

Water Impedes Mining Operations

Richard Holton, Cornell Pump Company

Innovative pump solution dewateres the longwall face of a mine, leading to more operational uptime and reduced energy costs.

Water is a consistent problem in mining operations. Operating underground in areas below the water table, water will seep, even pour, into a mine. Water can slow operations, lead to costly downtime and make the mine uneconomical to operate. Often, because of the nature of the shafts that are dug, the transfer route for removing the water is not straight, and the distances can be long.

The Problem

In Alabama, a large mining company needed to keep water off the longwall face in its mine. It consulted with a design firm, Jim House and Associates, that specializes in water and wastewater transport and treatment, to suggest methods of dewatering the situation.

The chief strategist assigned to the account was Mark Hall. It was made clear that it was essential to remove the water from the mine.

System Requirements

The mine needed to move water from a sump located 1,800 feet along the longwall to the tailgate. That application required a 1,850-foot suction line with a shallow low spot or sump as the water source. The elevation of the sump was 675 feet, and the elevation of the pump was 670 feet. The unusual issue with the flooded pump suction was multiple dips and rises along the suction line length that kept water from free flowing due to entrapped air.

The mine operators wanted as much water removed from the longwall face as possible. Previously, as they mined past these sumps, the electric Mine Safety and Health Administration (MSHA) submersible pumps had to be pulled when the face reached them.

Hall explained that if the pump solution could provide an end suction pump to handle the water out of the tail gate entry, then the added value for the mine would be unprecedented.

Pump Options

One of Hall's favorite sayings is, "Plan your work, and then work your plan." Here is how the "plan was worked." On the recommendation of the design consultants, the mine company considered two options to dewater the longwall face: a submersible pump or some type of self-priming pump.

Three criteria influenced the pump choice:

- Durability was the first and most important measurement for project success. Given the need to run the mine at peak efficiency, downtime of the pump meant downtime of mining. The product had to work well in difficult and demanding conditions.
- The pump solution also had to contend with no water in the line during the initial start-up of the system, as well as water loss during stoppage.
- Finally, the mine company wanted to purchase a system that had high wire-to-water ratings. A highly energy-efficient motor was desired to lower the cost of ownership—through energy used and replacement costs. A smaller motor also better fit the space constraints of the project.

A submersible pump would work in the wet environment of the mine. However, energy efficiencies using a submersible motor were not at the level at which the mine company wanted to operate. A self-priming option was also examined. This pump included a patented mechanical seal which meant that it would not leak water, as is commonly the case with packed pumps. The pump also had the ability to run dry. This dry-run feature ensured that no damage to the seal would occur if the pump lost prime and continued to run.

Self-Priming Solution

The self-priming pump option was selected to remove the water from and keep it off the longwall face once the longwall mined past the location. The system used a positive sealing float



box and a mechanically driven, low-maintenance, high-volume vacuum pump for rapid priming. This design allowed no water carry-over from the priming system into the environment. A line size of 12 inches was determined to minimize the friction loss, allowing the pump to employ sufficient NPSHR to accomplish the job.

During the initial priming cycle, the pump ran with no water in it for 50 minutes. Even with those dry-run conditions, the seals worked perfectly. The pump featured extended seal life, and the mechanical seal was protected from damage.

Because of the shallow sump (3 feet deep), operators were concerned that, once the suction started, the application would experience vortex and introduce air into the system. Hall had an innovative solution. A five-foot-long strainer was made using 12-inch PVC pipe with quarter-inch diameter holes drilled in the bottom half of the pipe. The strainer was capped, resulting in no vortexing with start-up.

The design firm and the mining company planned and ran the suction line down the #2 entry before any issues with falls of the roof occurred. Once the system was initiated, a visual and audio inspection of the suction line occurred to find any air leaks. In multiple locations, the PVC suction pipe was introducing air into the system. Hall employed another innovative solution for this problem. He used clear shrink wrap to cover the couplings and stop the leaks. Once the leaks were controlled, the pump took 50 minutes to evacuate all the air from the 1,850-foot, 12-inch suction line, allowing the water

to be transferred to another sump. This application kept water off the longwall face. Previously, mining had to be halted to accomplish the same task. The longwall is 1,600 feet past the source of water.

After more than six months of operation, the solution continues to work efficiently, with the longwall face dry and with no loss of production due to water issues on the face. Marrying a dependable pumping system with an efficient and economical solution allowed the mining company to save time and money. The right pumping solution can minimize expenses that are associated with energy consumption.

P&S



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