

## New Rail Loadout Systems Save on Wear and Tear

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Coal loadouts require very large hydraulic systems to support relatively heavy weight, which is measured in thousands of tons. Conventional systems use hydraulic actuators with dual-stage cylinders. Operation is crude, with no control over the speed of the gates. When reaching full-open or full-closed positions the cylinders reach a hard stop, inducing wear and tear on the equipment and earning themselves the nickname bang-bang systems.

The larger the cylinder, the larger the bang; and the larger the bang, the harsher the treatment becomes on the mechanical system, specifically the cylinder mounts, clevis, pillow blocks, and trunnions. The systems suffer from high-maintenance downtime and costs. A new loadout configuration has been designed to retrofit existing systems built around the hydraulic bang-bang technology.

The Automatic Loadout Motion Control System developed by Concept Systems Inc., in conjunction with Brake Supply, provides smooth cylinder motion throughout the entire stroke of the cylinder. This is done by using a Delta RMC100 motion controller. The Delta motion controller ties to hydraulic servo positioning valves and linear position transducers, providing closed-loop motion control of the hydraulic cylinders. This gives the operator the ability to ramp the speed of the cylinders to a stop, rather than banging them into the end of stroke, providing obvious mechanical benefits.

Using position feedback on the hydraulic cylinders, proportional valve control, and the motion controls, the system generates a new loadout sequence based on a motion profile that continually monitors the loadout weight, and adjusts the percent-closed of each gate on a continual basis. Loadout weights are based on operator-selected recipes on a per-batch basis.

Concept Systems Inc. has also developed a flexible PC-based, front-end, allowing the operator to adjust the motion profile of each axis independently. A schedule is set up for each gate, telling the gate where and how fast to move when a preset weight is detected. The result is the ability to customize the gate-closing scheme for each silo, taking into account any variances that may exist in the loadout characteristics from silo to silo. There are two other benefits to this:

- The ability to maximize the amount of time the gates stay open and still maintain loadout accuracy. This has resulted in a decrease in loadout times; and
- The ability to fine tune the final closing of the gates. The key to this is minimizing the final stroke length to close the last gate, resulting in a very repeatable and accurate loadout weight.

According to the developer, the benefits become clear compared to traditional systems of having essentially eight discrete positions. With the Automatic Loadout Motion Control System, the operator has an unlimited amount of programmable positions. It becomes a matter of fine tuning the system to accommodate the characteristics of each individual silo.

The system also has the ability to auto correct. Larger pieces of coal take longer to batch than finer pieces and characteristics tend to change throughout the day as an operator unloads. The system will detect trends

in the amount of error for each batch and automatically corrects such deviations. If the system detects an over batch, the system will automatically adjust the final close position to close earlier on the next batch. On an under batch, the final position will close later. This is a feature of traditional systems, however with the high resolution of gate positions, the new system can make finer adjustments and more accurately track these variances. Loadout weights of +/- 50 pounds (lb) are normal on a fairly repeatable basis (+/- 150 lb on occasion), as opposed to the traditional +/- 500-lb accuracy.

The Automatic Loadout Control System is designed to retrofit existing loadout configurations, including flood, trim, and surge bin batch and discharge gates, and top-off discharge gates. The system can be provided with a new PLC control system, or configured to interface with existing industry-standard PLCs (Allen-Bradley, Modicon, Siemens, or GE). The System can include a new Operator Interface for recipe selection, status information, and diagnostics, or an existing operator interface can be re-configured.

According to the developer, the result is a smooth, accurate motion for each gate throughout the loadout process rather than discrete independent moves. Maintenance wear and tear is significantly reduced, loadout time is shortened, and weight accuracy is improved.

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