

The background of the top half of the page is a photograph of a large industrial petroleum refinery. The scene is captured during sunset or sunrise, with a sky filled with soft, orange and pink clouds. The refinery itself is a complex of tall, cylindrical distillation columns, interconnected by a network of large, silver-colored pipes. Scaffolding and walkways are visible around the equipment. The overall atmosphere is industrial yet serene due to the lighting.

# DOWNSTREAM PETROLEUM REFINING

Refineries across the global emphasize improving the reliability of major equipment to increase production and throughput while avoiding shutdowns. Ensuring reliable and efficient equipment operation leads to increased profit and production. To achieve this, refining applications need dependable actuation technology with quick, accurate and repeatable control. Installing REXA Electraulic™ Actuators provides optimized process control and high plant efficiency and safety - key metrics needed to reach production, profit, and safety goals.

REXA actuators are well-suited for numerous applications within refineries and provide the power, speed, reliability, and performance of hydraulics without routine oil maintenance. Unique to REXA, the Electraulic™ Power Module is a self-contained, positive pressure sealed system that does not require an external reservoir, oil filtration system or any fluid-based maintenance. This inherently clean approach to hydraulics provides years of trouble-free operation, avoids unplanned shutdowns, maximizes plant throughput.

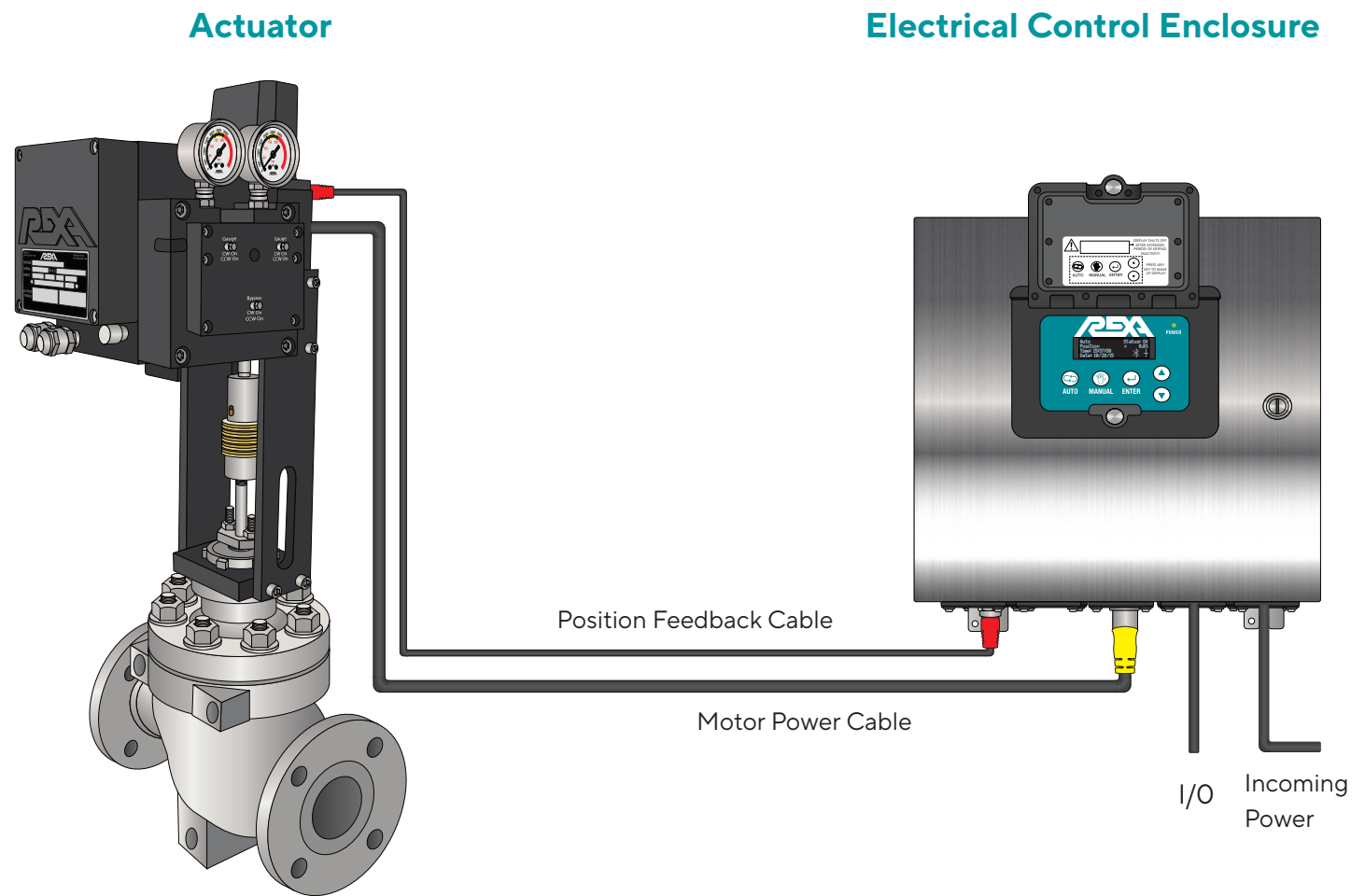
## Why REXA?

At REXA, we have 30 years of experience in the petroleum refining market. We offer reliable, high quality low/no maintenance Electraulic™ Actuators that have been field-proven in some of the most critical and difficult applications.

The REXA XPAC Electraulic™ Actuators is a superior positioning device well suited for critical control applications, such as those found in refineries. Our actuation technology reliably controls severe process conditions in harsh environments for a wide range of severe service applications. REXA Electraulic™ Actuators and Drives provide the final control element capabilities to match the most sophisticated instrumentation and distributed control systems.

The XPAC is comprised of the mechanical subassembly and the electrical subassembly. The mechanical subassembly consists of a double acting hydraulic cylinder, position feedback sensor and an Electraulic™ Power Module. The power module is a unique, self-contained, positive pressure-sealed hydraulic pumping system which manages oil pressure and flow to and from the cylinder. The electrical subassembly consists of the power supplies, motor drivers and a dedicated microprocessor.

The combination of these mechanical, hydraulic, and electronic technologies ensures precise and repeatable control of refinery processes.



### Hydraulic Power Unit

Traditional hydraulic power units (HPUs) are commonly used in critical severe service applications requiring position accuracy, speed, and response time. However, HPUs have numerous drawbacks associated with them, including:

- Reliability contingent on oil cleanliness
- Frequent hydraulic fluid, desiccant and filter changes
- Expensive and large hydraulic fluid volumes
- Requires large, vented external reservoir (some also require chillers to decrease oil temp)
- Continuously running pumps consume more electricity, cause fluid to heat up, accelerates oil and seal breakdown and require more maintenance
- Open-loop hydraulics allow atmosphere exposure, risking oil oxidation and particulate contamination



### Pneumatic Actuators

The inexpensive, familiar design of pneumatic actuators makes them the most common type of actuation technology where air is readily available. Though perceived as a low-cost solution, the true cost of pneumatics is often overlooked.

Drawbacks include

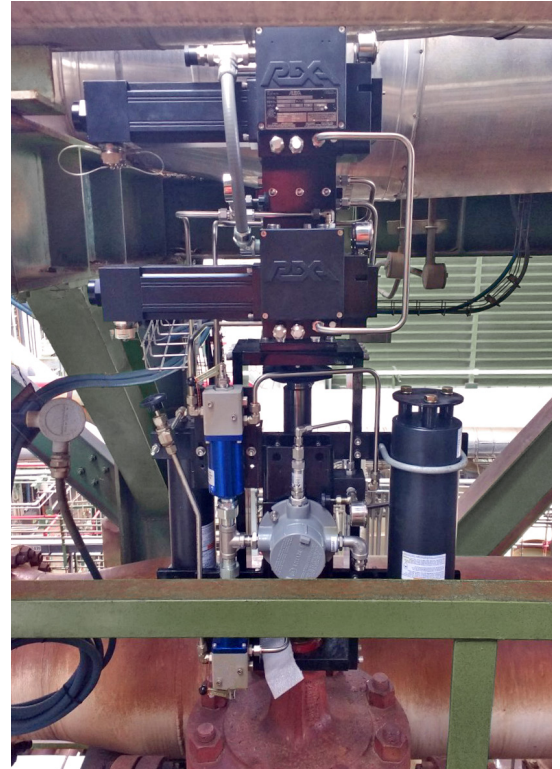
- Prone to overshoot due to air compressibility and static friction
- Smart positioners increase actuator response deadtime
- Poor resolution and accuracy for small position changes
- Structural supports needed for heavy/large actuators
- Volume boosters and quick exhausts are required for fast speeds
- Requires costly clean, dry instrument air
- Low/limited frequency response



### Compressor Anti-Surge Valve

A critical component, the compressor anti-surge valve (ASV) ensures efficient and safe operation of the entire compressor train. Modern compressor control systems include advanced load sharing and process control algorithms, requiring faster and smarter ASVs to enhance machinery and plant performance. Pneumatic actuators cannot handle the more complex startup, shutdown, tuning and sequencing of the new digital control, hindering operation.

REXA actuators enable the ASV to achieve bi-directional speeds of less than 1 second with emergency trip speeds in the milliseconds range. REXA's low dead-band of 0.05% allows for tighter and more precise control, improving compressor performance, efficiency, and throughput. With REXA, ASVs are no longer subject to overshoot and hysteresis.

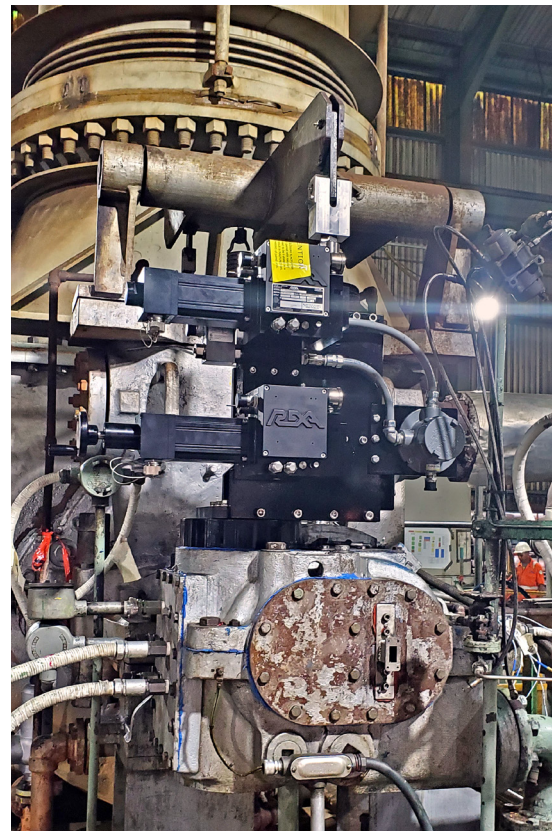


### Steam Turbine Governor Control

The steam turbine governor controls steam flow into the turbine casing, maintaining rotor speed at a constant value. Accurate, repeatable, and steady speed control drives the turbine at optimal RPMs.

Antiquated, lube oil-based steam turbine governors driven by servo/proportional valves are extra-sensitive to dirt or tiny particulates and require frequent, costly maintenance. Pneumatic actuators are also a poor choice for this application due to their slow speed of response, susceptibility to static friction problems, hysteresis, and poor control.

REXA Electraulic™ Actuators' unique, self-contained design requires no filters and no oil-based maintenance - allowing for long stretches of service intervals from one turnaround (TAR) to the next. High performance and low deadband resolution provide tight, precise control down to +/- 1 RPM. REXA actuators enable your turbine to run efficiently, safely, and reliably for years to come.

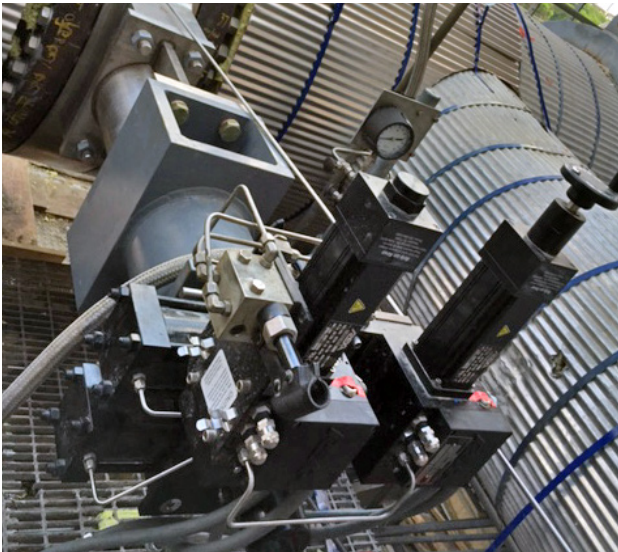


## FCC Slide and Butterfly Valves

To carry out the delicate fluid catalytic cracking (FCC) process, the spent catalyst, regenerated catalyst, and flue gas valves must be highly reliable and quick to respond to any process changes. These valves have long travels, fast stroking speeds for normal and emergency operation, and high thrust or torques.

Old antiquated HPUs requiring large volumes of hydraulic oil are common. Equipment such as sensitive servo/proportional valves, outdated electronics, filters, pumps and accumulators require frequent service. Hydraulic oil must be conditioned in order to prevent any unwanted shutdowns. Take into consideration the hydraulic tubing and hoses that pose as potential leak paths, and these HPUs quickly become safety and reliability hazards.

The flue gas slide/butterfly valve controls the differential pressure between the reactor and the regenerator. REXA actuators provide the critically necessary tight control to maintain the FCC pressure balance in the cracking process, allowing smooth flow of the catalyst and feedstock oil between the reactor and the regenerator.

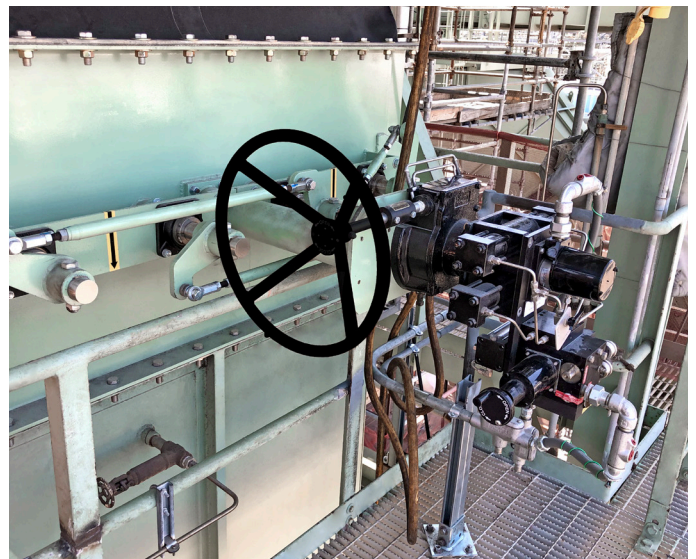
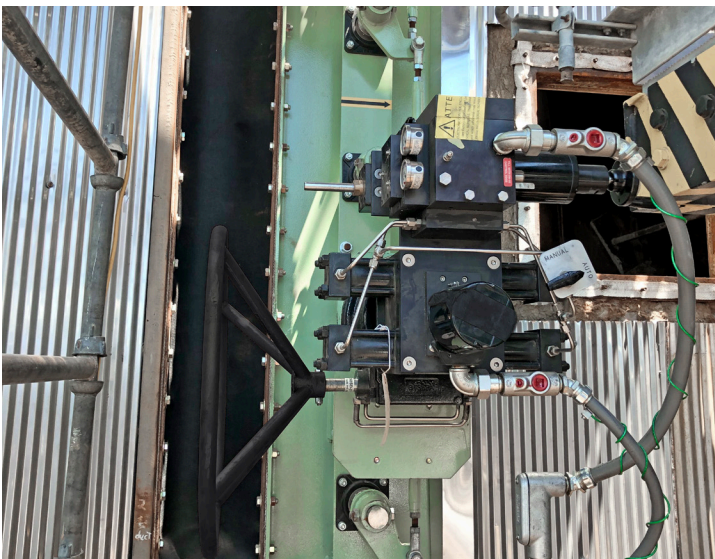


## Furnace and Heater Stack Dampers

Refineries use process heaters to heat hydrocarbon fluids, converting them into fuels like gasoline or diesel, and chemicals such as ethylene. These heaters increase the fluid temperatures for further processing in some types of downstream reactors. With furnaces accounting for at least half of total plant energy consumption, small improvements in efficiencies could increase financial returns.

Continuously evolving federal and local environmental laws mandate refineries and petrochemical plants to carefully monitor and reduce cumulative CO and NOx emissions. Often overlooked are the gains associated with better draft control using accurate damper control.

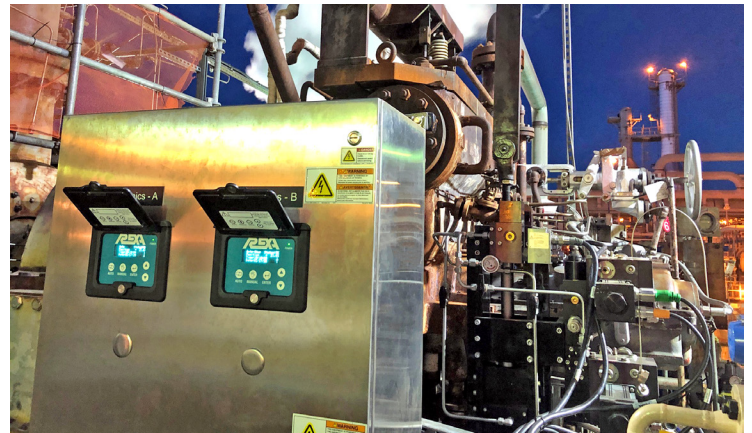
REXA's modern actuation solution provides furnaces with precise damper control. With accurate, repeatable, and quick positioning, refineries optimize furnace temperature and draft. Plant operators notice an immediate ROI through improved product quality, increased plant safety and run time, and lower emissions and maintenance costs.



### Rotating Equipment

- Anti-Surge Valve
- Governor Speed Control
- Fuel Gas Valve
- Inlet Guide Vanes (IGVs)
- Pump Recirculation
- Boiler Feedwater Regulator
- Snort/Blow-Off Valves

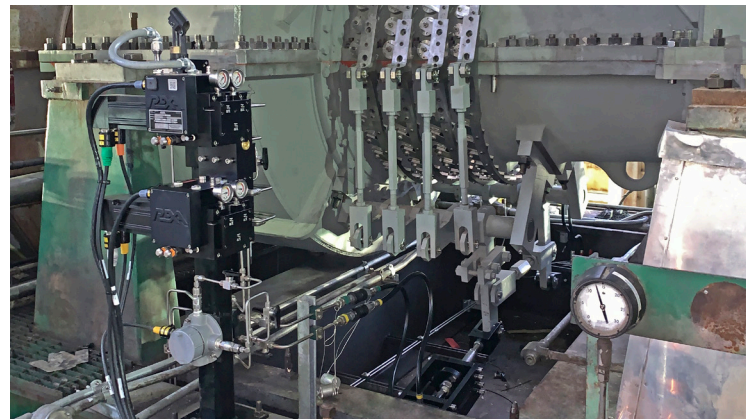
### Steam Turbine Governor Control



### Dampers

- Natural Draft Furnace Dampers
- Induced Draft Furnace Dampers
- Forced Draft Furnace Dampers
- Balanced Draft Furnace Dampers
- Furnace and Heater Stack Dampers

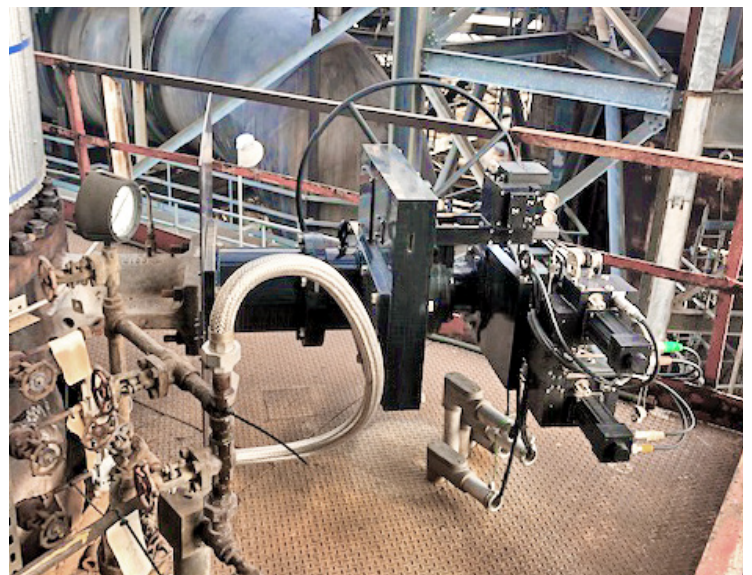
### Inlet Guide Vanes



### Control and Isolation Valves

- Flue Gas Valves
- Spent Catalyst Valves
- Regenerated Catalyst Valves
- Pressure Reducing Valves
- Isolation Valves
- Turbine Bypass Valves
- Spraywater Valves
- Pressure Letdown Valves
- Emergency Shutdown Valves (ESD) for SIS
- Overhead Vapor Valves
- FCC Slide and Butterfly Valves

### 77" Flue Gas Butterfly Valve





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