DEVELOPMENTS IN METALS AND MINING

In last year’s Nordic Steel and Mining Review, we presented ABB’s organizational changes in relationship to the value-based solutions for customers in Metals and Mining. This article summarizes the most recent developments in the ABB Metals and Mining operations.

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A customer-oriented organization
ABB has now formed a strong but simplified organization with Power Technologies and Automation Technologies as its core business. The Metals and Mining business in Västerås, headed by Per Eckemark, is organizationally part of the Automation Technologies division. It has three Centers of Excellence, CoE, that have worldwide responsibility for marketing and technological development.

- CoE Metallurgy Products is responsible for electromagnetic products for metallurgical processes. Recently, it has developed a new electromagnetic product, the EM Stabilizer, for applications also in processing lines.
- CoE Hot Rolling Mills is responsible for electrical equipment and control systems for hot rolling mills.
- CoE Underground Mining is responsible for mine hoist systems, including both their mechanical and electrical parts. In addition, it has developed an Integrated Mine Automation System, IMAS, based on the ABB IndustrialIT automation platform.

Metals and Mining in Västerås also has the overall responsibility for ABB’s activities towards the Swedish Market. Sales manager for the Swedish Market is Petter Oscarsson.

He works closely together with account managers to ensure that the customers do business with only “One ABB”. The same concept applies to CoEs in other countries as well.

EM stabilizer
ABB’s Electromagnetic Stabilizer, EM Stabilizer, has been developed primarily for use in hot dip galvanizing lines, but it can be applied in other processing lines as well.

High-pressure air knives, high strip speed and a long free path cause vibration and oscillation in hot dip galvanizing lines. This problem leads to variations in the zinc layer thickness, zinc splash between the air knives and scratches on the coating. The EM Stabilizer minimizes vibration, reduces the oscillation amplitude and provides more efficient operation of the air knives and cooling boxes. In addition, it helps ensure a uniform coating thickness and reduces zinc splash and scratches. Controlling vibration and oscillation with the EM Stabilizer also makes it possible to increase the line speed, thereby achieving higher productivity. It improves the availability of the air knives by reducing zinc clogging of their nozzles. Other features include the absence of physical contact, installation close to the air knives as well as simple and reliable operation.

Enhanced EMS products for metallurgical processes
ABB is launching its enhanced EMS products for arc furnaces, ladle furnaces, aluminium melting furnaces as well as for continuous casting together with the ElectroMagnetic Brake for slab casters. The most recent development is the AF-EMS for arc furnaces.

New IDC features for rod and bar mills
In Profile Rolling Mills, the well-known Rolling Mill Control with hundreds of installations worldwide has now been adapted for use with ABB’s IndustrialIT concept for rolling mills. ABB’s Interstand Dimension Control (IDC) System provides a useful tool for the continuous improvement and control of the rolling process and especially the tolerances from head to tail of round, long products. IDC installations at our customers’ plants, such as Fundia Special Bar Mill at Boxholm in Sweden, has led to the introduction of several new features and improvements in IDC technology.

One of those features of the new IDC concept is its openness. It is easy to integrate into any existing automation system via a network or digital/analog I/Os and it can be configured as a control or measuring system. Installation and commissioning can take place during normal production.
The other new IDC feature is its scalability. Customers can start by installing an IDC system on a small scale and expanding it step by step when their investment budgets allow this. The customer himself can carry out the first step by just installing a Stand-alone Measuring System. Later on, this system can be upgraded to a Stand-alone Control System or an Integrated Control System with the addition of the IDC control system based on AC800M controllers.

IDC systems have been installed at, for example, Ovako Steel, Fundia Special Bar, Fine section Mill and Fagersta Stainless Steel in Sweden, as well as at Hylsa Steel in Mexico and SMI in the US.

Diagnostic tools for hot rolling mills

ABB has developed powerful diagnostic tools based on its IndustrialIT automation platform to minimize downtime. The structured Status Lists provide a diagnostic system that quickly identifies any fault or unfulfilled condition that stops the mill or prevents it from starting and provides information in clear text. The Status Lists are dynamically updated to ensure that they keep continuously abreast of the conditions in the mill. The diagnostics for equipment not selected for use in the current production are filtered out so that the list presents only information about the equipment in use. The Status Lists are grouped according to the working sequences of the mill operator.

Start-up diagnostics. The start-up of a rolling mill is divided into well-defined stages such as Ready for Switch On, Ready for Run, etc. Each stage has its own Status List, which, in the event of unfulfilled conditions, helps the operator meet the conditions so that the start-up can proceed.

Stop diagnostics. There are a number of different types of stop (various stop rates, delayed stops, etc.). Each stop type has its own Status List that quickly informs the operator about the root cause of the stop order.

Interlock diagnostics. A rolling mill includes a lot of equipment that can perform a number of automatic operations and sequences. Each operation normally has a set of interlock conditions that have to be fulfilled for operation to take place. Generation of status information is integrated into the interlocking logic. The list specifies in clear text all unfulfilled conditions for the operation.

The IndustrialIT automation platform has a unique software architecture known as AspectObjects. This organizes the automation system into Objects, whose characteristics are defined as Aspects. The architecture has been developed so that information from automation systems from other suppliers can be easily integrated into the ABB IndustrialIT system. The Objects are arranged in a Plant Explorer structure based on either functionality or geographical location. This gives the mill crew the big advantage that all information about the process objects such as drawings, descriptions, manuals, maintenance statistics, etc., is immediately on hand when required. No more searching for documentation while production is waiting. Additional information can be added to the system for the most part irrespective of its form.

Enhanced measuring systems

AvestaPolarit has ordered another strip edge sensor for measuring the strip position and width, the so-called MeasureIT Millmate Strip Scanner System (MSS). The MSS sensor is to be installed on a 20-roll cluster mill in Långshyttan, Sweden. This is the second strip scanner for the Långshyttan mill and, in total, the eighth so far ordered by the AvestaPolarit Group. The MSS sensor for the order from the Långshyttan mill will be supplied with a new combination of accurate measurement of strip position and width.

MeasureIT Millmate Thickness Gauging Systems

After a one-year trial period with the MeasureIT Millmate Thickness Gauging System (MTG) the aluminium producer Alcan has decided, due to very satisfying results in the leveling line, to order three more MTG systems for their production unit in Singen in
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ASTAT crane motion control

The steel industry is the most important user of large EOT cranes with a high lifting capacity. Like the rest of the process and manufacturing industries, it demands from its equipment suppliers lower prices in combination with better performance. This has been a difficult market situation for many crane builders, whose profits have not reached an acceptable level. The main cost driver has been the electrical equipment. Conventional frequency converter drives give rise to extra costs associated with their supplementary parts, like air conditioning and EMC precautions. With its ASTAT Crane Motion Controllers, ABB can offer improved availability, integration into the crane’s information system and a surprising cost reduction for an EOT crane for the steel industry of about 10 - 20 per cent. Another factor of importance is the ruggedness of the motion control system. The ASTAT system is designed to operate at a temperature of 70° C, in areas with conductive dust as well as at 70 per cent of the nominal line voltage. A commonly asked question is the cost of slip-ring motors. The price difference between a crane duty motor of squirrel-cage or slip-ring type is minimal as long as cast-iron motors are compared. Light-alloy motors are always cheaper.

New drive systems for mine hoists and rolling mills

To satisfy the requirements for higher drive performance and higher network quality, ABB has developed a new generation of drives. Two basic series are available: ACS600 for 690 V and ASC6000 SD for 3,150 V systems. The new drive using DTC, Direct Torque Control, is now proven technology for mine hoist applications through more than two years of service in the first installation in the Pyhäsalmi Mine in Finland. This installation uses MV technology based on the ACS6000 SD drive with synchronous motor. The new generation of drives offers unequalled speed and torque control performance as well as a low impact on the supply network by controlling the power factor to unity with a minimum of harmonics distortion.

Currently, two mine hoist systems with the new drive system (one at Pyhäsalmi Mine and the other at the St Gotthard tunnel) are in operation. A third system has recently been delivered to INCO’s Creighton Mine in Canada. The DC motor for the double-drum main cage hoist at this mine was reaching the end of its life. After considering various options, INCO decided to order a new drive based on latest technology, with a synchronous motor and ACS6000 SD drive.

ABB is currently installing two hoists in AvestaPolarit’s Kemi Chromite Mine in northern Finland using LV technology with induction motors based on ACS600 drives with high-speed machines. The 3.3 m friction hoist with skip, cage and counterweight is powered by a 1,500 kW, 1,000 r.p.m. induction motor, while a 75 kW, 1,000 r.p.m. induction motor drives the single-drum auxiliary hoist. It is interesting to note that the Old motors are upgraded to new ones with the ASTAT crane motion control system.

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Kemi Mine specified AC drives for the new hoists. In fact, DC drives have never been used in this mine. Installation of the new hoists is scheduled for completion in August this year.

**IMAS, Integrated mine automation system**

IMAS is an integrated automation system that is based on the IndustrialIT Platform. IMAS provides integrated solutions for all activities associated with underground mining, ranging from haulage to crushing, hoisting and ventilation. Third party products used to control equipment in the mine can be integrated into IMAS, as is also the case with links from the mining company’s business and maintenance systems. For such automation projects ABB cooperates closely with the customer, starting with feasibility studies and continuing right through to the completion of the project.

**New orders and ongoing projects**

Since last year, Metals and Mining at ABB Sweden has experienced positive changes in terms of the order intake. So far this year, Metals and Mining has received several contracts in Sweden, China, Russia, Poland, Turkey and Italy for the supply of electrical equipment and control systems for the mining industry and rolling mills as well as of electromagnetic stirrers for steelworks and aluminium plants.

**Mining projects**

Recently, LKAB’s Svappavaara ore concentration and pelletizing plant in northern Sweden ordered new automation and process electrical systems. This upgrading project will be divided into six phases extending over a period of three years. It includes the installation of a new control system, new low-voltage switchgear, new frequency converters as well as engineering, installation, commissioning and project management.

‘ABB will deliver a state-of-the-art IndustrialIT solution including intelligent switchgear systems equipped with INSUM, electronic units that supervise each single motor,’ says Petter Oscarsson. INSUM is an intelligent system that provides protection, control and monitoring functions for optimized motor management.

‘The complete installation will be based on our concept for enhanced productivity, availability and service friendliness,’ emphasizes Per Eckemark.

ABB has recently received a repeat order from ALROSA, Russia’s largest diamond company and one of the world’s leading rough diamond producers. This contract includes the supply of 40 advanced hydraulically controlled disc brakes, DC drive systems, control systems and shaft signaling equipment for four hoist systems to be installed in the Mir Mine. Together with this latest order, ABB is equipping a total of ten mine hoists in ALROSA’s mines.

Poland has traditionally been a major customer of ABB’s mine hoists. The most recent order was received from KGHM Polish Copper Ltd. for the replacement of a mine hoist in their Rudna No. 11 Mine. This 5.5 m diameter hoist with skips in balance is one of the largest production hoists in Europe. Powered by two 3,600 kW motors, the hoist has a payload of 33 tonnes. KGHM has been a customer of ABB since the 1960s. The original brake, drive and control systems were in fact supplied by ABB in 1972. All equipment will be replaced except the motors. The revamp is scheduled to take place over a shutdown period of as short as 16 days at the end of this year.

China is the most important market for ABB hoists and ABB is the largest foreign supplier of hoist systems to China. This year, China has ordered several complete brake systems for mine hoists for their coal industry as part of a campaign to increase safety and reliability. Recently, ABB received an order from Luan Mining Co., Shaxi Province, for the supply of two complete hoists for their new service shaft in the Tunliu Mine. The larger of the two hoists, a 4.0 m diameter 4-rope friction hoist is powered by a 1.5 MW synchronous motor controlled by an ACS 6000/SD drive.

The metals industry

In September last year, ABB received another order for a medium section mill project, this time from ProfiARBED, part of the Arcelor Group. This is also the first major order received by ABB from the steel industry in Luxembourg.

The delivery includes the power supply installation with transformers as well as medium- and low-voltage switchgear. The drive systems comprise frequency converters and motors for both the main and the auxiliary drives. The main drives consist of the newly developed medium-voltage frequency converter system DriveIT ACS6000 SD with direct torque control. This will feed and control synchronous motors with outputs of up to 4 MW. The drive system control is based on the DriveIT Rolling Mill Drive, which combines the converter, motor and drive train in an optimal way. It allows the use of high-speed, high-power motors for the rolling mill. This in turn makes it possible to select much smaller motors, which leads to substantial cost savings for the customer. The rolling mill’s control system is based on the OperateIT platform, which will give the operators a state-of-the-art tool to follow and supervise the rolling process.

This project is being executed by a consortium, whose partners are ABB, SMS Meer GmbH (mechanical equipment), DSD Industrieanlagen GmbH (cabling and erection) and PERTUY Construction S.A. (civil works).

According to Patrik Modig, ABB’s project manager, the project is running as scheduled. The PS Platform Tests will take place in ABB’s facilities in October and will be followed by the Factory Acceptance Test prior to the shipment of the equipment to the site at the beginning of 2004. It is interesting to note that all the electrical rooms are being shipped in “E” containers, which will permit more extensive factory testing. This will help to minimize some of the typical problems normally experienced at the beginning of the cold commissioning. Most of the ABB engineers now working on the project will also participate in the commissioning on site, which will also help to ensure a smooth start-up of the ABB equipment. Cold testing will commence in March 2004, no-load testing in June 2004 and production in September 2004.

Last year, AvestaPolarit awarded ABB yet another contract for the supply of the power distribution and drive systems as well as other electrical equipment to their hot flat mill at Tornio, Finland. Three new mill stands as well as a new coiler will be added to the existing rolling mill in order to double the production. This project is also divided into several phases to minimize disturbances in the production. The first production shutdown took place in March this year in conjunction with the revamping of the roller table bridge. This will be followed in November by the second shutdown for the installation of new DC motors.