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Issue Article

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RECOMMENDATIONS AND INSTRUCTIONS ON THE CHOICE OF METHODS OF OPERATION OF WELLS OF OIL AND GAS FIELDS IN THE WESTERN AREA OF TURKMENISTAN

Abstract: *The article considers the analysis of the selection and recommendations, as well as instructions on how to operate wells in the Western area of the oil and gas fields of Turkmenistan, in order to increase oil and gas production from productive layers of the horizons of the red-colored strata. To analyze the choice of well operation methods, materials from previously operated wells, geological and operational characteristics of deposits and the guidance document "Operating Instructions for oil and Gas wells", as well as safety rules in the oil and gas industry were used.*

The article presents a detailed analysis of the complexity of the operation of oil and gas wells and their specific causes, as well as recommendations on the choice of operating methods and operating instructions for different types of downhole pumps.

This work can be used to perform the assigned tasks in the production of oil and gas wells and in the development of a field with complex geological and operational characteristics.

Key words: *curvature of pillars, natural curvature, gas factor, rock strength, sand occurrence, productivity coefficient, high-paraffin oil, submersible equipment.*

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Introduction

The main difficulties in the operation of oil and gas wells in the fields of Western Turkmenistan are:

- large depths of finding productive formations;
- a sharp decrease in the initial reservoir pressure on productive formations and a decrease in the liquid level in wells;
- operation of productive reservoirs at pressures below saturation pressure;
- high values of gas factors of producing productive formations;
- the curvature of the pillars of wells due to natural curvature due to the alternation of the strength of clay rocks;
- the tendency of oil formations to sand phenomena;
- high-paraffin oil content;
- a wide range of changes in the productivity coefficient;
- due to a decrease in reservoir pressure of productive horizons, an increase in the depth of gas input in gas lift wells from the mouth.

The choice of mechanized methods of oil production in the fields of the Western area of Turkmenistan is carried out taking into account the above factors. In addition, the geographical location and climatic conditions are also taken into account, the analysis of the inter-repair periods of previously drilled wells, the presence of paraffin and mechanical impurities in the extracted productive fluid, as well as

the consumption of electricity [1, 2].

In the fields, the presence of oil and gas deposits, as well as gas deposits with oil rims, is distinguished by the nature of saturation of productive layers. For most deposits, the mixed regime is characterized by reservoir energy released from oil and gas and the manifestation of the activity of contour waters at a later stage of development [3, 4].

Reliability and the possibility of maximum extraction of oil reserves from multi-layer oil and gas horizons with a large depth of occurrence composed of weakly cemented rocks.

Operation of wells with IRDP (installation of a rod depth pump)

In the conditions of the deposit of Western Turkmenistan, the use of IRDP has a very limited area. However, IRDP is distinguished by the perfection of its design, a wide range of manufactured equipment of the normal range, as well as ease of maintenance. Installations of rod depth pumps can be used for pumping liquid from relatively shallow depths, which are effectively used in low-flow wells with high water content of products, mainly in the fields of Uzboy, Gumdag, Ekerem, Barsagelmes, Cheleken. In most of the oil and gas fields of Western Turkmenistan, the limiting factors for the use of the method of operating wells with IRDP are: high gas factors, large depths, the curvature of the boreholes in the oil and gas fields of Western Turkmenistan.

The modern normal range of drives of the deep pump of the beam-pumping and downhole pumps of the plug-in type allow theoretically lifting liquid from depths of 3500m.

However, with such a large pump descent, due to the insufficient operational reliability of the pumping pipes and rods, problems arise related to the provision of the repair base of the fields [5, 6].

The installation schemes of the column head and fountain fittings should ensure the sealing of the pipe, annular and inter-pipe spaces, the possibility of sampling oil and gas, conducting research and silencing the well. Fountain compressor fittings, regardless of the expected operating pressure, must be mounted with a full set of studs and seals provided for in the technical conditions for the supply of fittings.

The working pressure of the fountain valve should correspond to the maximum expected at the wellhead, but not be lower than the pressure of the pressure of the production column. In cases where an gas, oil and water shows is expected and there is a danger of swinging of the fountain fittings, it should be reinforced with anchor bolts and guy ropes.

The pressure testing of the valve in assembled form must be carried out:

- at the manufacturer's factory and after repair with the use of welding at the test pressure provided for in the passport;

- at the enterprise before installation at the wellhead - at the operating pressure;

- after installation at the wellhead - to the pressure of the production column pressure testing.

The results of the pressure testing are formalized by an act.

In the case of work (fracturing, acid treatments, various fillings, etc.) that require pressures exceeding permissible, it is necessary to install special heads at the mouth, and protect the production column by installing a packer [7, 8].

Fountain fittings must be equipped by the manufacturer with adjustable chokes with manual, and at the request of the customer - and with remote control [9, 10, 11]. Securely reinforced supports must be installed under the ejection lines of the fountain compressor fittings located at a height, preventing the lines from falling when they are disconnected during repair, as well as vibrations from jet impacts.

When operating a well with a temperature at the mouth above 200 °C, appropriate fountain fittings should be used, the design and heat resistance of which ensure the safety of the technological process and maintenance personnel.

Fountain wells with a flow rate of 400 tons/day of oil or 500 thousand m^3/day of gas or more, located at a distance of less than 500 m from the settlement, are equipped with downhole equipment (packer and shut-off valve, circulation valve, control station, etc.) [12, 13, 14].

During the operation of the well, the shut-off valve must be periodically checked for operation in accordance with the manufacturer's instructions. The installation of the shut-off valve and its check for operation must be formalized by an act.

Temperature compensators must be installed on the discharge lines and manifolds of wells operating with a working fluid temperature of 80 ° C or more. To measure the buffer pressure and the pressure in the annular space, pressure gauges with three-way taps must be permanently installed on the fountain fittings.

The mouth of the fountain well should be equipped with a shaft well and devices for monitoring inter-column pressures with the possibility of carrying out technological operations.

Fountain fittings must be equipped with shut-off valves with remote and manual control and be able to replace pressure gauges.

Troubleshooting, replacement of wear-resistant and replaceable parts of fountain fittings under pressure are prohibited. It is allowed to reduce the pressure in the annular space only through the fitting installed after the second valve from the crosspiece of the fountain fittings. Before changing the fitting and the fitting nozzles, it is necessary (after transferring the jet to the backup outlet and closing the corresponding valves on the working outlet) to reduce the pressure in the jet behind the fitting to atmospheric using a valve installed on the line.

After installing the manifold and connecting it to the taps of the fountain fittings and the pipe head, the

system is pressed with water to the working pressure.

The control station for the fountain fittings of a gas lift well should be installed at a distance of 30-35 m from the mouth in a special room, securely strengthened and grounded. The temperature in the room should ensure the trouble-free operation of the station.

Air ducts. Connecting the control station with the fountain fittings, and cables should be laid in trenches sealed to prevent precipitation and accumulation of aggressive environment.

If it is not possible to build trenches, air ducts and cables should be laid on tinctures 40 cm high from ground level or water mirrors.

The transfer of the well to gas lift operation should be carried out in accordance with the project and the plan approved by the oil and gas producing enterprise [15].

Before transferring the well to gas lift operation, the production column, wellhead equipment and pumping and compressor pipes must be pressed to the maximum (starting) pressure and checked for tightness.

Seamless steel pipes connected by welding should be used for strapping wells and equipment, as well as for gas pipelines during fountain and gas lift operation. Flanged connections are allowed only in places where valves and other fittings are installed.

Gas distribution pipelines after installation must be purged with compressed air, pressed with water at a pressure 25% higher than the maximum operating pressure.

The mouth of the gas lift well must be equipped with fittings with a manifold having purge lines with a lead to a candle at least 20 m away. A check valve is installed on the manifold.

Preparation of the working agent (gas) during gas lift operation should provide for its drying from water vapor to the dew point - 10 ° C [16, 17].

The working agent must be supplied to the high-pressure gas pipeline drained.

Heating of the working agent (gas) for gas lift operation is allowed in exceptional cases and must be carried out with special heaters provided for by the project.

When eliminating hydrate plugs, the pressure in the gas pipeline should be reduced to atmospheric, and these sections should be heated by steam.

Pressure gauges with a three-way tap are installed to measure pressure in fountain fittings and gas pipelines.

Gas distribution batteries must have devices for automatic distribution of the working agent through wells with the control system output to the control room.

During the operation of the compressor station of the gas lift system, it is necessary to carry out:

- monthly inspection of all technological pipelines, separators, tanks, shut-off and control valves with recording of the results in the logbook;
- monitoring of the operability of fire extinguishing systems, gas drying, lighting, ventilation and alarm systems, lightning protection, protection from static electricity, communications and telemechanics according to the approved schedule [18].

When operating wells with rod pumps, the wellhead must be equipped with fittings and a device for sealing the stem.

The beam-pumping must be installed in such a way that its moving parts do not come into contact with the details of the tower or mast, as well as the foundation and the ground.

For the maintenance of the electric drive and the brake of the beam-pumping , a platform with a fence is installed.

The wellhead must be equipped with wellhead fittings that allow gas to be taken from the annular space and research work to be carried out.

The upper end of the mouth gland should rise no more than 1 m above the level of the platform.

When stuffing the seal of the wellhead oil seal, its cover must be held on the polished rod by a special clip.

When rearranging or changing the fingers of the crank mechanism, a clamp should be installed on the stuffing rod, and the connecting rod should be securely attached to the rack of the beam-pumping

The design of the wellhead oil seal with possible fountain manifestations should allow you to safely change the packing.

At the lowest position of the balancer head, the distance between the traverse of the suspension of the stuffing box or the rod holder and the mouth gland should be at least 20 cm.

The counterweight of the beam-pumping can be installed on the balancer only after connecting the balancer with the crank mechanism and the stuffing box. It is forbidden to flush the radiator pulley manually and brake it by placing pipes, scrap or other objects in the spokes [19].

Balancing counterweights of beam-pumping should consist of sections weighing no more than 40 kg each and be securely fastened.

The connection of the suspension with the stuffing box must be carried out with the help of a special device.

Binding the wellhead connections of a periodically blowing well should allow the release of gas from the annulus into the discharge line through a check valve and changing the stuffing box of the stem in the presence of pressure in the well.

Before the start of repair work or before inspecting the equipment of a periodically working well with automatic, remote or manual start-up, the electric motor must be turned off, and a poster should be posted on the starting device: “Do not turn on, people are working”

Posters with the inscription "Attention! The start is automatic". The same inscription should be on the launcher.

Systems for measuring the flow rate of wells, starting, stopping and loading on the polished rod (balancer head) must have access to the control room.

Operation of wells by centrifugal, diaphragm, screw, submersible electric pumps.

The wellhead is equipped in accordance with the requirements of the Safety Rules in the oil and gas industry. The passage hole for the power cable in the wellhead fittings must have an airtight seal. When lowering and lifting a submersible centrifugal or screw electric pump, a device should be installed on the wellhead flange that protects the cable from damage by the elevator [20].

The power cable must be laid from the control station to the wellhead in a trench or on special support racks. The cable is attached to the lifting pipe column by belts installed above and below the coupling of each pipe. Belts should not have sharp edges.

The developed installations with a submersible electric pump must be equipped with sensors to obtain information at the control station about the pressure at the pump intake and the oil temperature in the electric motor.

Installation and dismantling of ground electrical equipment of electric pumps, their inspection, repair and adjustment should be carried out by electrical personnel.

The cable roller must be suspended by means of a chain or a special cable suspension on a bracket attached to the foot of the mast by a yoke, and on a tower or tripod - to a belt. Workers engaged in this operation must work from a platform that has a fence and a tower or mast located on the side of the stairs, or wear a safety belt. It is forbidden to hang the roller on a hemp rope or rope loop.

The cable passed through the roller during descent and lifting operations should not touch the structural elements of lifting mechanisms and the ground.

It is forbidden to touch the cable when testing the electric motor of a submersible, centrifugal or screw electric pump at the wellhead.

When screwing and unscrewing the pipes, the cable should be removed outside the working area in such a way that it does not interfere with working personnel.

The rate of descent (lifting) of the submersible equipment into the well should not exceed 0.25 m/s.

Loading and unloading of the drum with cable, electric motor, pump, tread, winding and unwinding of the cable on the drum must be mechanized. The turns of the cable should be laid on the drum in even rows. It is forbidden to transport the cable without a drum.

During the well repair process, the drum with the cable should be installed so that it is in the field of view of the workers. The drum, the cable roller and the wellhead must be located in the same vertical plane. At night, the drum must be illuminated. A submersible, centrifugal or screw electric pump at the wellhead should be assembled using special clamps, the eyelets of which should be equipped with safety pins. It is forbidden to install clamps on a smooth body that does not have stops.

The borehole into which the submersible electric pump descends for the first time, as well as when changing the pump size, must be checked with a template in accordance with the requirements of the operating instructions for the submersible electric pump.

The wellhead operated by a screw submersible pump must have an oil seal device for sealing the shaft that transmits torque from the gearbox to the column of pumping rods.

The systems for measuring the flow rate of the well, starting, stopping, as well as the load readings of the electric motor should have access to the oilfield control room [21].

Operation of wells by hydraulic and jet pumps

Block automated installations of hydraulic pumps are designed for the operation of cluster directional and deep wells (over 4000m) with low dynamic levels (3000m) and with debits up to 100 m^3 /day. The small dimensions of these pumps allow them to be lowered into wells with an internal diameter of the production column of 117.7-155.3 mm.

The principle of operation of the installation is based on the use of hydraulic energy of a liquid pumped under high pressure through a special channel into a hydraulic downhole reciprocating piston engine, which converts this energy into reciprocating motion of a piston pump rigidly connected to the engine.

These pumps have a high efficiency (0.65), which decreases slightly with a decrease in the dynamic level in the wells. The distinctive ability of hydraulic pumps is the possibility of using the same unit to work with different pressures, i.e. to operate wells with different depths and to take liquid in the right quantities.

As hydraulic installations, IGP 25-150-25, IGP 40-25 0-20, , IGP 100-200-18 are recommended.

Hydraulic units of the discharged type HP are recommended for pumping reservoir fluid from wells -59-89-10-118, HP-59-89-25-25, HP-59-89-40-20.

According to their production characteristics, ease of operation, they fully meet the operating conditions of the deposit of Western Turkmenistan [22].

The room of the technological unit of the installation must have:

- forced ventilation, providing eight-fold air exchange over the entire internal volume of the room

for an hour, with automatic switching on and off depending on the state of the air environment;

- at least two outputs;
- the temperature in the blocks is not lower than 5 °C, the noise level is not more than 85 dbl, the vibration speed is not more than 2 mm / s.

When using well products as a working fluid, the installation must be equipped with an automatic volumetric gas fire extinguishing system.

Before entering the room of the technological unit, it is necessary:

- check the gas contamination of the room and the condition of the ventilation system;
- turn on the lighting;
- switch the gas fire extinguishing system from automatic start mode to manual.

If a fire occurs in the block, it is necessary to leave the room, close all doors and turn on the automatic fire extinguishing system using the button located at the entrance door.

After leaving the room, it is necessary to switch the fire extinguishing system to automatic start.

Before the descent of the packer, the production column must be calibrated, if necessary, calibrated, washed to the bottom and pressed.

Extraction of the hydraulic pump, scraper and other equipment must be carried out using a special lubricator available in the installation complex.

Installation and dismantling of the lubricator must be carried out with the help of rope equipment and a mast with the central gate valve closed in compliance with the guidelines for carrying out this type of work.

When installing and removing a lubricator with a hydraulic pump, precautions should be taken to prevent it from falling out of the lubricator.

Each discharge line must be equipped with a pressure gauge and a working fluid flow regulator.

Power pumps must be equipped with electric contact and indicating pressure gauges, as well as safety valves. The outlet from the safety valve of the power pump must be connected to the pump intake.

The serviceability of the automation system and safety devices is checked within the time limits set by the operating instructions.

Before the descent, the discharge pipelines of the system must be tested for a one-and-a-half working movement.

The power plant is put into operation after checking the serviceability of automation systems with open shut-off devices on the suction, discharge and bypass lines of the working fluid of the power pump. The pressure in the pressure system is created after the normal operation of the ground equipment is established.

When the power pump is stopped, the pressure in the discharge line must be reduced to atmospheric.

The system for measuring the flow rate of wells, the indications of the operation of power pumps should have access to the control room.

Operation of wells with the use of an installation with an electric centrifugal pump (ECP)

The main criterion that determines the inexpediency and impossibility of application is the large depth of 80% of the operated wells. The maximum depth of descent of the ECP is up to 1600m. In addition to this limiting factor, the presence of high gas content in the pumped liquid and planned flow rates, which are significantly lower than the minimum capacity of the ECP, are also noted in the fields of Western Turkmenistan. These factors are opposed to the possibility of using ECP at this field.

The practice of fountain and gas lift operation in the fields of Western Turkmenistan proves the expediency of their use, both in continuous and periodic lifting of liquid. For the purpose of the most efficient operation, wells with debits above 30 t/day are recommended to be operated with a continuous gas lift. Wells operating with debits below 30 t/day should be operated with a periodic gas lift. In the conditions of this field, a periodic gas lift is the most realistic, ensuring the design production volumes until the end of the field development [23].

When studying the geological and operational characteristics of multi-layer deposits of Western Turkmenistan, it was revealed that oil and gas layers alternating in productive horizons are isolated from each other by impermeable layers having relatively large thicknesses. To a large extent, gas formations overlap oil formations by area, which creates favorable conditions for the implementation of methods of dual completion operation (DC) of oil and gas facilities with one well. At the same time, it is also advisable to partially use the technology of the downhole gas lift, the most efficient method of operation that does not require additional capital investments [24].

At the later stages of operation, with a detailed study of the geological and operational characteristics of the field, it is recommended to use the gas lift method, as well as the operation of wells using hydraulic piston and jet pumps.

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