

Case note

ACS5000 medium voltage drive offers reliable and efficient motor startup in steel mill

Al-Tuwairqi Steel Mill Ltd suffers from an electricity network that restricts direct-on-line startup of its medium voltage motors. The reliability and availability of an ACS5000 drive system is called upon to provide soft start without increasing operating costs or further impacting on the network.

Al-Tuwairqi Steel Mill

The Al-Tuwairqi Steel Mill Limited (TSML) complex belongs to Saudi Arabia's Al-Tuwairqi Holding and extends across 220 acres at Bin Qasim in Karachi, Pakistan. The facility employs the world's most advanced direct-reduced iron (DRI) technology, producing 1.28 million metric tons of high-quality DRI per annum.

Challenge

The site uses six medium voltage asynchronous motors, rated from 2000 to 6150 kW, to power pumps and compressors used during the DRI process. Initiating these motors direct-on-line would generate exceedingly high starting currents.

As it is not possible to secure a strong and sufficient network connection from the utility grid, the plant relies on its own gas turbines and the impact caused by starting current of high power motors requires attention.



The Al-Tuwairqi Steel Mill Ltd in Pakistan.

Highlights

- Minimized network harmonics to fulfill IEEE 519-1992
- Extended lifetime of electrical and mechanical equipment
- Reduced maintenance costs by 20 %
- High reliability to avoid unscheduled plant shut downs
- No restriction on number of starts compared to DOL

Solution

After considering various motor starting methods, the design team opted for a variable-speed drive. The plant process involves starting the motors in sequence, with no requirements for speed control. As such, using a variable-speed drive with each motor was not viable. However, a single variable-speed drive system, capable of starting every motor, provides high reliability of the plant's network without the need to increase the capacity of the customer's turbines to handle the motor's starting current.

TSML selected an ABB air-cooled ACS5000 medium voltage (MV) drive with an integrated transformer and a synchronized bypass unit which allows the automatic transfer of the motors from converter to the fixed frequency direct-on-line (DOL) operation. Supplied by ABB Pakistan, the drive system is used to perform sequential starting of six ABB medium voltage motors, increasing the efficiency and productivity of the factory.

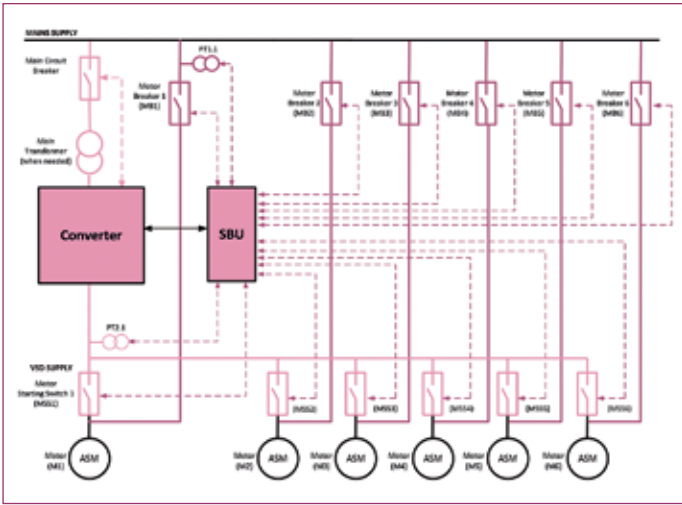


Figure 1: MV drive system

Benefits

High reliability and availability

Being the sole motor starter, reliability and availability of the drive system is essential. ACS5000, with fuseless design and use of high voltage power semiconductors, reduces the drive system's part count significantly, thereby improving the overall reliability and availability.

Simplicity

As the drive system is only used to start the motors, an air-cooled drive with integrated transformer simplifies the system without increasing plant operating costs as there is no continuous heat loss from the drive system in the switch room.

Minimized network harmonics

The 36-pulse rectifier section of the ACS5000 reduces harmonic distortion on the plant's island network, thereby eliminating the need to implement a mitigating solution.



Pump motor soft started by the ACS5000 to reduce mechanical wear and tear.

Proven solution

Before the circuit breakers switch the motor from the drive system to direct line feed, the output of the ACS5000 is synchronized with the bypass line using the add-on synchronized bypass unit, featuring the well proven SYNCHROTECT 5. All actions are executed automatically by the drive system upon command from the plant operators with manual mode available for emergency operation.

Key data of ACS5000 product family

Inverter type	Multilevel voltage source inverter (VSI)
Power range	Air cooling: 1.5 – 7 MW Water cooling: 5 – 36 MW
Output voltage	6.0 – 6.9 kV (optional 4.16 kV)
Maximum output frequency	75 Hz (optional: + 250 Hz)
Converter efficiency	Typically 98.5 % (including auxiliaries)
Type of motor	Induction, synchronous or permanent magnet motor

For more information please visit:

www.abb.com/drives
www.altuwairqi.com.pk