



## CEMENT KILN FEED CONTROL



**BACKGROUND:** Cement is pyroprocessed in long, cylindrical kilns that rotate axially at a rate 30 to 250 revolutions per hour. The axis of the kiln is slightly sloped, typically 1-4°, enabling the raw mix or meal that's fed into the upper end of the tube to be properly processed at the prescribed rate. A burner pipe located at the opposite end of the kiln produces charge temperatures of approximately 1450° C. Kilns are frequently as much as 12 feet in diameter, which is large enough to accommodate an automobile. In many instances, kilns are taller than the height of a 40-story building. The limestone and clay mixture gradually moves through the kiln. Certain elements are driven off in the form of gases. The remaining elements unite to form a substance called clinker. Clinker comes out of the kiln as red-hot gray balls, about the size of marbles. After cooling, clinker is grinded and mixed with small amounts of gypsum and limestone to make cement.

**KEY TO SUCCESS** in producing high quality clinker in a rotary kiln is to have minimal process variation of the feed materials entering the kiln. Tight feed rates can achieve a stable and predictable bed depth. This will in turn lead to more controllable reaction rates and lower flue gas emission levels which are critical for successful production at a cement plant.

**PROBLEM:** Modern cement producers utilize the dry process, where the raw materials (limestone, shale, etc.) are finely ground and dried into the raw meal, which is then pre-heated to 900°C prior to entering the cement kiln. The feed rate of the raw meal must be closely linked with the kiln

# ELECTRAULIC™ ACTUATION

rotational speed to obtain proper bed depth of the raw meal. The loss in control of bed depth directly impacts the quality of the clinker product, causes increased fuel usage, as well as imparts stress on kiln motors. All of these problems will decrease overall kiln efficiency and likely result in greater particulate and greenhouse gas emissions.

**SOLUTION:** Greater process control is a hallmark of REXA's Electraulic™ Actuators, which provide more precise and accurate performance than pneumatic and traditional hydraulic technologies. At a cement production facility in the Philippines, the feed control gate was operated with a rotary vane pneumatic actuator. Based on the requirements of this plant, the kiln feed rates must be set at 185 tonnes per hour to ensure the proper chemical reaction occurs. With the pneumatic actuator, the feed variation was +/- 5.5%, causing the process engineers to set a lower feed setpoint of 165 tonnes per hour to account for the "hunting" by the actuator. If the feed rate is too high, there is not enough time to complete the clinker product reaction.

The plant sought a solution to this problem, and ultimately selected REXA's X2R Rotary Actuator to replace the old pneumatic model. Based on the company's proprietary, self-contained Electraulic® Technology, which combines the simplicity of electric operation, and the power of hydraulics. The REXA Rotary Actuator was able to dramatically improve control performance by reducing the feed variation to +/- 1.5%. Similarly, the REXA Rotary Actuator's high stiffness and exact positioning enabled the feed setpoint to be increased 8% to 178 tonnes per hour. Based upon the output of the Philippine facility, this amounts to 122,000 additional tonnes per year.

The REXA X2R Rotary Actuators allow Hydraulic pressure is generated by an internal positive displacement gear pump driven a stepper or servo motor with no limitations on starts, stops, or reverse cycles. This self-contained electro-hydraulic system locks the cylinder in place when no movement is required. This minimizes wear-and-tear on moving components and eliminates unnecessary power consumption.



## RESULT

REXA's Electraulic™ Actuators have been engineered for use for modulating duty cycle and precise positioning independent of load variation. REXA's technology provides the precise modulating control required by using cylinders rated for 2,000,000 full strokes or 20,000,000 dither cycles. Sophisticated electronics allow complex diagnostics and partial stroking for enhancing the operation and service life of the gate. Software designed specifically for REXA Actuators allows the user to calibrate and customize the actuator operation. The actuation package supports both HART (Highway Addressable Remote Transducer) and Foundation Fieldbus control system protocols.

As a result of the design, features and performance of the REXA Actuators, problems with feed rate setpoints and variation are essentially eliminated, resulting in a more efficient process and higher yield.

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