

Case note

Regenerative AC drive improves overhead travelling crane performance



Three regenerative ABB industrial drives are used on BlueScope Steel's 26 tonne electrical overhead travelling (EOT) crane at its fully integrated steel mill, in Glenbrook outside Auckland.

BlueScope Steel's fully integrated steel mill, in Glenbrook, New Zealand, produces a range of flat steel products for both domestic and export markets. The process uses locally-sourced iron sand and coal to produce about 600 000 tonnes of steel slabs a year. Slabs are rolled into hot and cold rolled products, which are either sold or processed into hollow sections and galvanised steel.

During the manufacture, a 26 tonne electrical overhead travelling (EOT) crane is used for transferring steel slabs from the slab caster line. It has a span of about 15 meters and over 100 meters travel length.

Overcoming high energy wastage

Previous AC drives used on the crane, regenerated energy back to a brake resistor when the motor was braking. For example, when the crane hoist was lowering a load, the drive, which is generating, wasted its energy as heat via a large brake resistor. While having no detrimental affect on the crane control, this technique suffers from high energy wastage through heat dissipation and a risk of fire; large footprint of the resistors; and the need to position the resistors close to the drive.

"Heat resistors would have to be placed on top of the crane and be kept clean for effective heat radiation, causing a tricky maintenance problem," says Richard Wilton, primary plant engineer at BlueScope Steel.

All-round crane performance improved

Not only did the use of regenerative ABB industrial drives generate energy back to the mains supply rather than wasting it as heat through the brake resistor, the drives also benefitted the overall crane control. Only one drive was required to run two long-travel motors, while all motors, except the hoist motor, were run open-loop.

The crane uses two 13 kW motors on the long-travel axis and one 3.7 kW motor on the cross-travel axis. The hoist is powered by a 91 kW motor. The hoist motor and the motor for the cross-travel axis are controlled individually by one active front-end drive each, while the two motors on the long-travel axis are controlled by a single drive.

The ABB drive also features the motor control platform, direct torque control (DTC) which helps ride through power disturbances caused by arcing as the carbon brushes jump on the copper rails. Measurements of the power disturbance caused by the collector rails were discussed before the installation at ABB's factory in Finland, where the engineers concluded that the drive would be able to cope with the level of disturbance.

DTC also provides accurate control of the original slip ring induction motors, the slip rings of which are shorted to make them perform as asynchronous motors. This saves any costs and downtime that would be incurred if the motors were renewed. Output chokes were installed to protect the insulation of the old slip-ring motors.

"The AC drives also have the advantage that they could be installed with the existing motors, reducing the investment cost," Wilton continues.

The system was engineered by ABB in New Zealand and installed by BlueScope Steel's own engineers.

Challenge

- Eliminate need for brake resistors
- Control two motors with one drive
- Short power disturbances as carbon brushes jump on the collector rails supplying power

Solution

- Wall-mounted regenerative AC drives equipped with an active supply unit, providing an extensive selection of built-in features including LCL line filter and charging circuitry
- ABB industrial drives with crane control program that includes mechanical brake control, torque memory and crane handling reference
- Active front-end drives regenerate braking power into electricity and feed back to the grid
- One drive runs two motors with equal torque sharing
- The drives' power supply side sufficiently robust to ride through short power disturbances



ABB industrial drives are equipped with an active supply unit, providing an extensive selection of built-in features including LCL line filter and charging circuitry.

Benefits

- Compact regenerative AC drive with built-in features saves installation time and space
- Reduced maintenance time and cost
- Reduced investment cost by using one drive with two motors and re-using existing motors
- Robust power supply side on drives enables use of existing power distribution with collector rails

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