

250T Ladle Bay Cranes Outokumpu, Sheffield



Drives and Automation carry out a £2.25m upgrade to three 250T Ladle Bay Cranes at the Outokumpu Stainless Works in Sheffield.

Outokumpu is an international stainless steel company with plants worldwide. Stainless steel is the fastest growing metal market across the world and Outokumpu are one of the world's four largest producers, and widely recognized as world leaders in technical support, research and development.

Outokumpu have three Ladle Bay cranes servicing the SMACC department. The cranes are 40 years old and were becoming unreliable.

Drives and Automation were asked to provide a turnkey solution to upgrade the existing slipping motors to inverter control on the cranes main hoist, auxiliary hoist, long travel and cross travel drives. In addition provide a complete PLC control system, purpose built control room, new drivers cabin, drivers seat, air conditioning units and mechanical installation works.

To allow production to carry on whilst the refurbishment took place, Ladle Bay Crane No.1 was chosen as access to the Ladle was still available using the middle crane.

The control system comprised an Allen Bradley SLC5/05 PLC, a Pilz safety PLC system, a Control Techniques inverter drive, Ethernet communications and a drivers seat mounted HMI control station.

Control equipment is located in a single air conditioned control room located above a new air conditioned driver's cabin.

A main 1200A MCCB isolation device with undervoltage trip is located at the crane entrance and is used to isolate the main power to the crane.

A secondary isolation device is used to isolate the crane auxiliary supplies if required. Both devices can be locked off for maintenance and isolation purposes.

The drive system is based on Control Techniques range of Unidrive SP Microprocessor controlled A.C PWM inverters suitable for high performance drive applications.

The Unidrive SP inverters installed on the 250, 50 and 10 tonne hoists have been configured for accurate closed loop speed and position control using absolute encoder feedback.

Technical Details

- Control Techniques Unidrive SP / SPM Inverter modules
- Unidrive SP SM Applications / CTNet Modules
- Allen Bradley SLC5/05 PLC System
- Allen Bradley PanelView + 1000 HMI
- Pilz PLC Safety Relay System
- Cressall Dynamic Braking Resistors
- Sick Hiperface Multi-turn Absolute Encoders
- Gessmann Drivers Chair
- Cattron Anti-collision System
- Cattron Radio Control System
- Lintern Air Conditioning System



The 250 tonne hoist features dual motors and inverters, this hoist is configured to mechanically load share.

The main cross travel, auxiliary cross travel, and long travel inverters are configured to control their respective motors in open loop vector control.

The long travel is driven by four motors, each located at the four corners of the machine. These four motors are driven by two inverter drives.

The Unidrive SP's use Control Technique's proprietary high speed communications network CT NET to exchange data between the inverters.

The PLC exchanges data using an Allen Bradley peer to peer data exchange with a Modbus Converter between the CT inverters. Typically, this data consists of motor loading, drive alarms, software hoisting position alarms and running status.

The software programs developed for this application include:

- Torque Proving
- Brake Proving
- Hoist position and display on the HMI screen
- Provision of software limits for the hoist position and calibration.
- Cross-travel speed
- Watchdog function
- Speed selection inputs.

Each hoist motor features an absolute encoder to provide both motor speed and motor position control. Absolute encoders provide extremely accurate feedback of motor position thus allowing the motor / drive combination to be capable of providing software hoisting limits.

A laser collision device is configured to prevent the crane colliding with the other cranes.

The crane operators control chair was housed within a new control cabin mounted underneath the crane. The chair was equipped with multiple joystick controllers, indicator lamps and an HMI displaying Hoist / Ancillary drive status.

The crane is configured to be operated remotely via a Catron radio control system when required.

The contract required Drives and Automation to provide mechanical services on the crane.

Drives and Automation employed the services of Qualter Hall Ltd of Barnsley as the mechanical subcontractor.

A new drivers cabin and control room were manufactured, assembled and pre-wired at their works.

The installation works on the crane were carried out during the summer shutdown and comprised the removal of cabin and control room, installation of new cabin and control room, fitting of encoders to existing motors and gearboxes and installation of air conditioning units.



Unidrive SP Drives in-situ

The Control Techniques Unidrive SP covers a complete drive spectrum from 0.37kW to 1.9MW. All drives share the same control interface and can be operated in either servo, closed loop vector, rotor flux vector, open loop vector, v/f control or regenerative control.

The Unidrive SP supports a wealth of communications options and powerful second processor solutions.

Following the success of the first installation the remaining two Ladle Bay Cranes have been refurbished. These refurbishments were carried out over a period of three years during summer shutdowns.

Problem Solved

- Obsolete system
- Unreliable, erratic hoist operation
- Production downtime
- Poor documentation

Solution

- A complete turnkey package utilising the existing slip ring motors.
- A variable speed control over all motors
- Provision of hoisting information, loading, position and fault diagnostics for operator and maintenance staff.

Benefits

- Smooth hoisting and crane axis control
- Reduced downtime
- Maintenance easily undertaken
- Fault diagnostics



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