conditions the thermodynamic efficiency is 30-40%, then with borehole compressorless gas lift its value reaches 85-90%.

Restricting the inflow of water to the bottom of production wells is one of the most important problems in the system of measures to improve the efficiency of oil field development and increase oil recovery. In wells operating several productive layers at the same time, watering occurs unevenly - water moves through more permeable interlayers and interlayers. In many cases, the inflow of water through such interlayers occurs so intensively that it seems that the well is completely flooded. In such conditions, there is an uneven development of individual layers.

The bottom water does no less harm to the normal operation of deposits and wells. It is conically pulled into the bottomhole zone and enters the well through the lower holes of the perforation interval of the production string. The watering of the wells is progressing from year to year. Premature watering of wells (not associated with full depletion of the formation) reduces the final oil recovery, leads to high costs for the production of associated water and the preparation of marketable oil.

The wide variety and complexity of ways to water oil wells make it difficult to solve the problem, which is further aggravated by the lack of reliable methods for determining the ways of water entering the well. In the conditions of the complex geological structure of oil deposits and reservoirs, all the variety of forms of water inflow is observed:

1. by pulling up the bottom water (formation of a water cone);
2. due to the advanced advance of water along the most permeable layers of one layer (formation of watering tongues);
3. due to the primary watering of highly productive formations when two or more productive formations are combined into one development target;
4. on a poor-quality cement ring. In this case, the wells are watered both by the waters of the production layer and by the waters of the above- and lower-lying aquifers.

In recent years, more and more attention has been paid in the oil industry to the search for methods of limiting water inflows to the bottom of oil wells. Methods for limiting water inflow into wells, depending on the nature of the influence of the injected water-insulating mass on the permeability of the oil-saturated part of the reservoir, exposed by perforation, are divided into selective and non-selective.

Selective isolation techniques are those that use materials that are injected into the entire perforated portion of the formation.

In this case, the formed sediment, gel or hardening substance increases the filtration resistance only in the water-saturated part of the formation, and the oil part of the formation is not blocked. With media, there is no need to re-perforate.

Taking into account the mechanism of formation of water-insulating masses, five selective methods

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can be distinguished:

Selective isolation methods based on the formation of a water-insulating mass, soluble in oil and insoluble in aqueous media. It is recommended to use materials such as naphthalene, paraffin, dissolved in aniline, creosol, acetone, alcohol, or other supersaturated solutions of solid hydrocarbons in solvents. Viscous oils, emulsions and other oil products, insoluble salts and latexes of the SKD-1 type are used.

Selective isolation methods based on the formation of sediments injected into the reservoir in water-saturated zones. It is proposed to pump inorganic compounds such as FeSO4, M2SiO3 (M is a monovalent alkali metal), which, reacting with each other in an aqueous medium, form ferrous oxide hydrate and silica gel. A stronger mass is formed by organosilicon oligomers, which have a long-lasting effect.

Methods based on the interaction of reagents with formation water salts. Methods of limiting the movement of water in the reservoir using such high-molecular compounds as derivatives of cellulose and acrylic acids are based on the deposition and structuring of polyvalent metal ions Ca + 2, Mg + 2, Fe + 2 and others. In contact with the cations mentioned, a number of copolymers of polyacrylic and methacrylic acids with a high degree of hydrolysis are precipitated from the solution. In the oil environment, they retain their original physical properties, thereby ensuring the selectivity of the impact on the oil-water-saturated reservoir.

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