Low Profile Remote Roof Bolting Module

Bill Kyslinger, Design Engineer, with co-authors Gene Wilson, R&D Manager; Craig Collins, Project Engineer; and Bill Schwab, Design Technician; all with J.H. Fletcher & Company, Huntington, West Virginia gave a presentation to the Ground Control Conference on Development of Low Profile Remote Roof Bolting Module.

In March 2004 a Letter of Intent was signed between Boart Longyear Poland, KGHM of Poland, and J.H. Fletcher & Company to, “Design and develop a roof bolter able to install 1.2 meter mechanical roof bolts in a heading no lower than 1.6 meters with the operator located in a protected air conditioned cab.” The low-profile remote roof bolting machine is shown in Figure 1. J.H. Fletcher & Co. designed, developed, and manufactured the boom and drilling module while Boart Longyear Poland designed, developed, and manufactured the cabin and its components.

The objective was to produce a machine to provide ergonomic improvements for the operator while working in the mine environment. This dictated the requirement for a small, easily controlled, maintenance-friendly design with a remote operator’s control station. The selected design method was to use starter and finisher drill steels. This combination, requiring a number of mechanized machine motions, provides the ability to drill the required depth in the specified mine height. The roof bolting parameters are shown in Figures 2. To accomplish the task from a remote location, a decision was made to employ current technology in the form of small pressure compensated hydraulics and electronic controls. The electronic control system is shown in Figure 3 and the hydraulic control system is shown in Figure 4.

The result of the design work is a modular assembly with each sub-component designed to be replaceable and adjustable independently from other machine components. The low profile remote roof bolting module is made up of six major subcomponents. Each major component is guided in a different order to help the operator make the visual connection from the drill module to the operator control/display monitor. The Stabilizer (white) secures the module between the mine floor and the drill module. The Drillhead (orange) produces the drilling rotation and torque, but also must slide out of position to allow the machine to manipulate the drill steels and drill consumables from position to position during installation.

Bill Kyslinger

Fig 1 Low-profile remote roof bolting module

Fig 2 Roof bolting parameters

Fig 3 Electronic control system

Fig 4 Hydraulic control system

Fig 5 Low profile remote drill module

Fig 6 Drillhead (orange)

Fig 7 Drill steel carousel (blue)

Fig 8 Manipulator arm (green)

Fig 9 User control console

Fig 10 Low-profile remote roof bolting module

The low-profile remote roof bolting module allows the operator to drill and install a roof bolt manually or automatically with the push of a button. The Operator’s Drill Module Controls of the cab are shown in Figure 9. This design substantially reduces the operator’s exposure in the mine environment, as well as inherent pinch points and rotating hazards, positioning the operator safely in the confines of the air-conditioned cab (see Figure 10). In addition, the operator is always under a supported top eliminating the miner’s exposure to skin falls during the drilling operation and ultimately reducing the risk of injury. The improved ergonomics should also help reduce operator injuries and repetitive trauma.

The low profile remote roof bolting machine has recently been delivered to KGHM and since then deployed into the Polkowice-Sieniawice Mine. The machine has been tested underground with a few minor adjustments and the low profile remote roof bolting machine is currently in production. A patent is pending on the drill module.