



## COKE OVEN COLLECTION MAIN PRESSURE CONTROL

**BACKGROUND:** Coke ovens process coal into coke, which is used as a fuel source in steel mill blast furnaces. The transformation is done in batches in a coke oven battery at temperatures up to 1,100°C for approximately 24 hours. Coal carbonization is done in what's called a "reducing atmosphere furnace" where oxygen and other oxidizing gases are absent. Higher quality coke demands tight control of this process in order to limit the impurities and impart the highest thermal energy potential of the final product.

**PROBLEM:** Within the coke battery, the primary device responsible for controlling the pressure of outgoing byproduct gases is called the Cross Over Valve. Typically a butterfly style valve, the Cross Over Valve is part of a collection system that is designed to keep the collection main under a small positive operating pressure to prevent the infiltration of air/oxygen. Too much pressure in the coke oven may cause the byproduct gas to be diverted from the co-product plant to the atmosphere which is environmentally hazardous. Too little pressure may cause air/oxygen to enter the oven, which ruins the coke, damages the refractory, and allows oxygen into the system which could also be a fire risk.

**SOLUTION:** To combat such problems as have been described, a major coke oven battery manufacturer, turned to REXA for an actuator that provides precise and reliable performance under the coke oven applications and conditions targeted by the company. To meet the performance requirements of the manufacturer, REXA recommended its drive unit based on its proprietary, self-contained Electraulic® Technology, which combines the simplicity of electric operation, the power of hydraulics, the reliability of solid state electronics, and

# ELECTRAULIC™ ACTUATION

the flexibility of user configured control.

Electraulic™ Technology is comprised of two primary subassemblies: a mechanical sub-assembly and an electrical sub-assembly. The principle behind its technology is a unique hydraulic circuitry called the flow match valve system. The actuator incorporates a bi-directional gear pump coupled to either a DC stepper or an AC servo motor that provides a highly efficient method of pumping hydraulic fluid from one side of a double-acting cylinder to the other. The discrete operation of the motor and pump creates action only when a position change is required. Once the required position is reached, the motor shuts off and the flow match valve system hydraulically locks the actuator in place. Power is not required to maintain actuator position. The motor and pump sit idle until a new command signal is received.

Balancing the pressure within the collection lines requires an actuator technology with precise modulating control and 100% duty cycle capabilities. Pressure within the oven is not uniform throughout the transformation process, and can build dramatically at certain key steps. For instance, as the coal charge increases, the coal undergoes physical and chemical changes where it is liquefied and re-solidified into pure carbon (coke). This liberates gases, referred to as coke oven gases (COG), that travel upward within the oven to a flue at the top of the chamber. Should the Cross Over Valve fail to properly control pressure, the transformation process could shift outside the allowable limits required to produce a stable end-product. In a worst case scenario, the lack of pressure control could result in air entering the coke oven with a possibility of an explosion or fire.

As with any extreme service, the reliability of the actuator technology is vital for operational safety and efficiency. Coke plant operators have turned to Electraulic™ Actuation, which provides precise modulation control and 100% duty cycle demanded for the coke transformation process. To meet these strict requirements, Electraulic™ Actuators have large torque, fast moving, and accurate fully open/close cycling. Actuators featuring this technology have been field-proven over decades to handle critical applications in the harshest environments. Rotary Electraulic™ Actuators installed on coke oven Cross Over Valves have proven to be highly reliable and require virtually no maintenance. These actuators are also capable of rotating to 355 degrees required for valve tar cleaning.



## RESULT

REXA's Electraulic™ Actuators have been engineered for use with constantly modulating Cross Over Valves in coke ovens, for the production of coke. 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 valve. REXA also incorporates in the actuator package a seat loading cylinder to protect the severe service trim.

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 pressure changes during the carbonization process are overcome with less downtime, less fugitive emissions, and a more efficient coke oven operation.

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