Impact Factor:					
	ISRA (India) = 6.317	SIS (USA) = 0.912	ICV (Poland) = 6.630
	ISI (Dubai, UAE) = 1.582	РИНЦ (Russia) = 3.939	PIF (India) = 1.940
	GIF (Australia) = 0.564	ESJI (KZ) = 8.771	IBI (India) = 4.260
	JIF = 1.500	SJIF (Morocco) = 7.184	OAJI (USA) = 0.350

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2023 **Issue:** 11 **Volume:** 127

Published: 03.11.2023 **http://T-Science.org**

Issue Article

Annaguly Rejepovich Deryaev
Scientific Research Institute of Natural Gas of the State Concern „Turkmengas”
Doctor of Technical Sciences, Principal researcher,
Corresponding Member of International Academy of Theoretical and Applied Sciences,
Ashgabat, Turkmenistan
annagulyderyayew@gmail.com

THE EFFECTIVENESS OF THE USE OF ELECTRIC DRILLING AND THE CHARACTERISTICS OF THEIR EQUIPMENT COMPONENTS

Abstract: *The article considers the analysis of the selection and recommendations, as well as instructions on the effectiveness of the use of the method of electric drilling and their components during the construction of wells in the Western part of the oil and gas fields of Turkmenistan to accelerate the commercial rate of penetration and reduce the time for mechanical drilling. To analyze the determination of the effectiveness of the use of electric drilling and the selection of their component equipment, materials from previously drilled wells were used and the possibility of drilling wells with electric drilling based on information received from the bottom of the well in real time was considered.*

This paper provides a detailed analysis of the efficiency of drilling by electric drilling of deep directional oil and gas wells and monitoring their trajectory in real time, and also provides recommendations and operating instructions for various types of electric drills, as well as their accessories.

This work can be used to perform the assigned tasks when drilling oil and gas wells and for accelerated field development.

Key words: *power, amperage, gear insertion, inclinometry, efficiency, curvature mechanism, bit, penetration, current supply, welding, transformer, voltage.*

Language: *English*

Citation: Deryaev, A. R. (2023). The effectiveness of the use of electric drilling and the characteristics of their equipment components. *ISJ Theoretical & Applied Science, 11 (127),* 23-32.

Soi: http://s-o-i.org/1.1/TAS-11-127-7 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2023.11.127.7

Scopus ASCC: *2209.*

Introduction

The efficiency of the hole drilling technology with the use of electric drills and mass-produced technical means is determined by:

Using gearboxes-inserts with different gear ratios, which allow drilling at optimal conditions using bits with a sealed oil-filled support, which leads to a significant increase in penetration per bit.

Using a telemetry system, which reduces the time spent on orienting the tool and increases the accuracy of the well drilling.

The use of a telemetry system allows you not to limit the amount of axial load on the bit, which contributes to an increase in penetration on the flight when working with curvature mechanisms.

At the same time, the time spent on inclinometric work is also reduced. [1, 2]

The ability to control using the energy parameters of the electric drill (power, current) for the operation of the bits, which contributes to the fullest use of their resource.

The moment characteristic of electric drills with gearboxes-inserts, which allows using the values of specific axial loads exceeding the strength limit by drilling rocks.

Using washing liquids with various additives that increase the efficiency of the drilling process [3, 4].

Low pressure drop on the engine, which allows you to realize a large hydraulic power in the hydraulic nozzles.

The possibility of using elements of the bottom of the drill string of various types, which helps to increase the durability of the bit, eliminates the need to expand and study the bottom-hole zone and improves the quality of the wellbore [5, 6].

Electric drill equipment

When drilling with the use of electric drills, standard drilling rigs (without automatic descent ascent) are additionally equipped with a complex of submersible and ground equipment made in the form of separate prefixes to the main equipment used in turbine and rotary drilling.

The ground equipment includes special power transformers for drilling with the use of TMTE 630/6 electric drills, stations and control panels for electric drills (UZEB-80 complex device), a current collector, as well as devices for caring for the electric drill and current supply.

Along with electric drills, gearboxes-inserts to the electric drill, prefixes for core sampling, check valves, insulation monitoring devices, mechanisms for stabilizing the direction of the hole, pipe logging probes and telemetry systems belong to the service complex. The use of telemetry systems makes it possible to conduct the process of drilling wells on the basis of continuous downhole information received in real time [7, 8].

The electric drill is powered by a special current supply mounted inside the drill pipes. Electricity is transmitted through the two wires-a pipe system.

For the installation of the current supply, measuring drill pipes equipped with locks are used.

Operating mode of electric drills

The correct choice of the operating mode of the electric drill has a significant impact on its service life and the efficiency of the bit. The operating mode of electric drills is selected based on the conditions for ensuring rational operation of the bits, while also taking into account the operating conditions of electric drills, which, if possible, should not differ significantly from the nominal parameters of the electric motor [9, 10].

Operating instructions

1.When setting up overload protection and charging the electric drill, the current setpoint should be calculated for a long-term permissible current value of 140A.

2.When setting up short-circuit protection, the calculation of the current rate should be carried out according to the values of the starting currents given in Table 1 by taking into account the depth of the face and the gear ratio.

3.The installation of the required voltage value on the TMTB-630 drilling transformer should be carried out taking into account the depth of the face and the gear ratio of the gearbox.

4.The correctness of the value of the set voltage should be monitored by the value of the idling current of the electric drill motor in the downhole zone. If the no-load current is underestimated in comparison with the above, the voltage on the drilling transformer should be increased, if it is increased, the voltage on the drilling transformer should be reduced [11, 12].

Technical data of the equipment used in drilling wells using electric drills

The electric drill is a submersible downhole unit designed to rotate the bit when drilling wells. It consists of an asynchronous three-phase oil-filled motor with a short-circuited rotor and an oil-filled spindle. Between the motor and the spindle, in case of technological necessity, insertion reducers IR (single or double), curvature mechanisms MC or SE stabilizers are installed to maintain a given direction of the wellbore trajectory.

The connection of the electric motor and the spindle and the mechanisms mounted between them (IR, MC, SE) is carried out by means of body threads, and their shafts by means of a toothed coupling and a hinged sleeve with rubber rings. The shaft of the electric drill is full, through the hole of which a washing agent is supplied to clean the well bottom.

In the upper part of the electric drill there is a translator with a neck for grabbing an elevator, ending with a lock nipple for connection to drill pipes. In the nipple of the translator there is a contact rod of the cable entry.

The cavity of the electric motor is filled with transformer oil (TKP) or aviation oil of the MS-20 brand (MK-22) with electrical strength (50 Hz purity and 20 C temperature (not lower): kW. The pressure in the cavity of the electric motor must exceed the external pressure by a value of 0.294- 0.049 MPa (3.0-0.5 kgf / cm^2).

The electric drill spindle is used to transfer the axial load created by part of the weight of the drill string through the body of the electric drill to the bit, bypassing the rotor of the electric motor, as well as to transfer torque from the electric motor to the bit [13, 14]. The spindle cavity is filled with MS-20 (MK-22) aviation oil. The pressure in the spindle cavity must exceed the external pressure by a value of 0.294-0.049 MPA (3.0-0.5 kgf/cm^3).

The oil pressure in the cavity of the electric drill must be monitored using a pressure gauge and by the amount of compression of the compensator spring.

The body of the electric drill must be grounded by connecting to a circuit whose grounding should not exceed 0.66 ohms.

Electric drill current supply

The current supply is used to transmit electricity and electric drill using a string of drill pipes.

The current supply consists of separate cable sections mounted in drill pipes used as an electrical wire for the "two wires - pipe" power supply system.

The current supply is designed to transmit electricity at a frequency of 50 Hz with a voltage of up to 3000V, a current of 165 A with a short-term increase (within 3 seconds) to 400A.

Cable sections can be operated at hydraulic pressure up to 115 MPa (1150 kGf/cm^2) and ambient temperature up to 100 C.

The cable section KST1 consists of a segment of a two-core hose cable of type 4 KTSHE 2x50 or two segments of a single-core circular cable of type KTSHE 1x50, a two-pin rod, a two-pin coupling to the ends with a support for fastening in a drill lock [15, 16].

Decoding of the designation: C-cable, S-section, T-current supply, 1-modification number.

KST1 cable sections are used in a set with drill pipes (B127) and H140.

Drill pipes with planted inner ends B127x10 are made of the same length 12000 + 50 mm.

Drill pipes H 140x10 are made of two lengths: 11950 + 50 mm and 12050 + 50 mm.

On the pipes with a length of 12050, one identification belt is applied with red paint, on the pipes with a length of 11950 mm - two belts.

Drill locks of type ZE1-155 are used for pipes B127 and D167, 129, and locks of type ZE1-185 are used for pipes H140.

A power transformer for an electric drill.

The three-winding power transformer TMTB-630/6 with a capacity of 630 kW, 155 A, 600/1100 - 2300/525 V serves to power the electric drill and the winch motor.

The middle winding (MW) has 25 steps of 50 V to regulate the voltage during drilling.

Voltage regulation of the power supply windings of the electric cord (CH) in the range from 1100 to 2300 V is carried out in 25 steps of 50 V at each stage.

If it is necessary to expand the limits of voltage regulation, counter or consonant activation of the MW and low winding (LW) is possible. In this case:

- with a consonant switch-on, 910 V is added to the voltage of the MW winding:

- with a counter switch - 910 V is deducted . The presence of an additional 115 and 230 V winding at the "B" phase in the case of phase misalignment makes it possible to compensate for voltage asymmetry in the "current supply-electric drill" system [17, 18].

Complete UZEB-80 U2 Device (UZEE-65MU2)

The complete UZEB80 U2 device is designed to control and protect all types of electric drills used in drilling oil and gas wells.

According to its technical level, the complete device UZEB-80U2 has operational advantages compared to the complete device UZEB-65 G1U2.

Elements of increased reliability have been introduced into the UZEB-80. Instead of relay contactor elements, the protection system is made on integrated circuits of increased reliability. The use of a block design of the control and protection device reduces downtime on drilling rigs during installation, commissioning and repair, does not require special commissioning equipment and qualified adjusters.

Reducer-insert (RI)

Reducer inserts are designed to reduce the rotation speed of the rock-crushing tool and increase the torque of the electric drill. They are installed between the motor and the spindle of the electric drill. Technical data and characteristics of planetary oil-filled gear inserts are given in Table 2.

The electric drill can use two sequentially connected gearboxes with different gear ratios, which provides a wide range of fixed bit rotation speeds.

The efficiency of planetary gearboxes is 0.90-0.94.

To limit the maximum torque of the electric drill when using gearboxes, the rated voltage of the electric motor must be lowered.

Mechanisms of curvature (MC)

The curvature mechanisms are designed to force the curvature of the wellbore trajectory, cutting new holes and combating the curvature of the well. They are made in diameters corresponding to a number of electric drills in 1; 1.5; and 2-degree versions and are installed between the motor and the spindle of the electric drill, when using gearboxes-inserts - between the gear spindle.

Electric drill current collector (TE)

The current collector is designed to transfer electricity from a stationary system - a current supply cable to a rotating system -a current supply in drill pipes, as well as the transition from a three-phase system to a “the two wires-a pipe” system by grounding the lower contact ring. Connection of the current collector to the supply line is carried out by a three-core cable of the KTHSE 3 x 50. The current collector is mounted directly under the swivel. Its body is protected from turning by two special tubes attached to the swivel and pantograph housings. In order to avoid chafing of the insulation hose shell, the cable is attached at the two extreme points so that it does not touch the mortar hose [19, 20].

Core sampling device

Core sampling during electric drilling is carried out using a special device SK-164/80. This device is a modified design of the core collector SK-164/80 ED in relation to the electric drill (the connecting adapters have been changed and the valve has been installed). The core collector is manufactured in a single-section design.

By screwing an additional section of the housing and the core intake pipe, it can be assembled in a 2-3 section design. Depending on the design, it has a core intake pipe length of 8200, 16400 and 24600 mm, respectively.

Devices and devices for the care of electric drill and current supply

A complex of special devices and devices is used for the maintenance and maintenance of electric drills and current lines, including:

-a device for measuring and pumping oil into the engine, spindle and gearbox-an electric drill insert. It is a tee, one process of which is screwed into the valve of the motor or spindle by means of an M10xl thread, and a pressure gauge for measuring oil pressure and a hose from a hand pump are connected to two others;

-tanks with a manual pump and electric heating for pumping transformer oil into the electric drill engine and oil MS-20 into the spindle and gearbox insert;

-a device for heating and filtering castor oil, which is powered through a separation transformer at a voltage of 220 V;

-ring brushes and brush brushes for cleaning and lubrication of contact (rods and couplings) connections of the current supply;

-pressure gauges for measuring the insulation resistances of the current supply.

Setbacks, racks for laying drill pipes

Drill pipes are installed on the setback with locking couplings down. The design of the setback provides for the possibility of installing HI40 drill pipes with locking couplings having an outer diameter of 185 mm. To install drill pipes B127 with locks with a diameter of 155 mm, special guide strips must be mounted on the base of the candlestick. The device of the setback should provide the possibility of flushing the contact muff sections in the drill pipes with special devices [21, 22].

Racks for laying drill pipes should have horizontal sections along the length of the pipe And be located so as to make it convenient to replace damaged cable sections in drill pipes, for which it is necessary to provide an approach to the pipes from both ends. Pipes on the walkway are laid with a lock nipple to the drilling rig.

Check valve ball type (CHVB)

The ball check valve is installed in a string of drill pipes with a current supply and is designed to prevent the reverse movement of the flushing fluid during the build-up, descent and lifting operations and blowout.

When using gearboxes-inserts, restrictions are introduced related to their strength, which is carried out by reducing the value of the supply voltage.

The choice of the voltage value at the terminals of the secondary winding of the TMTB-630/6 transformer for powering the electric drills used depending on the drilling depth is made in accordance with which the values of the idle current of the electric drill corresponding to these voltages and the of the magnitude of the no-load current of the electric drill [23, 24].

According to the correspondence of the actual values of the no-load current indicated in Tables 1 and 2, the correctness of the voltage selection is judged.

Selection of the drilling transformer voltage during operation of the electric drill E 240-12 V 5 (140 kW,1450 V,135 A,450 rpm, efficiency = 65, 57., Co =0.63)

Table 1. Selection of the power current, idling during operation of electric drills

Drilling depth, m	Without reducer		
	Electric drill data		
	Transformer voltage, V	Inrush current , A	Idle current, A
0	1550	315	113
1000	1700	315	125
3000	1800	280	130
4000	1800	252	125
5000	2000	257	148

Table 2. Selection of the power current, voltage idling during operation of electric drills

Drilling depth, m	Without reducer			Gear ratio		
	Electric drill data			I=1,75		
	Voltage V	Inrush current, A	Idle current, A	Voltage V	Inrush current, A	Idle current, A
0	1350	310	95	1300	309	95
1000	1550	314	137	1350	287	105
2000	1550	286	135	1500	290	115

3000	1550	256	133	1550	297	126
4000	1700	254	138	1700	254	138
5000	1880	249	147	1800	249	147

Continuation of table 2.

Drilling depth, m	Gear ratio					
	I=3			I=10		
	Voltage V	Inrush current, A	Idle current, A	Voltage V	Inrush current, A	Idle current, A
0	990	240,9	89	600	139,7	34
1000	1090	240,3	98	650	134,5	39
2000	1200	234,6	107	700	129,5	43
3000	1300	226,4	119	750	126,4	45
4000	1400	221,3	128	800	121,6	49
5000	1500	216,2	139	850	118,5	57

The choice of the drilling transformer voltage during operation of the electric drill E190-8MB5 with gearboxes having different gear ratios is shown in Table 2.

The choice of the transformer voltage of the drilling transformer during operation of the electric drill E190-8M2-B5 (106 kW 1140 V, 121A, 660 rpm, efficiency-69.5 Cos = 0.64) without a reducer and with reduceres having different gear ratios is shown in Table 3.

Table 3. Selection of the transformer of electric drills

Drilling depth, m	Without reducer and with reduceres with gear ratio I=2, I=3			With reducer I=10 Electric drill data		
	Electric drill data			I=1,75		
	Voltage V	Inrush current, A	Idle current, A	Voltage V	Inrush current, A	Idle current, A
0	1250	374	102	1100	310	80
1000	1350	348	115	1100	304	75
2000	1450	344	118	1200	292	79
3000	1550	338	121	1350	290	97
4000	1650	332	124	1500	287	115
5000	1750	317	150	1600	277	125
6000	1850	305	165	1700	267	133

The choice of the drilling transformer voltage during operation of the electric drill E164-8MV5 (71 kW 1000 V, 73A without gearboxes and with gearboxes having different gear ratios and overall, installation dimensions and weight of electric drills is shown in Tables 4 and 5.

Table 4. Selection of the drilling transformer voltage when operating an electric drill without reducer and with reduceres having different gear ratios and overall dimensions

Drilling depth, m	Gear ratio					
	I=3			I=10		
	Voltage V	Inrush current, A	Idle current, A	Voltage V	Inrush current, A	Idle current, A
0	300	60	640	174	21,2	
1000	1100	263	58	740	170	25,3
2000	1100	227	55	840	167	29,1
3000	1200	217	62,1	940	161	32,5

4000	1300	212	69,7	990	151	36,4
5000	1400	202	78,2	1040	143	42,0
6000	1500	198	89,5	1150	141	49,2

Table 5. Selection of the drilling transformer voltage when operating an electric drill without reducer and with reduceres having different gear ratios and overall dimensions

Name of the parameter	The norm for an electric drill type			
	E164-8-V5	E190-8-V5	E240-8M-V 5	Э290-12АМ-В5
Diameter of the electric cord, mm	164	190	240	290
Length of the electric drill, mm	11700	12900	13600	12600
Thread A on the upper adapter	З-133	З-147	З-171	З-189
Thread B on the adapter for the chisel	З-117	З-117	З-152	З-177
Weight of the electric drill, kg, 5%	1500	2200	3600	4500

Characteristics of the TM-630/6 transformer, technical data of planetary reducer–inserts, types of single and double curvature mechanisms are shown in Tables 6, 7.

The standard sizes of the bending mechanisms used and their technical characteristics are given in the tables 8, 9.

Table 6. Characteristics of the TM-630/6 transformer

Name of parameters	**Norms**
Rated power, kVA	630
Rated voltage of the high voltage winding, V	6000
Rated voltage, V	1100-2300
Rated voltage of the low voltage winding, V	525
Diagram in the winding connection group	/ /-0-11
The rated current of the high voltage winding, A	60,7
The rated current of the medium voltage winding, A	155
The rated current of the low voltage winding, A	630
The voltage regulation limits of the medium voltage windings and the number of steps	50 to 25 steps
Additional windings for balancing electric drill currents	115 and 230V
Overall dimensions in mm, (height, length, width)	2735x2635x12
Transformer weight, kg	5500

Table 7. Technical data of planetary (RI) reducer –inserts

Type of reducer	Gear ratio	Output shaft rotation frequency		Nominal moment	Maximum kN (ts)
		0,017s-1	rpm		
RI 164 – 3MV5	3	3,74	220	-	-
RI 164 - 10 MV 5	10	1,19	70	4000 (400)	250 (25)
RI 185 – 2 MV 5	2	6,12	360	3600 (360)	250 (25)
RI 185 – 3 MV 5	3	4,08	240	5400 (540)	300 (30)
RI 185 – 10V5	10	1,19	70	5400 (540)	300 (30)
RI 190 – 10V5	10	1,27	75	4500 (450)	300 (30)
RI 125 – 3 MV 5	3	3,74	220	7500 (750)	350 (35)
RI 240 – 2 MV 5	2	5,85	345	5900 (590)	350 (35)

RI 240 – 3 MV 5	3	4,25	250	8850 (885)	400 (40)
RI 290 – 2V5	2	3,825	225	1000 (100)	400 (40)
RI 290 – 3 MV 5	3	2,55	150	1157 (116)	400 (40)

Table 8. Single curvature mechanisms

Designation	Angle of curvature, degrees
MI 164 – 185	1
MI 164 – 1, 5V5	1,5
MI 185 – 1 V 5	1
MI 185 – 1, 5 V 5	1,5
MI 215 – 1 V 5	1
MI 215 -1,5 V 5	1,5
MI 215 – 2 V 5	2
MI 240 – 1 V 5	1
MI 240 – 1,5 V 5	1,5
MI 240 – 2 V 5	2

Table 9. Double curvature mechanisms

Designation	Angle of curvature, degrees
MI 164 – 1 – 1V5	1
MI 164 – 1 - 1, 55V5	1,5
MI 164 – 1 - 2V5	2
MI 185 – 1 - 1V5	1
MI 185 – 1 – 1,5V5	1,5
MI 185 -1 - 2V5	2
MI 215 – 1 - 1V5	1
MI 215 – 1 – 1,5V5	1,5
MI 215 – 1 - 2V5	2
MI 240 – 1 - 1V5	1
MI 240 – 1 -1,5V5	1,5
MI 240 – 1 – 2V5	2

To work with a two-wire current supply without an upper grounding adapter, a current collector TE-2MV5 is used. The third phase is grounded directly in the current collector.

A current collector of the TE-ZMV5 type is used to work with a two-wire current line with an upper grounding adapter, see Table 10

Decoding: T-current collector; E - electric drill; 2 or 3-number of cable entry contacts; M-modification; B-climatic version; 5 - placement category.

The connection of the drill pipe column to the phase must be carried out in the pantograph by attaching its ring marked "B" to the shaft of the pantograph with two copper conductors with a cross section of 35 mm^2 each.

Table 10. Parameters of the current collector TE-2V5

Name of parameters	Norms
Voltage between the rings, V	2500
Current. A	200
The current is maximum, short-term, And	600
The maximum pressure of the washing liquid, kgf / cm^2	350
Shaft rotation speed (maximum), rpm	200

The weight of the tool held by the pantograph, t	300
Resource before write-off, h	1000
Time to failure, h	200
Weight, kg	450

Device for monitoring the isolation and position of the DMIO type diverter.

The DMIO is designed to monitor the insulation resistance of the current supply and the winding of the electric drill when it is powered according to the " two wires-a pipe " scheme, as well as to measure the angle of the deflector position and the zenith angle of the well during drilling.

The structure of the DMIO includes a deep device and a ground device. A device without a unit is used only for insulation control.

DMIO are used with diameters of 127, 164 and 215 mm. Moreover, DMIO 164mm can be used to work with an electric drill with a diameter of 185 (190 mm), and DMIO 215 mm for working with an electric drill 240 mm. The parameters of the DMIO 164 mm and 215 mm are shown in Table 11.

Table 11. DMIO parameters are 164 mm and 215 mm

Name of parameters	Norms
Operating current at a temperature of not more than 90 C, A.	from 50 to 200
The circulating fluids	from 0 to 360 from 0 to 120
DMIO 164 UZ DMIO 215 UZ	
Measurement limits:	
- angle of installation of the deflector, degree	
- zenith angle, degree	

The electrical circuit for switching on the telemetry system is given for the communication channel is the current supply of the electric drill.

With the help of telesystems, zenith angles up to 55 degrees, the azimuth of the system and the angle of installation of the deflector in the range from 0 to 360 degrees are measured. The relative infallibility of the measurement is no more than 2.5 degrees.

Telesystems are available in diameters of 164, 185 and 215mm, their data are given in Tables 12, 13.

The technical characteristics of the check ball valves are given in table 14.

Table 12. Technical data of STE with a diameter of 164, 185 and 215 mm

Type	Thread	D, mm	Z, mm	L, mm	Weight, kN
STE -164	3-133	164	10020	9520	900
STE -185	3-147	185	10545	10045	800
STE -215	3-171	215	9942	9512	1300

Table №13. Technical data of the STE with a diameter of 164, 185 (190) and 215 mm

Name of parameters	Norms
Measurement limits: - zenith angle of the well, degree from 0 to 55 (from 0-110) from - azimuth (magnetic) boreholes, degree 0 to 360 from 0 to 360 - angle of installation of the deflector, degree Measurement error: - zenith angle of the well, no more - azimuth (magnetic) of the well, no more Angle of installation of the diverter, no more	 from 0 to 55 (from 0-110) from 0 to 360 from 0 to 360 2,5 2,5 2,5 2,5 – 2,5

Table 14. Technical data of CHVB

Name of parameters	Norms	
	CHVB 114-B5	**CHVB 140-B5**
Outer diameter of the body	155	185
Valve ,mm	2020	2020
Length, mm	25	40
Maximum axial load, ts	150	150
Maximum pressure drop, kgf/cm^2	5	5
Maximum closing pressure, kgf/cm^2	180+20	221+20

References:

1. Basarygin, Yu.M., Bulatov, A.I., & Proselkov, Yu.M. (2000). *"Oslozhneniya i avarii pri burenii neftyanyh i gazovyh skvazhin"*
2. Vadeckij, Yu.V. (1985). *Burenie neftyanyh i gazovyh skvazhin.* (pp. 326-333). M.: Nedra.
3. Deryaev, A.R. (2022). *Vskrytie produktivnyh gorizontov burovym rastvorom na uglevodorodnoj osnove dlya odnovremenno-razdel'noj ekspluatacii.* Sbornik statej Mezhdunarodnoj nauchno-prakticheskoj konferencii "Nauka v sovremennom obshchestve: zakonomernosti i tendencii razvitiya". (pp.35-39). Ufa: Izdatel'stvo OOO "Omega sajns".
4. Deryaev, A.R. (2022). *Sovremennoe sostoyanie izuchennosti bureniya napravlennyh i mnogozabojnyh skvazhin s razdel'noj ekspluataciej odnovremenno neskol'kih gorizontov (zarubezhnyj opyt).* Sbornik statej mezhdunarodnogo nauchno-issledovatel'skogo konkursa "Akademicheskaya nauka na sluzhbe obshchestvu". (pp. 170-178). Petrozavodsk: Nauchnoe izdanie: MCNP "Novaya nauka".
5. Gandzhumyan, R.A., Kalinin, A.G., & Serdyuk, N.I. (2007). *Raschety v burenii*. (p. 668) M.: RGGRU.
6. Gol'dberg, B.G., & Skvorcov, N.P. (1986). *Pronicaemost' i fil'traciya v glinah*. Moskva: Nedra.
7. Deryaev, A.R. (2022). Rekomendacii po kompleksnomu vnedreniyu s razdel'noj ekspluataciej odnovremenno neskol'kih gorizontov na gazovyh mestorozhdeniyah Turkmenistana. *Problemy nauki* №1(69) – M: Izdatel'stvo "Problemy nauki". pp. 16-21.
8. Aziz, H., & Settari, E. (1982). *Matematicheskoe modelirovanie plastovyh sistem.* (p. 408). M.: Nedra.
9. Iogansen, K.V. (1986). *Sputnik burovika*. 2-e izd., pererab. i dop., M.: Nedra.
10. Deryaev, A.R. (2022). Tekhnologicheskie i tekhnicheskie problemy, svyazannye s provodkoj gorizontal'nyh skvazhin elektroburom i puti ih resheniya. *UNIVERSUM; Tekhnicheskie nauki* №1(94) chast' 3. M: Izdatel'stvo "MCNO". pp. 46-49.
11. Deryaev, A.R. (2022). *Osobennosti bureniya naklonno-napravlennyh skvazhin i tekhnologiya ih odnovremennoj razdel'noj ekspluatacii.* "Fundamental'naya i prikladnaya nauka: sostoyanie i tendencii razvitiya". Monografiya. (pp.76-96). Petrozavodsk: Nauchnoe izdanie: MCNP "Novaya nauka".
12. Bulatov, A.I., Izmajlov, L.B., & Lebedev, O.A. (1979). *Proektirovanie konstrukcij skvazhin*. M.: Nedra.
13. Bunyak, B.T., Sel'vashchuk, A.L., & Bondarenko, A.P. (1983). *Vybor racional'noj konstrukcii skvazhin pri burenii na Krestishchenskom gazokondensatnom mestorozhdeniya.* seriya "Burenie", vyp.12. (pp. 3-4). M.: VNIIOENG.
14. Deryaev, A.R. (2022). Treatment of drilling mud with "PACS-T" additive. "Innovative approaches in the modern science" Proceedings of CXV international scientific – practical conference. *International scientific journal* №7 (115) – M: pp. 74–77.
15. Deryaev, A.R. (2022). Zadachi issledovaniya dlya metoda odnovremennoj razdel'noj ekspluatacii mnogoplastovyh mestorozhdenij. *Innovacionnye nauchnye issledovaniya* №2-2(16) – Ufa: Nauchno-izdatel'skij centr "Vestnik nauki". pp. 43–51.
16. Deryaev, A.R. (2022). *Rekomendacii po burovomu rastvoru dlya bureniya sekcii 295,3 mm otkrytogo stvola naklonno-napravlennoj skvazhiny*. Sbornik statej II Mezhdunarodnoj nauchno-prakticheskoj konferencii "Nauka, obshchestvo, tekhnologii: problemy i

perspektivy vzaimodejstviya v sovremennom mire". (pp.7-11). – Petrozavodsk: Nauchnoe izdanie: MCNP "Novaya nauka.

17. Deryaev, A.R. (2022). *Rekomendacii po bor'be s pogloshcheniem pri burenii naklonno-napravlennyh skvazhin.* Sbornik statej Mezhdunarodnoj nauchno-prakticheskoj konferencii "Instrumenty i mekhanizmy sovremennogo innovacionnogo razvitiya". (pp.62-65). Ufa: Izdatel'stvo OOO "Omega sajns".
18. Bliznyukov, B.Yu. (1983). *Issledovanie i razrabotka racional'nyh konstrukcij glubokih skvazhin v slozhnyh geologicheskih usloviyah.* M.: VNIIBT, 1983. Avt.ref. № 187824.
19. (1976). *Instrukciya po raschetu obsadnyh kolonn dlya neftyanyh i gazovyh skvazhin.* Rukovodyashchij dokument, VNIIT neft'. – Kujbyshev.
20. Deryaev, A.R., & Orazklychev, K. (2015) *Sposob odnovremenno-razdel'noj dobychi nefti i gaza iz mnogoplastovoj zalezhi odnoj skvazhinoj.* Patent № 644 ot 08.06.2015. (nomer zayavki 15/101320).
21. Deryaev, A.R., & Orazklychev, K. (2015) *Sposob odnovremenno-razdel'noj i sovmestnoj ekspluatacii neskol'kih produktivnyh gorizontov odnoj skvazhinoj i ustrojstvo dlya ego osushchestvleniya*. Patent № 643 ot 08.06.2015. (nomer zayavki 14/101317).
22. Deryaev, A.R. (2022). *Industrial tests of oil-base spacer fluid (ODSF) used to remove oil-base drilling mud (OBM).* "Prospects and key tendencies of science in contemporary world". XVI International Multidisciplinary Conference. (pp. 34–38). Spain – Madrid: Publishing house: «Internauka».
23. Buzinov, S.N., & Umrihin, I.D. (1973). *Gidrodinamicheskie metody issledovaniya skvazhin i plastov*. (p. 247). M.: Nedra.
24. Deryaev, A.R. (2022). Ohrana nedr i okruzhayushchej sredy pri razrabotke gazovyh mestorozhdenij metodom odnovremennoj razdel'noj ekspluatacii. *Nauchnyj zhurnal Metod Z* №2(4) – Sankt-Peterburg: Izdatel'stvo: GNII «Nacrazvitie». pp. 12-14.