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ABB drives improve blast furnace control and efficiency

A major refurbishment of a blast furnace in South Wales has given Tata Steel better control and improved efficiency following the installation of ABB variable speed drives (VSDs).

Solutions supplied include what are believed to be the largest low voltage air-cooled VSDs in the UK, delivering 2.7 MW at 690 V, used on the fume extraction systems, as well as other drives, motors and controllers for the Stoves combustion air and water tower cooling.

Tata Steel's Blast Furnace No. 4 at its Port Talbot works was rebuilt in 2012. A £185 million project, this included an upgrade to the fan systems that supplied combustion air, cooling air and fume extraction to the furnace.

The fume extraction systems already used VSDs but their age meant that these were now ready for upgrade. Chris Court, Electrical Project Engineer for Tata Steel, says: "The refurbishment was a chance to renew our drives for this application by taking advantage of the latest drive technologies."

A major part of the project was the design, manufacture, supply, installation and commissioning of the transformer, drives, motors and control systems for the stove combustion air fans, cooling tower fans and fume extraction fans.

The drives' solution was supplied by Iconsys, an ABB System Integrator partner: "Iconsys had worked with us before," says Court. "ABB are known as a quality manufacturer and they turned out to be the most competitive bidder. We gave them the drive sizes we required - 90 kW, 600 kW and 2.7 MW - and they quantified the best drive set up to fit our requirements, incorporating drives, motors and ABB controllers. We also detailed the specific ranges of ABB drives we wanted, ACS800s with harmonic reduction. The plant engineers had a preference for ABB and for air cooled over water cooled drives and the 12 pulse ACS800 was the only way we could get the drive power in an air cooled frame. It would also mean we had ACS800 across the furnace.

"The furnace also had ABB controllers- so we knew integration would be easy and we also already had ABB VSDs on site."

Tata Steel wanted to replace the existing direct-on-line motor starters on the stove combustion fans and cooling tower fans with low harmonic VSDs, along with new transformers and motors to achieve greater energy efficiency.

"As well as achieving energy savings by slowing the speed of the fan motors, we also wanted to increase the capacity of the fume extraction system, so larger drives and motors were needed," says Court.

The stove combustion air fans comprise three 600 kW ACS800 VSDs, with speed determined by duty cycle and combustion air demand. The fans operate as two duty and one standby, although they can also operate together at a reduced speed. The control and speed set points are derived from an ABB AC800 PLC over a Profibus DP link.

Each combustion air fan system consists of 3,300 V/690 V supply transformers, a 600 kW ACS800 low harmonic VSD and local operator stations at the drive, transformer and motor.

“The three combustion air fans were previously 3.3 kV direct-on-line, with one fan for each stove. When a stove was lit, the fan was operating at full speed – there was no speed control. The three new fans can now control fan speed to give a constant air pressure, while saving energy. We can also run two fans on a duty/standby system, rather than having a fan individually tied to a stove. This scheme gives use better availability and greater energy efficiency,” adds Court.

These drives were fitted with internal ducting, which removes over 50 kW of dissipated heat from the drives. Andy Bunce, Sales Director for Iconsys, says: “Most other vendors simply vent the air to atmosphere but Tata Steel is using this recovered heat to heat the building during colder winter months and vent it during the summer.

For the water cooling tower fans application, the existing fixed speed motor control systems for the water cooling towers were replaced with new ACS800 low harmonic 90 kW VSDs. The speed and number of fans driven is varied to maintain the set delivery water temperature, while the control and speed set points are derived from an ABB AC800 PLC over a Profibus DP link.

The VSDs and five switch fuse supplies, together with local operator stations located at each motor, are housed in a specialised IP54 steel container designed specifically for this application.

The two fume extract fans were previously driven by “Syncdrive” VSDs. “The drives were obsolete and very problematic, suffering numerous component failures. They were 2.4 MW 6 phase drives and were complicated, difficult to maintain and had a wound rotor with field controller,” says Court.

“These have been replaced by new three phase drives and squirrel cage motors, and are much simpler. The original fume extraction fans were to be retained but the speed was to be increased from 1,000 RPM to 1,130 RPM.”

The drives for the fume extract fan application, two 2.7 MW ACS800s, are believed to be the largest low voltage air cooled VSDs installed in the UK. The control and speed set points for these VSDs are derived from an ABB AC800 PLC over a Profibus DP link.

Each of the two fume extraction systems consists of 11,000 V/690 V supply transformers, a 2.7 MW motor including bedplate, coupling and guard and local operator stations.

These drives are also housed in their own special IP54 steel container which is fitted with forced air to keep the drives cool and keep the dust out.

One of Tata Steel’s requirements was a cost-effective way to maintain the G5/4 harmonic standard. To achieve this, Iconsys supplied the 2.7 MW drives with active filters using a diode front end. The smaller drives use passive filters.

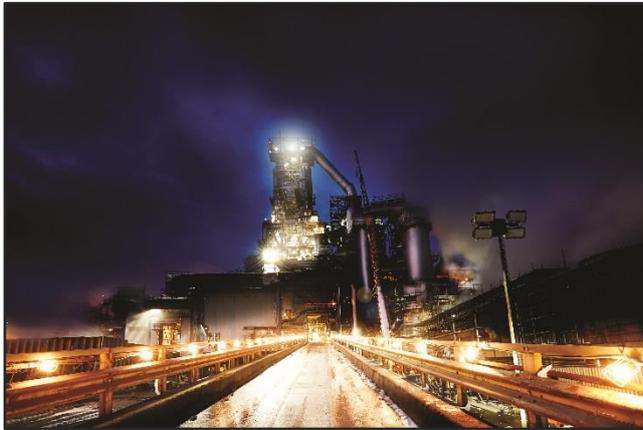
“An active front end for 690 V only goes up to 2.4 MW but the customer wanted 2.7 MW or higher. The diode front end was supplied to match the higher power requirement, up to 5 MW, giving much more flexibility to go bigger if needed.

“The ABB diode front end is supplied as a module that can be wheeled in and out if it needs to be replaced. We built the drive cabinets to accommodate this. Another challenge was the combination of low voltage and high power, giving large current and needing bigger cables. Our drive cabinets were designed to give more cable termination space, making them easier to wire up,” says Bunce.

“We have been very pleased with the applications since they were installed in February 2013. Any minor issues we have had have always been very quickly resolved by Iconsys’ service department,” added Court.

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Caption: Tata Steel has better control and improved efficiency on Blast Furnace No. 4 following the installation of ABB variable speed drives.

For more information please contact:
Layla Hewitt
Marketing Communications
Phone: 01925 741517
Email: layla.hewitt@gb.abb.com

ABB Ltd.
Daresbury Park
Daresbury
Warrington WA4 4BT

Emma Jenkinson
Armitage Communications
Phone 020 8667 2218
Email: emma.jenkinson@armitage-comms.co.uk