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Issue Article

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OPERATION OF ELECTRIC DRILLS FOR DRILLING OIL AND GAS WELLS UNDER CONDITIONS OF ABNORMALLY HIGH RESERVOIR PRESSURES

Abstract*: The article discusses the analysis and recommendations, as well as instructions for the operation of electric drills for drilling oil and gas wells in conditions of abnormally high reservoir pressures in the fields of Turkmenistan in order to accelerate the completion of the constitution of wells provided for by the project.*

To select the operating mode of electric drills for the purpose of drilling wells, materials of previously operated wells, literary and Internet materials, geological and operational characteristics of deposits and the guidance document "Operating instructions for electric drills for drilling oil and gas wells" were used.

This paper provides a detailed analysis of the operation of electric drills for drilling oil and gas wells and provides recommendations and instructions for choosing the operating modes of different types of electric drills (downhole motors). This work can be used when drilling directional oil and gas wells and field development in order not to seal the development grid.

Key words*: pipe carrier, drill pipe, hydraulic weight indicator, spindle, oil tanker, pressure gauge, stabilizer, phase, defect, cable section, oil.*

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Introduction

Drilling with electric drills requires slightly more labor costs and a more qualified approach than with other drilling methods. Therefore, drilling crews have an additional number of workers - one electrician in each watch.

When transported on a pipe carrier, the electric drill is placed by the spindle on the front support and the stator housing on the rear support of the pipe carrier.

In order to avoid excessive stresses in the threaded connections, the electric drill is laid on the support beam of the trailer of the pipe so that the departure from the support beam to the end of the electric drill is 1/4 of its length. In order to prevent longitudinal and transverse movements during transportation, the electric drill is fixed with special clamps or cables in the places of the supports. Electric drills with a diameter of 164 mm are allowed to be transported only in a special transport case. It is strictly forbidden to dump an electric drill from a pipe carrier [1, 2]. When unloading the electric drill on the racks, the pipe carrier must drive sideways to the racks so that the elevator translator is directed towards the entrance to the drilling.

When transporting an electric drill on a tractor sled, it is allowed to unload it on the ground right in front of the receiving bridge of the drilling rig. In this case, in order to prevent its damage, it is mandatory to use special rolls with a length of at least 3 m.

When loading drill pipes onto a pipe carrier and unloading them onto the receiving bridge of the drilling rig, the safety of protective cups in the nipples of locks and cable sections mounted in the pipes must be

ensured. When transported on a pipe carrier, drill pipes are laid with a lock nipple on the trailer.

When dragging drill pipes to the receiving bridge of the drilling rig and to the rotor, a protective cap must be screwed onto the lock spindle. It is forbidden to use the eye of the protective cap to pull the drill pipe.

Each electric drill entering the drilling rig must be provided with a trip passport. The passport is an acceptance document for both drilling and rolling and repair facilities. It is inserted into a sealed cartridge attached to the contact rod of the cable entry.

The electrician is obliged to fulfill all the points of the trip passport after each one way. The operating time of the electric drill is recorded based on the readings of the diagrams of the hydraulic weight indicator or a special electric clock that turns on when the "Start the electric drill" button is pressed. At the end of the work of the electric drill, the trip passport signed by the drilling foreman is sent together with the electric drill to the rolling and repair base [3, 4, 5].

Before screwing the bit onto the electric drill shaft, the axial lift of the spindle shaft is checked. To do this, the suspended electric drill is placed on the rotary table and at the time of setting, the mixing value of the shaft relative to the spindle body is measured.

The displacement of the shaft should not exceed 1.5 mm. The presence of oil in the compensators of the motor and spindle and the condition of the threaded connections are also checked. The threaded connections are checked by an external inspection, the tightness of the connections between the motor housings, spindle, compensator, as well as in the places of plug installations is checked. In case of detection of oil leaks and mobility of threaded connections, if it is impossible to correct defects on the spot, the electric drill must be sent to the workshop.

The oil pressure inside the electric drill is measured by a device that is a pressure gauge with a scale of 51:10 kgf / cm^2 and a tip with a thread M10 x 1 and a needle. The tip with a nanometer is screwed into the valve thread, the needle squeezes the ball and the pressure gauge shows the oil pressure, which should correspond to the values specified in the electric drill's trip passport [6, 7].

Pumping transformer oil into the engine on the drilling rig is carried out through the calapans in the upper part of the engine by a special oil tanker, which is a small manual piston pump with an oil capacity. At the same time, it is recommended to use a device for pumping oil, which allows you to simultaneously monitor its pressure inside the electric drill. It is a tee to which the hose tip from the oil tanker is connected, one of the fittings with the M10 x 1 thread is screwed into the engine valve, and a pressure gauge is screwed into the other. Before pumping transformer oil into the engine, it is necessary to visually check the purity of the oil in it, the absence of impurities of clay solution [8, 9, 10].

Transformer oil is transported and stored on the drilling rig only in an oil tanker with constant heating for winter conditions and a selikogel filter. Regardless of the oil consumption from the oil tank, it must be replaced with a new one every 3 days.

The presence of oil in the spindle compensators, gearboxes and other mechanisms mounted between the engine and the spindle is determined by measuring the oil pressure through check valves.

Air oil is pumped through valves located in the upper part of the spindle and other mechanisms using a manual oil tanker.

It is recommended to pump oil into the engine and spindle after each one way.

Before each descent of the electric drill into the well, it is necessary to check the value of the insulation resistance of the motor winding relative to the housing. In this case, it is necessary to pre-rinse and clean the contact rod with castor oil. The insulation resistance is measured by a magnetometer (at a voltage of 500 or 1000 V). The engine delivered from the workshop must have at least 50 mOhm at a temperature of +20 -25 C, the one lifted from the well must have at least 30 mOhm at a body temperature of +50 C . With a sharp decrease in the insulation resistance of the electric motor, the electric drill must be sent for repair [11].

Drill pipes with cable sections delivered to the drilling site must be subjected to (on the drilling site) preventive inspection, checking of cable section fasteners in drill pipes and checking the insulation resistance with a magnetometer for a voltage not lower than 500 V.

The measured insulation resistance between the phases and each phase relative to the ground should be at least 2000 mOhm.

Pipes with defects in cable sections, as well as pipes with sections attached without spring washers, are not allowed to be drilled.

Data on insulation resistance, oil pressure in the engine, spindle and gearbox, and on the oil pumps produced must be recorded in the trip passport and the electrician's log.

Before lowering the electric drill into the well, it is necessary to check the direction of rotation of its shaft. This is done every time there are circumstances in which it is possible to change the direction of rotation of the shaft.

The direction of rotation of the shaft is checked before the electric drill is lowered into the newly drilled well. The inspection is performed over the wellhead visually. The rotation should be clockwise when viewed from above [12, 13, 14].

It is allowed to check the direction of rotation of the shaft of the electric drill lowered into the wellhead in the direction of the action of the reactive moment. The driving rod at the moment of switching on the electric cord should move in the direction of reverse rotation of the shaft.

It is forbidden to check the direction of rotation of the shaft of an electric drill with an unfastened translator and a bit at the wellhead and above the open rotary shaft.

After building up the next pipe, when turning on the electric drill, you should also make sure that the direction of rotation of the electric drill is correct. At the same time, the direction of rotation is judged only by the action of the reactive moment [15].

At a significant depth of the well, when the action of the reactive moment on the working rod is no longer transmitted, it is necessary to check the phasing of the cable sections of all drill pipes, without exception, prepared for the build-up.

Upon completion of electrical installation work at substations, electric lines, cables and high-voltage switchgears feeding the transformer of the electric drill, it is also necessary to check the direction of rotation of the electric drill. At the same time, it is recommended to pay attention to the direction of rotation of the ground engines installed on the drilling rig.

When changing the current collector and the current supply cable, before switching on the electric cord, it is necessary to check the phasing of the current supply, starting from the contact coupling of the drive rod to the control station tires, and make sure that the phasing has not changed.

The contact rod and coupling, before screwing the drill pipes into the column, should be cleaned with brushes and lubricated with heated castor oil. Dust or dried dirt from the working surfaces of the contact joints must be removed before cleaning with castor oil.

It is forbidden to use unheated, contaminated and moistened castor oil, as this leads to an electrical breakdown of the insulation (overlap) between the contact rings and the failure of the contact connection [16, 17].

Castor oil should be heated in a special tank for heating castor oil.

When lowering the drill pipe string after screwing each plug, it is necessary to control the insulation resistance of the current supply circuit and the motor winding of the electric drill relative to the "ground". The insulation resistance of the "current supply-electric drill" system relative to the "ground" is controlled by a lamp megometer supplied complete with an electric drill control device. To do this, the noise of the tube megohmmeter is applied to one of the contact rings of the rod. As the well deepens, the insulation resistance of the "current supply-electric drill" system may decrease [18, 19].

A sharp decrease in the insulation resistance of the "current supply-electric drill" system after the build-up of the next candle indicates a defect in the cable section of the screwed candle. Such a candle must be removed, check the insulation resistance of its cable section and, if a defect is detected, send it for repair or change of the cable section.

In case of insulation breakdown, the place of damage is found using a tube megohmmeter when lifting drill pipes after flushing the contact rod of the pipe located on the elevator with water. To do this, the probe of the lamp megohmmeter is applied to each of the copper rings of the contact rod. If, after lifting one candle, the insulation resistance has sharply increased, then the breakdown, as a rule, turns out to be in the cable section of the last unscrewed candle.

Prevention of current supply on the drilling rig during operation is carried out as follows:

- at each lifting of the drill string, all contact rods in the working connectors of the candles are thoroughly washed with water, and after installing each candle on the candlestick, the contact coupling of the lower pipe is also washed with water using a flushing tube;
- at each descent of the drill string, the electrician must carefully inspect the contact couplings and rods in the drill pipes. If mechanical damage to the contact connections or other damage is detected, the drill pipe with the cable section must be replaced;
- if a thickened and contaminated castor oil film is found on the contact rings and on the rubber surface of the contact joint, it must be cleaned, rinsed with “Galosha” gasoline, then with water and re-lubricated with clean, heated castor oil;
- to prevent damage to the contact connections in non-working connectors, it is advisable to change the place of the connector in the spark plugs of drill pipes after 1-2 months;
- it is recommended at least once during the drilling period, and during deep drilling after 3-4 months of operation of the current supply, to carry out its preventive inspection, paying attention to the condition of fastening the current supply supports to the crackers in the nipples and couplings of drill locks [20, 21, 22].

At the end of drilling, the pipes together with the current supply are thoroughly washed with water until the remains of the washing liquid are completely removed from all contact connections, crackers, supports and bolts of cable sections.

Drill pipes from the drilling rig should be sent to the pipe base for preventive maintenance. It is allowed to send drill pipes directly to the next drilling rig, where they must be laid out on the receiving bridge and subjected to mandatory prevention before being introduced into further work.

The insulation of the cable sections of individual pipes is checked with a 2500 V megohmmeter with a scale of 10000 mOhm. The insulation resistance between the phases and each phase relative to the pipe body must be at least 2000 mOhm.

The cable section with low insulation resistance should be removed from the pipe and replaced with a new one.

To prevent overflow of the washing liquid when building up the next pipe, it is recommended to use the check valve KOSH-140 - with pipes H140 or KOSH-

114 - with pipes H114 and B127. The valve must be installed on the first spark plug under the drive rod. During the build-up, the valve moves down and at the end of the roundtrip it must be returned to its original position [23].

It is possible to turn on the electric drill located in the well only if there is a circulation of the washing liquid and without applying an axial load on the bit. It is forbidden to start the electric cord under load.

In order to protect electric drills from breakdowns during overloads caused by the jamming of the bit, especially when it is worn out and the tool feed rate is inappropriate, protection is applied, which is triggered after a certain time after the start of the overload.

The complete device provides:

- switching on and off of the electric drill using a push-button station from the driller's console;

-high-speed protection of the current supply-electric circuit system from short-circuit current;

- protection of the electric drill with a time delay of 2 seconds when the bit is jammed;

- overload protection with a time delay of 10 s;

- prohibition of re-activation of the electric cord after an emergency shutdown in case of a short circuit in the current supply system-electric cord;

- the possibility of sending a signal from the complete device to the remote drill for permission to start the electric drill;

- a mechanical lock between the door of the high-voltage cabinet and the disconnector prohibiting the disconnector from being turned on when the door is open and the door from opening when the disconnector is turned on;

-mechanical blocking between the disconnector and the high-voltage contactor, prohibiting disconnector disconnection when the contactor is switched on and contactor shutdown when the disconnector is disconnected [24, 25, 26];

-electrical blocking of the disconnector drive with a high-voltage contactor, prohibiting the activation of the high-voltage contactor when the disconnector is disconnected and disconnecting the high-voltage contactor when the disconnector is disconnected:

-electrical interlocks that prohibit the inclusion of the drilling transformer when the doors are open.

The complete device includes:

- control panel;

- cabinet with measuring instruments SHGS 5105-00B2;

- two push-button stations.

The operation of electric drills is economically effective for cluster drilling (construction) of wells mainly directional with mobile drilling rigs, the mouths of which are grouped at a close distance from each other from a common limited site, and the faces reveal the productive horizon at specified points in accordance with the development grid [27, 28]. The experience of work in different regions of the world demonstrates the success of the technology of cluster drilling of production wells with an electric drill with mobile drilling rigs.

In the modern period of development of the oil and gas industry, thanks to the improvement of electric drilling technologies, the development and production of new drilling equipment, chemicals and technologies, it has become possible to use innovative, previously little-known methods and techniques of well construction [29]. With the use of these advanced technologies, there are currently all possibilities for drilling directional wells with different trajectories and multi-barrel. The experience gained during the construction of an inclined-directional exploration well in southwestern Turkmenistan allowed us to conclude that it is possible to conduct prospecting and exploration work on the site of this field located in the shallow waters of the Gulf of the Caspian Sea, using inclined-directional wells with a deviation of the bottom a long distance from the vertical using electric drilling.

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