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ISSN 3030-3907

OCHIQ KON KORXONALARIDA BURG‘ULASH ISHLARIDA ISHLATILADIGAN SHAROSHKALARNING TURLARI VA ULARNING SAMARADORLIGI

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Annotatsiya. Ushbu maqolada ochiq kon korxonalarida burg‘ulash ishlarida qo‘llaniladigan dolotalarning asosiy turlari, ularning tuzilishi, texnik xususiyatlari hamda qo‘llanish sohalari ilmiy jihatdan tahlil qilingan. Uch sharoshkali (roliklikonus) dolotalar, PDC dolotalar va olmosli dolotalarning konstruktiv farqlari, ish printsiplari va iqtisodiy samaradorligi Angren ko‘mir koni ochiq razrezi misolida qiyosiy ko‘rsatkichlar asosida o‘rganilgan. Maqolada dolotalar yeyilishining asosiy turlari, ularning sabablari va burg‘ulash rejimlarini optimallashtirish bo‘yicha tavsiyalar keltirilgan.

Kalit so‘zlar: burg‘ulash, dolota, sharoshka, ochiq kon, PDC dolotalar, olmosli dolotalar, yeyilish, burg‘ulash rejimi, Angren razrezi.

Аннотация. В данной статье с научной точки зрения проанализированы основные виды долот, применяемых при бурении на открытых горных предприятиях, их конструкция, технические характеристики и области применения. Конструктивные различия, принципы работы и экономическая эффективность трехшарошечных (ролико-конусных) долот, долот PDC и алмазных долот изучены на примере открытого разреза Ангренского угольного месторождения на основе сравнительных показателей. В статье представлены основные виды износа долот, их причины и рекомендации по оптимизации режимов бурения.

Ключевые слова: бурение, долота, шарошка, открытое месторождение, долота PDC, алмазные долота, износ, режим бурения, Ангренский разрез.

Annotation. In this article, the main types of drillholes used in drilling operations in open pit mining enterprises, their structure, technical properties and application are scientifically analyzed. Constructive differences, principles of work and cost-effectiveness of three-ball (roller-cone) dolotes, PDC dolates and diamond dolates were studied on the basis of comparative indicators on the example of open pit

Angren coal mine. The article presents the main types of drill holes, their causes and recommendations for optimizing drilling regimes.

Keywords: drilling, drilling, drilling, drilling, open pit, PDC drills, diamond drills, drilling, drill mode, Angren drill.

Abstract. This article provides a scientific analysis of the main types of drill bits used in drilling operations at open-pit mining enterprises, including their structure, technical characteristics, and application areas. The structural differences, operating principles, and economic efficiency of tricone (roller-cone) bits, PDC bits, and diamond bits are studied on the basis of comparative indicators from the Angren coal mine open pit. The article presents the main types of bit wear, their causes, and recommendations for optimizing drilling modes.

Keywords: drilling, drill bit, roller cone, open pit, PDC bits, diamond bits, wear, drilling mode, Angren open pit.

INTRODUCTION.

In the modern mining industry, open pit mining method is increasingly using the method. Every year in the Republic of Uzbekistan, especially at large enterprises such as Angren coal mine, production of coal and vascular rocks by open mining method increases every year. This enterprise provides about 80% of the total production of coal in the country, and more than 25% of the electricity produced in the country comes from Angren coal combustion [1, 2].

The initial and most important stage of the extraction process is the drilling works that are carried out in preparation for blasting. The efficiency of our drilling work largely depends on the correct choice of the drilling equipment used. Depending on the constructive type of drilling, drilling speed, energy consumption, instrument lifetime, and the economic costs per 1 meter passage can vary dramatically [3, 4].

In the Angren razre, there is a frequent alternation of rocks with a hardness of f = 1 to 12. This puts high and controversial demands on drill rigs: it is necessary for the drill to work effectively on both soft and hard and abrasive rocks at the same time. In this case the scientific and practical task is considered to be the optimal type of dam for the geological and technical conditions of each mining enterprise [5, 6].

In this study, a comparative analysis of three-shed, PDC and diamond dolates was carried out based on the data of drilling operations carried out in the conditions of open pit mining of the Angren coal deposit. The indicators and conclusions used in the article are based on the authors' previous scientific works as well as modern international literature [6, 7, 8].

GEOLOGICAL AND TECHNICAL CONDITIONS OF ANGREN RAZRE.

ISSN 3030-3907

Angren coal mine located in Tashkent region is one of the main coal mining base in Uzbekistan. The geological structure of the deposit is influenced by the Paleozoic bedrock and the Meso-Cenozoic overlay. The total thickness of the cover varies from 180–200 m on the left bank side to 450–500 m on the right bank side [1, 2].

In the stratigraphic section, there is a frequent alternation of rocks of different genesis and lithological composition: igneous, metamorphic, sedimentary cemented and fragmented, related and artificially dispersed rocks. In the cross-section of the coal shaft, 'High' and 'Mighty' complexes are distinguished, which are complicated by dilution zones [2, 3].

Brands such as SBSh-250, SBSh-250, MNA-32, BTS-150, DXA-165, PR-10 and Atlas Copco DM-45 are used as drill rigs. To prepare for blasting works, wells with a diameter of 215.9 mm to 295.3 mm are drilled [4, 5].

Table 1.

Characteristics of the geological section of the Angren Valley

Breed type	Thickness, m	Hardness (f)	Contents
Gravel sediments	55–80	2–4	Boulders, gravel, sand
Upper coal complex	5–40	1–3	Coal, clay, sandstone
Sandstone and limestone	20–60	5–8	Cemented sandstone
Hard basic rocks	50–120	8–12	Limestone, granite
'Gliyazh' (burnt rocks)	variable	6–10	Thermally Changed Rocks

TYPES OF VALVES USED IN OPEN PIT

Three-ball (roller-cone) cylinders

Three-shallow drums are the most common type of instrument in open pit drilling operations. Their design consists of three rotating cone-waterfalls, each waterfall rotating freely around its axis and attached to the body of the dolota through the blades. During the rotation of the dolota, the balloons perform a complex movement both around their axes and around the main axis, which ensures that the teeth act on the rocks with the force of the blow and the force of the ball [5, 6].

According to the material of the teeth, the cabinets are made of two types. The first type are steel threaded (milled) drums, which are used on rocks of soft and medium hardness; The teeth are made by milling directly from the steel body

ISSN 3030-3907

of the waterfall. The second type are solid alloy gear coils, which consist of pressed gears made on the basis of tungsten carbide (WC); Used on extremely hard and abrasive rocks. The leading position in the Russian market is occupied by OJSC manufacturer of Volgaburmash [5].

Table 2.

Types and applications of three-valve valves

Type	Hardness (f)	Breed type	Tooth material	Drilling speed
M	1–3	Clay, sand, chalk	Steel (milled)	High
MZ	3–5	Soft sandstone, clay-stone	Steel+Solid Alloy	Upper-Medium
T	5–8	Sandstone, limestone	Solid Alloy (WC)	Medium
TZ	8–12	Granite, quartzite	Solid Alloy (WC)	Low-medium
OK	> 12	Extremely hard rocks	WC+ diamond finish	Low
OKZ	> 12	Abrasive, Extreme Rigid	WC+ diamond finish	Low

In the Angren fault, mainly T-type dolates are used in layers of rocks with variable hardness f = 1-12, since they are intended for medium and hard rocks. However, in soft layers, an M-type dolota can be much more effective. As a technological limitation, it should be noted that in wells of small depth it is not advisable to replace the dolota, therefore often a T-type dolota is used, calculated for a layer with a hardness of f = 8-10. As a result, the potential potential of the three-hole drilling method is not fully exploited [5, 6].

Grooves are an expensive tool, and the service life of their different elements differs from each other. The share of costs that go into drilling and drilling equipment is usually 20-40 percent, and in some conditions it can even exceed 50 percent. This situation further increases the economic importance of the right choice of drilling equipment [5].

PDC (polycrystalline diamond compact) cabinets

PDC drills are modern drill tools equipped with cutting edges (catters) made of polycrystalline diamond compacts, which operate without base parts. These types of dumps have become widespread in the oil and gas and mining industries in recent decades. PDC catters consist of a polycrystalline diamond sheet deposited on a tungsten carbide substrate, providing high hardness and edible resistance [7, 8].

ISSN 3030-3907

The leading manufacturers of the market are Baker Hughes, Smith International, Reed-Hycalog, and Halliburton. Foreign firms produce valves of type PDC without hydraulic monitors and bases. When using such cartridges, the drilling mode also changed: mainly due to the good cleaning of the cartridge, the bullet load was increased. At the same time, the velocity of the upstream is 0.6-1.2 m/s in the ground cavity [8].

Table 3.

Comparative figures of PDC and three-sheds (Market area, 295.3 mm, 1253-2220 m) [6]

bullet	**Three-stroke III-295.3 mm**	**PDC FS 16065 DHIU**
Number of used cupboards	5 pcs	6 pcs
Total jump, m	391	967
Average Transition/Rollover, m	78,2	161,2
Mechanical drilling speed, m/hr	1,05–3,63	2.86 (average)
Bullet Load, t	3–10	3–5
Rotational frequency, hm/min	40–100	80–100
Solution consumables, l/h	30–45	42
Number of SPO flights	135–140	3
Drill period, 24 hours	~48	24,8

According to the analysis, the PDC drills allow for drilling on average 3 times faster and the number of flights is significantly reduced. A large number of SPO operations result in a waste of time and resources. Although 135–140 flights were made in wells drilled with three-balloon dololas, the PDC drilled the same depth with only 3 flights [6, 7].

Also, experiments conducted at the Ruboi well show that increasing the rotation speed to 140 µl/min did not have a significant effect on the drilling speed, but rather increased the vibration of the instrument and equipment. This shows the practical value of determining the optimal rotation mode [6].

Diamond cabinets

Diamond bits make up the third main type of drilling equipment. In drilling of oil and gas wells, diamond belts began to be used a lot. For different rocks and well trunk parts, appropriate drill holes are used, which ensure maximum drilling speed under certain conditions [7, 8].

ISSN 3030-3907

According to their design, diamond carvings are of two types. In a single-layer (monoclay) cylinder, diamond grains (size 2-3 mm) are placed in a layer on the surface of the tool: for bonding only the surfaces that are touching the rock being drilled. On the impregnated canvas, small diamond grains (up to 1000 grains per 1 carat) are placed on the superficial layer of a matrix 5-6 mm thick. When using fine grains, they are placed on the superficial layer of a matrix about 5-6 mm thick [8].

The main advantage of diamond dolates over triangular dolates is that they make it possible to achieve more than a dozen times more passes in one flight under suitable geological conditions. This is done at relatively low bullet loads and satisfactory mechanical drill speeds. At diamond drilling, the number of accidents is significantly reduced; This is due to the continuity of drilling on the one hand, and a relatively small bullet load on the other [7, 8].

Table 4.

Main technical characteristics of Dolota types comparison table

bullet	**Three Waterfalls**	**PDC**	**Diamond**
Shear Mechanism	Shock + Mad	Trimming (smooth)	Trimming + friction
Scope (f)	1–12	1–8	Grades 4–12 and up
Passing a flight (relative)	1x	2–3x	5-20x
Arrow Load	Mid-High	Low-medium	Low
Price (relative)	1x	3–5x	5-15x
Number of SPO flights	A lot	Cam	Minimal
Work in rough rocks	Limited	Limited	Telugu
Outbreak rate	Mid-High	Low	Keep Low

THE MAIN TYPES OF EATING SHAROSHKA DOLATES

As a result of systematic observations and studies carried out in the Angren Range, four main types of edging of three-waterfall dolates were identified. Each of these is due to different reasons and is an important factor in determining the lifetime of the drill and the efficiency of the drill [5].

Breakage of Zublar

Sharoshka staples break evenly and become equal to the surface. This phenomenon occurs in the following cases: an excessively high rotational speed of the rotary section; when fractures and decayed rocks occur when drilling or

ISSN 3030-3907

drilling a well; incorrect choice of dolota; the transition of the sexes, accompanied by the occurrence of too hard sex additions. This type of feeding interrupts the drilling process and makes it necessary to quickly replace the drill.

Fall off the zublar

Displacement of hard alloy zithers from the body of the sharoshka is observed. The main reasons: the presence of metal in the well floor; erosion of the matrix of the sharoshka; release of the clamp of the zubk as a result of cracks in the shaft; exceeding the recommended load on the cabinet; difficult drilling conditions. Stubbles that fall in the stump can pose a hazard to the new drill in the next drill process.

Eating by height of zubs

The zubks are exposed to flat, flat feeding, and the drilling rate decreases. Causes: overload on the board; the inconsistency of the properties of the alloy zubk with the properties of the rock being drilled; the change in the properties of the breed due to the harsh abrasive adhesion; Very high speed of the rotary. An important difference is that if drilling and hourly endurance rates are high, this type of exhaustion can be rated as normal, indicating that the drill has completed its full operating life.

Thermal (thermal) decomposition

On the surface of the claws appears a characteristic scar in the form of 'snake skin'; This often leads to a fracture of the gums. There are two main reasons: the properties of the zubk alloy do not correspond to the category of rocks being drilled; In the process of drilling, solid alloy spurs are simultaneously heated and cooled by air-pumped water and groundwater flow into the well. The repetition of thermal cycles creates micro-cracks and finally the stubble is eroded.

Table 5.

Major Causes and Proportions of Triple Deck Failures [5]

Failure Cause	Share, %
1. Constructive defects (production)	2–10
2. Natural eating (normal)	5–25
3. Assembly defects	10–50
4. Maintenance and Repair Errors	10–50
5. Operation in violation of technical conditions	5–70

METHODS AND ECONOMIC ESTIMATION OF THE OPTIMAL TYPE OF DOLOTA

The optimal design or type of a hole of a given size is considered to be such a structure or type that it provides minimum operating costs per 1 m passage during drilling in certain geological-technical conditions. Flight drilling speed and

ISSN 3030-3907

operating costs per 1 meter pass have been accepted as the generalizing criteria for assessing the effectiveness of the dolota [7, 8].

According to the methodology of Baker Hughes, Smith International, and Reed-Hycalog, the efficiency of a dumpster is determined by the following formula:

$$C = \frac{C_g + C_v \cdot (T_{sp} + T_{bur})}{h}$$

Here: Cg is the value of the dollar (dollar); CV - estimated cost per hour of the drill rig (time dependent); Tsp - duration of SPO (hours); Tbur - mechanical drill time (hours); H - pass to the flight (meters).

Work on the selection of optimal ward constructions (types) is carried out in three stages [5, 7, 8].

1. **Stage I:** study of geological cross-section to determine the working conditions of drilling rigs; study and analysis of drilling performance indicators based on the collection and generalization of actual production data on previously used drillhole structures and drilling modes.

2. **Stage two:** Justification and selection of well designs, stratigraphic packages, bed depth ranges and rock complexes; substantiation of types and structures of wells for experimental studies.

3. **Third stage:** development based on experimental work of recommendations for selecting optimal drilling conditions and optimal drilling modes for similar well conditions.

To achieve cost-effectiveness, it is recommended to find a comprehensive solution to increase the durability and mechanical drilling speed of the drill bit, as well as reduce the cost of the drilling rig. In general, it is possible to find an integrated effective solution taking into account all the above aspects [5].

RECOMMENDATIONS AND DISCUSSION.

Based on the results of the research and comparative analysis, the following practical recommendations were developed for Angren exploration and similar open pit mining operations:

–On rocks of soft and medium-hardness (f = 1-5), it is desirable to use three-petal dolates of type M and MZ. PDC boards in these types also provide high efficiency and pay off economically in the long run.

–In medium and hard rocks (f = 5–12), the use of T and TZ type dolates remains the traditional approach. However, if there are necessary capital expenditures, switching to PDC boards will significantly increase cost-effectiveness in the long run.

ISSN 3030-3907

–In deep wells (more than 1000 m) and in massifs with uniform lithology, PDC wells are preferred. The reduction in the number of SPO operations from 135-140 to 3-5 will significantly save time and resources.

–For extremely hard and abrasive rocks (f > 12), it is recommended to use diamond (impregnated) dolots or tripleplates of type OK / OKZ.

–When choosing a dolota, it is always necessary to calculate the economic cost of the passage of 1 meter, do not decide by the first cost.

–Optimization of drilling mode: keeping rotational speeds within 40-100 µl/min, speeds above 140 oila/min increase vibration and reduce productivity.

CONCLUSION.

Based on the research carried out in conditions of open exploration of Angren coal deposit and comparative experiments conducted at Marketchmining field the following basic conclusions can be made:

4. Triple pods are the most common drilling instrument in open pits. They are preferred by their flexibility in various hardy rocks. However, the large number of SPO flights (135-140 units), the quick depletion of the base system and the short service life are their main disadvantages.

5. PDC drills demonstrate significant advantages when drilling in deep wells. The jump rate for one flight is 2-3 times higher than for three-stroke divers, and the drill period is about 2 times shorter. In terms of the total economic costs spent on 1 meter passing, PDC boards clearly dominate.

6. Diamond diamonds give the highest technical performance during extremely hard and abrasive rocks. On one flight will reach a dozen times more passes. But their value is high and it is desirable to use only in certain geological conditions.

7. Four main types of eating of three-peach dolates have been identified: stubble breaking, falling, eating by height, and thermal erosion. Each type is the result of misadjustment of different drilling parameters or the selection of a drill that is incompatible with geological conditions.

8. In assessing the cost effectiveness of a dolota, it is necessary to use the method of calculating the cost of a 1 meter pass, and not the first one. The three-stage selection methodology (geological study, substantiation, experimental recommendations) allows you to determine the optimal type of dolote.

It is scientifically and practically important that in the future for open pit conditions the introduction of combined valves (cut-ball and punch-ball), further research on optimization of drilling modes based on digital modeling and updating drilling materials is important

ISSN 3030-3907

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