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PUMPING OF CLEAN WATER IN REMOVAL OF PRECIPITATED MATERIAL AT THE BOTTOM OF THE OPEN PIT SOUTH MINING DISTRICT MAJDANPEK**

Abstract

The development of mining operations at the South Mining District Open Pit of the Copper Mine Majdanpek is conditioned in the following short term by removal the accumulated water, sludge and sediment from the inactive water collector from the level +150 m to the bottom of the Open Pit at +122 m. This must be done in order to create the conditions for the smooth development of the ore mining operations. This paper presents the technology of pumping the clean water.

Keywords: *Majdanpek, Open Pit South Mining District, clean water, sludge, sediment, pumping*

INTRODUCTION

The Majdanpek Copper Mine, which also includes the Open Pit South Mining District, is a part of the company Zijin Bor Copper doo. The Majdanpek Copper Mine, in production, technical and technological terms, is a complex mining system that has the activities ranging from the geological exploration of mineral resources, exploitation and processing of ore, to a range of supporting activities as a necessary support for the basic activities [1]. The production and processing of ore in the Majdanpek Copper Mine is currently taking place only at the Open Pit South Mining District and is of great importance for the copper production in the company system [2].

Mining activities at the Open Pit South Mining District are currently taking place in the eastern side of the Open Pit. Based on the current conditions of exploitation

and location, the mining activities could be developed to the E140 level. According to the planned capacity, the works would take place in a period of six months. The amount of ore that can be mined during this period is about 4,000,000 tons.

In order to achieve the planned mining and processing capacity of the ore in the next short-term period of 600,000 tons of ore per month, it is necessary to provide the space conditions for the development of ore mining operations at the levels E215 – E110. This requires the drainage and removal of material from an inactive collector of water at the level of K150 m of altitude to the bottom of the Open Pit at the level of K122 m of altitude. This is necessary in order to create the conditions for undisturbed exploitation.

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**CHARACTERISTICS OF MATERIALS
IN ACCUMULATION POOL AT
THE LEVEL K150 m OF ALTITUDE**

Figure 1 shows an accumulation pool of K150 m of altitude. It is estimated that three layers can be separated in the accumulation pool: a layer of clean water, layer of slurry, and layer of sediment. It is estimated that the layer of clean water is about 8 m deep, its concentration of solid phase is below 20%, and the total volume of clean

water is 350,000 m³. The slurry layer is about 4 m deep, its solid phase concentration is 20% - 40%, and the total volume is 156,000 m³. The sediment layer is about 18 m deep, its solid phase concentration is greater than 40%, and the total volume is 460,000 m³. Figure 2 shows a longitudinal accumulation pool profile [4].



Figure 1 Location of accumulation pool at the level 150 m of altitude of the Open Pit South Mining District

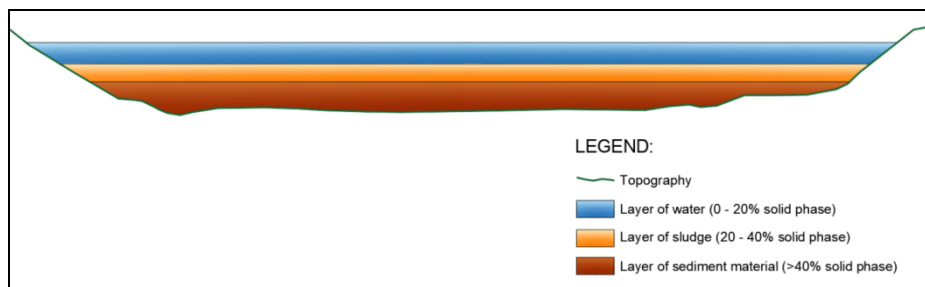


Figure 2 Longitudinal accumulation pool at the level K150 m of altitude of the Open Pit South Mining District

PUMPING OF CLEAN WATER

The existing system of clean water pumping

The existing system of water pumping from the Open Pit South Mining District is of the cascade type. A Flygt submersible pump, type BS 2250.011HT, was installed in the water tank at the K125 m of altitude level. The capacity of this pump is 360 m³/h for a pump head of 22 m. The electric motor power of this pump is 54 kW. Water is pumped through a 200 mm diameter PVC pipe with a length of 135 m into an accumulation pool at K150 m altitude. At the K150 m level, one KSB type centrifugal pump, type VL-200, was installed. The capacity of this pump is 360 m³/h for a head of 220 m. Water is pumped from the K150 m of altitude level by a 200 mm diameter PVC pipeline and 975 m long to the K350 m of altitude level next to the crushing waste plant. The pumped water is discharged into

the Mali Pek River after passing through a zeolite precipitate [3].

Before starting the pumping of clean water from accumulation pool at the level K150 m, it is necessary to relocate the stable pump to a new location, north of the current location, so that the pumped water from the level K125 m does not return to the accumulation pool at the K150 m level. A part of the existing stable pump pipeline of 415 m is also being relocated. The length of the relocated stable pump pipeline is shorter by 195 m than the length of the existing pipeline. The pipeline of the submersible pump is also relocated. The relocated pipeline of the submersible pump is 60 m long. Figure 3 shows a line diagram of the existing water pumping system. The location of the existing water pumping facilities at current and relocated locations is shown in Figure 7.

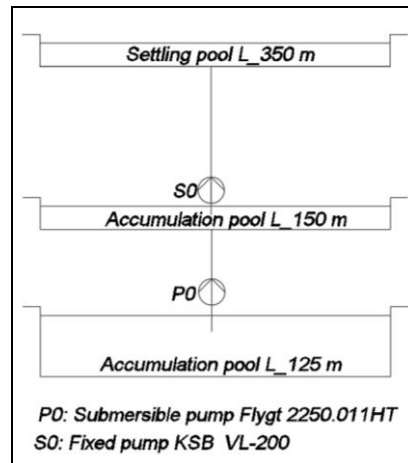


Figure 3 Line diagram of the existing water pumping system

Pumping of clean water from accumulation pool at the level K150 m of altitude

In the accumulation pool at the level K150 m, the estimated quantity of clean water is 350,325 m³. Clean water is from

the level K142 m to the level K150 m. The drainage system for this water will be of a cascade type. Submersible pumps will be

installed in the accumulation pool which will pump water to the water collector at the level K180 m, from where the stable pumps will be pumped to the settling tank for the physical treatment of particulate matter at the level K350 m next to the waste crushing plant. Such purified water goes into the existing settling pool with zeolite from which it flows into the Mali Pek River. The position of the stable pumping station is conditioned by the state of mine works at the Open Pit and the already existing plateau at the level K180 m.

Submersible pumps in the accumulation pool at the level K150 m are of the KL300-75 type. The estimated pumping capacity of one pump for an average head of 37 m is 330 m³/h. The electric motor power of one pump is 160 kW. Four pumps of this type are planned. Stable pumps at the level K200 m level are of the type MD360-92x2. For a head of 184 m, the pumping capacity of one pump is 360 m³/h. The electric motor power of one pump is 315 kW. Three pumps of this type are planned. All pumps are automatically started in synchronization.

To pump the total amount of clean water from accumulation at the K150 m level, the

required operating time of the submersible pumps is 265 h, and of the stable pumps is 324 h. With continuous operation of the system, the required pumping time of clean water from the accumulation pool at the level K150 m is 14 days. The required pumping time should be increased by 10-15% due to the water influx of atmospheric precipitation that may occur during this period, which fall directly into the accumulation pool area or reach the catchment areas from which they gravitate towards the accumulation pool. The required pumping time, taking into account the potential atmospheric precipitation is 15-16 days, i.e. the required operating time of submersible pumps is 298 h, and of stable pumps is 364 h.

Submersible pump pipelines are polyethylene 250 mm in diameter and 90 m long. Pipelines for stable pumps are made of reinforced plastic pipes 315 mm in diameter and 860 m long individually. Figure 4 shows a line diagram of the clean water pumping from accumulation pool at the level K150 m. The location of the water pumping facilities at the level K150 m is shown in Figure 7.

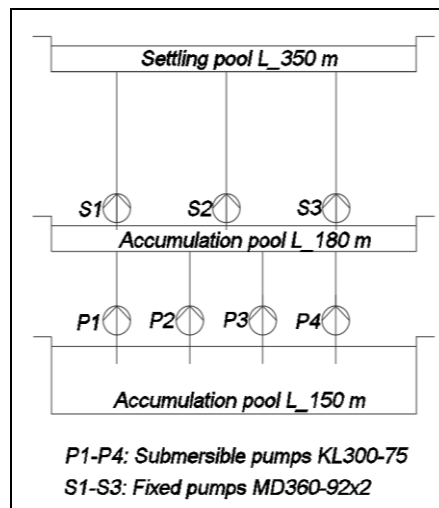


Figure 4 Line diagram of the water pumping system from the level K150 m of altitude

Pumping of clean water from water collector at the level K150 m of altitude

After pumping of clean water from accumulation pool at the level K150 m, the sludge layer is removed by cyclone. The amount of sludge in the accumulation pool is 155,700 m³. Hydrocyclone overflow - clean water, returns to the water collector at the level K125. Dynamics of the hydrocyclone sand removal is such that the whole process takes 8 days. The amount of water from overflow is 121,700 m³.

The pumping system for this water will be of a cascade type. Submersible pumps from the level K150 m will be relocated to the K125 m water collector, which will pump water to the K180 m water collector, from which water will be pumped to the level K350 m by the stable pumps for physical treatment of solid particles next to the waste crushing plant. Such purified water goes into the existing zeolite settling pool from which it flows into the Mali Pek River.

Submersible pumps in the water collector at the K125 m level are of the KL300-75 type. For a 75 m head, the pumping capacity of one pump is 300 m³/h. The electric motor power of one pump is 160 kW. Four pumps of this type are planned. The position of water collector and stable pumps at the K180 m level is unchanged. An existing drainage system with one submersible and one stable pump remains in operation in the

water collector at the K125 m level, which also performs the function of water pumping from the regular inflows. All pumps are automatically started in synchronization.

To pump the hydrocyclone overflow at the K150 m level, the required operating time of the submersible pumps is 101 h, and of the stable pumps is 113 h. With continuous operation of the system, the required pumping time of hydrocyclone overflow from the accumulation pool at the level K125 m is 5 days, however, the pumping dynamics must follow the cyclone dynamics so that the pumping phase will last for all 8 days of hydrocyclone operation. The required pumping time does not need to be increased for the influx of atmospheric precipitation because such water is pumped by the existing drainage system.

Submersible pump pipelines are polyethylene 250 mm in diameter and 300 m long individually. Pipelines for stable pumps are unchanged regarding to the phase of clean water pumping from the accumulation pool from accumulation pool at the level K150 m. Figure 5 shows a line diagram of pumping the hydrocyclone overflow and regular influx from the water collector at the level K125 m. The location of the water pumping facilities from the water collectors at the level K125 m is shown in Figure 7.

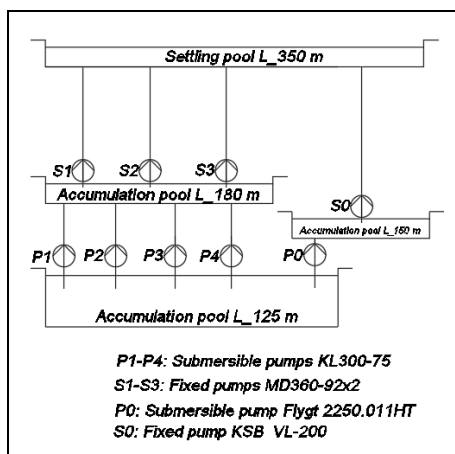


Figure 5 Line diagram of the water pumping system from the level K125 m

Clean water pumping in excavation the solid phase

The solid phase is excavated for 117 days. The amount of material is 459,225 m³ from the K138 m level to the K120 m level. A submersible pump will be installed at the site, which will be relocated from the water collector at the k+125 m level. During the solid phase excavation, the pump changes position depending on the progress of work. The water appearing at the site will be pumped by this pump to the water collector at the level K180 m, from where it will be pumped to the settling pool for physical treatment of solid particles at the level K350 m next to the waste crushing plant. Such purified water goes into the existing settling pool with zeolite from which it flows into the Mali Pek River.

Submersible pump in the excavation of solid phase is of the KL300-75 type. For a 50 m head, the evaluated pumping capacity of one pump is 315 m³/h. The electric motor power of one pump is 160 kW. The position of water collector and stable pumps at the K180 m level is unchanged. Submersible pump pipeline is polyethylene 250 mm in diameter and maximum length of 250 m.

Pipelines for stable pumps are unchanged regarding to the phase of clean water pumping from the accumulation pool from accumulation pool at the level K150 m.

Four submersible pumps will be installed in front of the site in previously excavated depressing funnels, unless the funnel is filled with material. 8 kW individual pumps will be installed in these depressing funnels. Water is pumped through these pumps to the water collector at the K180 m level. For an average head of 51 m the estimated pumping capacity is 7 l/s individually. The average operating time of the pumps is 20 h per day. It is not possible to know the exact inflow of water to the site, so it is estimated that the submersible pump should operate 6 hours a day if no prior drainage of the depressing funnels is performed, or shorter if a prior drainage of the depressing funnels is carried out, so that the electricity consumption is the same in both variants [3]. Figure 6 shows a line diagram of pumping water during solid phase excavation. The location of water pumping facilities from the solid phase is shown in Figure 7.

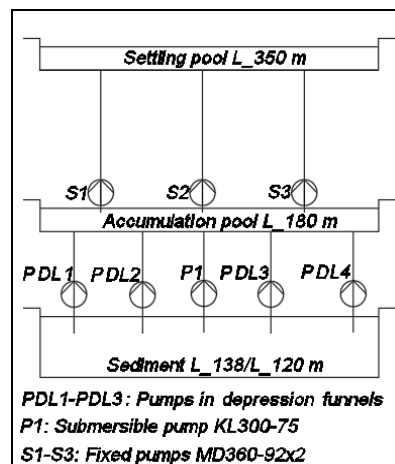


Figure 6 Line diagram of the pumping system in the solid phase excavation

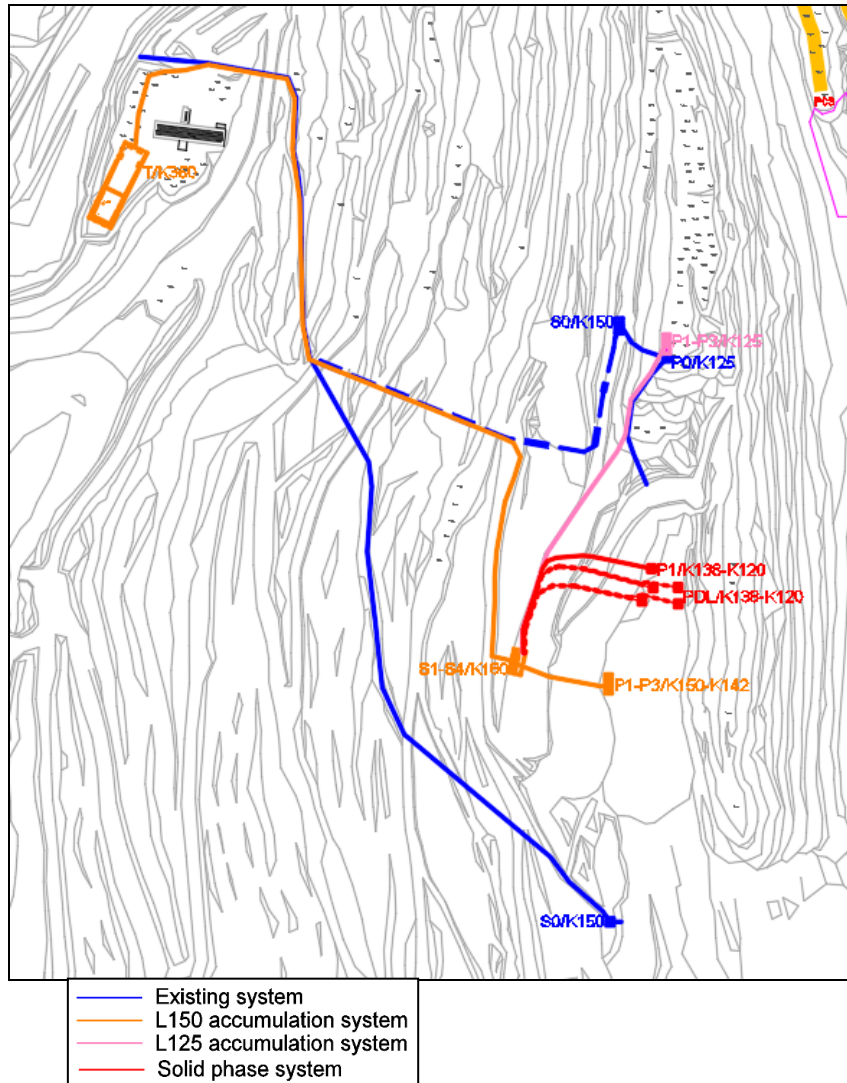


Figure 7 Position of facilities for pumping of clean water

CONCLUSION

In order to ensure the realization of 600,000 tons of ore excavation and processing per month, it is necessary to create the spatial conditions at the bottom of the Open Pit South Mining District. To this end, it is necessary to remove layers of water, sludge

and sediment from the inactive water collector at the level K150 m of altitude. The works will be carried out in three phases. Clean water will be removed first, then the sludge layer will be removed, and eventually the sediment layer will be removed.

All three stages of material removal include the pumping of clean water. The proposed technology foresees the maximum utilization of existing, and engagement a new drainage equipment, which is needed due to the time limitation of the works. Technology designed to ensure the safe operation of people and equipment during mining operations has also been proposed.

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