Case Study

Rockwell Automation

Medium voltage drive increases productivity and reduces energy in cement kiln application

Solutions

- **Solution provider:**
  - **Rockwell Automation**
  - **Indas Tech**
- **Medium Voltage variable frequency drive**
  - Medium Voltage variable frequency drive
  - Isolation transformer
  - Programmable Logic Controller

Results

- **Operations impact**
  - 25% increased productivity
- **Power system impact**
  - 40% reduced energy consumption

Background

The Tagrimpex Romcif Fieni cement plant, (acquired by Heidelberg Cement in 2002), implemented medium voltage drive technology to increase productivity by 25% and reduce energy consumption by 40%.

The Romcif company, founded in 1914 in Fieni, Romania, has an annual cement capacity of 1.2 million tons.
A cement kiln - the world's largest manufacturing machine - is the major component of the cement line. The kiln is a large rotating furnace approximately 100 m long, and four to seven m in diameter that weighs over 300 tonnes. It heats raw materials, such as limestone, clay and shale, at temperatures over 2700 degrees F to produce clinker, which is then ground together with gypsum to form cement.

Challenge

During normal operation, the kiln must rotate continuously, to prevent serious damage to it. Two systems are used to control the kiln rotation: a normal control system consisting of two large motors from 500kW to 700kW, and back-up system. Each motor has its own gear coupled to the bearing installed on the body of the kiln, and share the same electrical load.

The 20-year-old kiln rotation control system used sub-synchronous cascade. This system stopped several times a day and had poor kiln control, especially during the start and stop phases. These delays resulted in lost production time and re-starting the motors causing unnecessary wear and tear on the motors and equipment. The fixed speed of the existing motors resulted in needless energy use and related costs.

In 2001 Romcif decided to modernize this system with a goal of increasing production and reducing energy use. Requirements included controlling the speed of the kiln, smooth starting and stopping, quick re-start capability, and high availability of the control system.

Solution

Rockwell Automation and Indas Tech, a local distributor, proposed an Allen-Bradley medium voltage drive system. The system included three medium voltage drives with input voltage 3kV and output voltage 3kV, three medium voltage motors, an isolation transformer and a Programmable Logic Controller (PLC) to coordinate the system.

The isolation transformer had primary winding at 6kV and two secondary windings at 3kV, one delta and one star. The 12-pulse solution with load sharing reduces harmonics to the 6kV network.

During normal operation of the kiln, only two drives and two motors were required. One drive is settled into speed control mode and the second drive into torque control mode. Both drives have encoder feed-back for accuracy during speed control. The third drive is back-up to ensure the kiln will always run, in the event of issues or maintenance of the main drives.

Four input separators and four output separators were used to supply the drives from the isolation transformer and to connect them to the motors. Each separator has a switch to detect the closed position. All the switches are connected to the PLC drive system, which uses a SLC 5/04 processor with a RIO scanner module to issue a RIO link. This link is used to connect the MV drives by SCAN port interfaces, so the PLC drive system controls each of the three drives.

Also, the channel 0 of the processor is used to connect the PLC drive system with the PLC of the kiln. This connection gives the ability to control the drives from the central control room with PC's and RSView 32 software, or from the local drives room using push-buttons placed on the front doors of the drives or PLC cabinets.

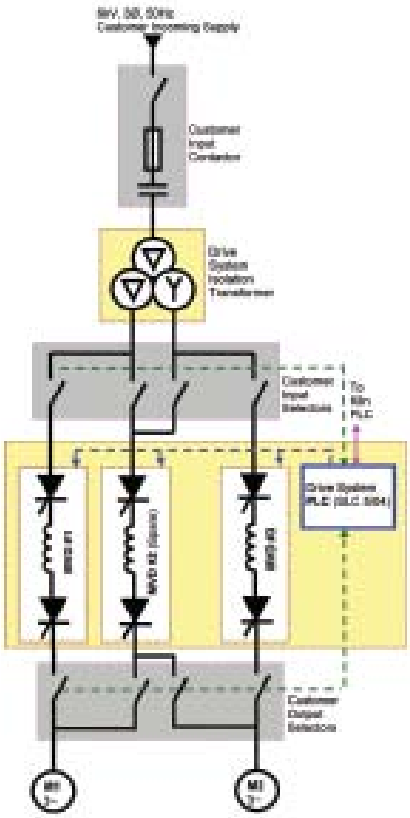
A selector switch on the front door of PLC drive system chooses the drives used for normal operation. If the positions of the input and output separators don't match with the drives combination selected, the PLC drive system won't give permission to start the drives.

Romcif built a drives room and separators room under the kiln and provided all installation and cabling. The system start-up was done by a team of Rockwell Automation specialists, authorized distributor Indas Tech specialists and Romcif employees.

The team simulated some possible faults, such as a drive beak-down and re-starting with the spare drive. Rockwell Automation also provided drives maintenance and troubleshooting training to Romcif.

Results

Romcif reports that during normal operations there were no stops reported due to the drives. This increased the availability of the kiln and allowed it to reach one of its highest rates of productivity - about 25% more than the normal production per day reached before medium voltage drives installation.
It also reduced energy use significantly. The high efficiency of the drives and the ability to control the kiln at the desired speed reduced energy consumption by approximately 40%.



ROMCIF drive system layout

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