FLUID CATALYTIC CRACKING CATALYST SLIDE VALVE CONTROL

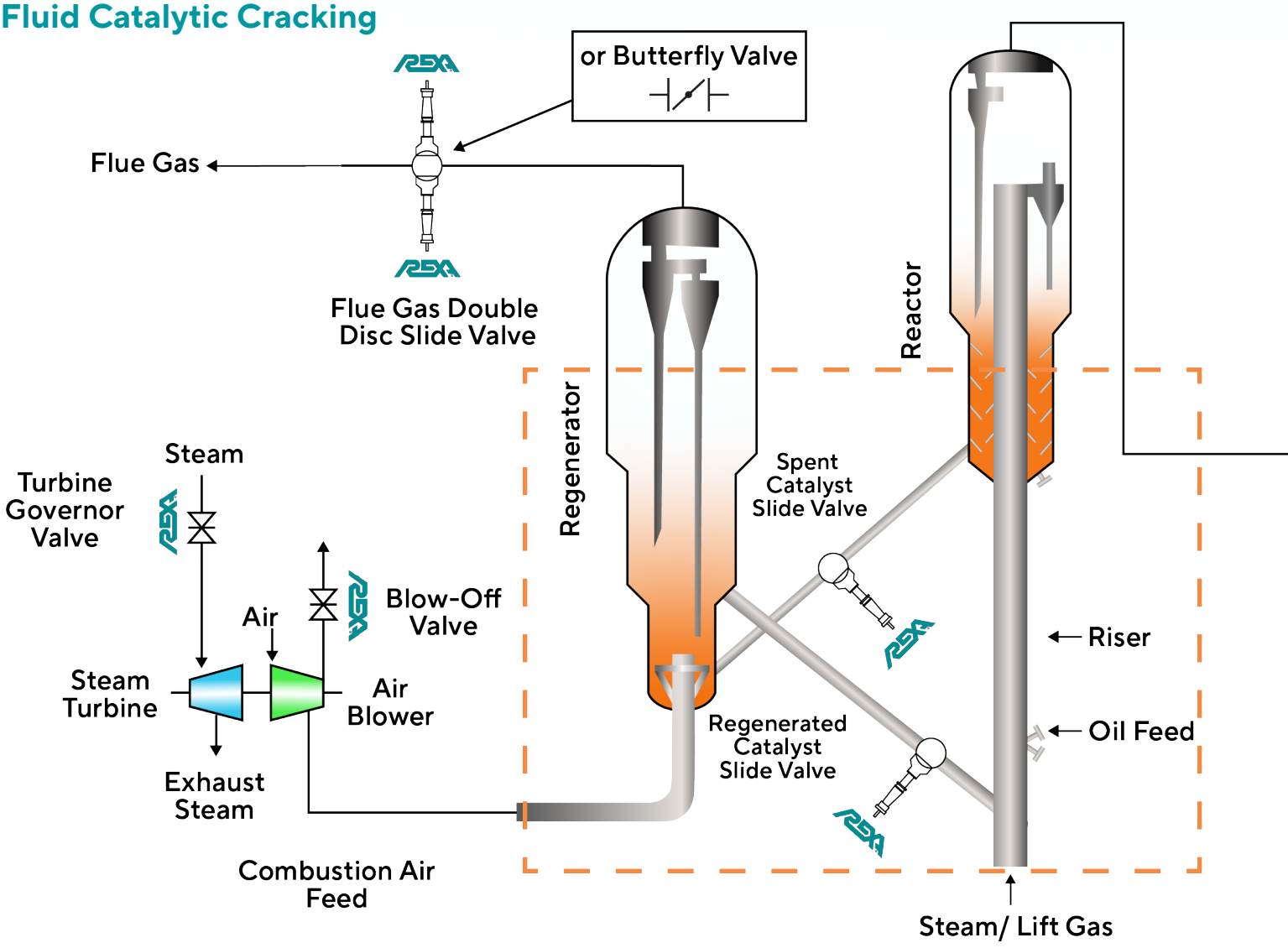
Fluid Catalytic Cracking (FCC) is a refining process used to convert heavier crude oil fractions into usable products such as gasoline, jet fuel, and diesel. In the reactor vessel feed oil is mixed with catalyst particles at high temperatures 900°F (482°C) to 1000°F (538°C), breaking the hydrocarbons into smaller particles. During the FCC reaction coke builds up on the catalyst, limiting its ability to carry out the reaction. The spent catalyst in the reactor chamber is then transferred to the regenerator to burn off the residual coke. Then the regenerated catalyst is transferred back to the base of the reactor riser to be used again.

The key to success of this application is Spent and Regenerated Catalyst Slide Valve actuators that provide both reliable **positioning accuracy** and **fast response** to the abnormal pressure disturbances that may occur. The valve stroke lengths are typically 8in (20cm) to 24 in (61cm). The Regenerated Catalyst Slide Valve regulates the flow of the regenerated catalyst to the riser, maintaining the pressure head in the standpipe and protecting the reactor from a flow reversal. Maintaining a proper differential pressure is **critical for smooth operation**. Too high of a pressure difference can lead to excessive catalyst carryover, while too low of a pressure difference can result in poor catalyst circulation. The Spent Catalyst Slide Valve controls the stripper catalyst level, regulates flow of spent catalyst to the regenerator and protects the reactor and main fractionator from a flow reversal. The Spent Catalyst Slide Valve plays a **crucial role in maintaining a catalyst barrier**, which stops hydrocarbons within the reactor from entering the regenerator. If mixed with oxygen, these hydrocarbons in the regenerator or flue gas train are a safety risk of an explosion. Poor valve performance can create pressure unbalances, which can lead to an inefficient hydrocarbon cracking process. If this condition worsens, it creates potential for unit shutdown and expensive downtime.

Problem

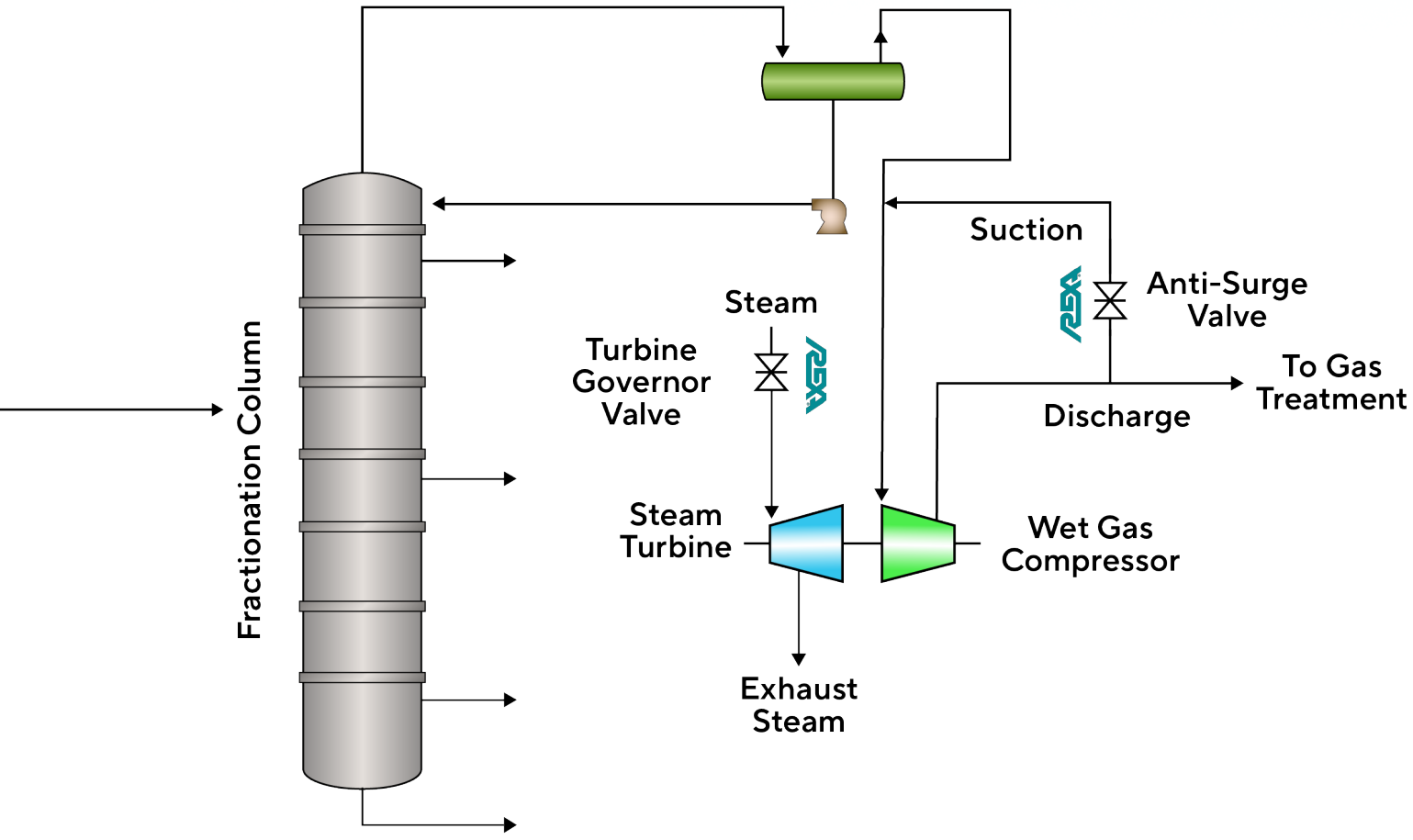
Traditional Hydraulic Power Units (HPU) are commonly used for positioning in critical FCC applications including the spent and regenerated actuators requiring position accuracy, speed, and response time. However, HPU systems have numerous drawbacks associated with them. Common to all is an "open loop" design. This design characteristic requires an intense and frequent maintenance program. Atmospheric humidity comes in contact with the hydraulic oil and creates acid build-up and premature oxidation. Dirt and particulate from the surrounding air enters the hydraulic system compounding the contamination issue. This is particularly problematic for servo and proportional valve driven hydraulic systems. These servo and proportional valve systems require very specific fluid cleanliness standards. If the fluid cleanliness is not kept within spec, the system cannot perform as designed and will result in undesired inconsistent operation and/or the need to bring the system down for maintenance. These oil cleanliness requirements necessitate the use of filters that must be replaced frequently. There are also dozens of soft goods within these systems that are subjected to high temperatures and need to be replaced periodically before they wear out and become potential leak paths. The pumps within these systems are constantly running to maintain a certain operating pressure for the hydraulic actuator to operate the valve. These continuously running pumps draw a lot of electricity (up to ~$23,000 per year) and they must be maintained at a significant cost to ensure the valve and process stay online. Finally, HPU systems often have several hundred feet of hydraulic tubing and hoses which all represent potential leak paths. In order to prevent unscheduled unit downtime, HPU systems are placed on rigorous preventative maintenance programs which are time consuming and expensive.

Fluid Catalytic Cracking

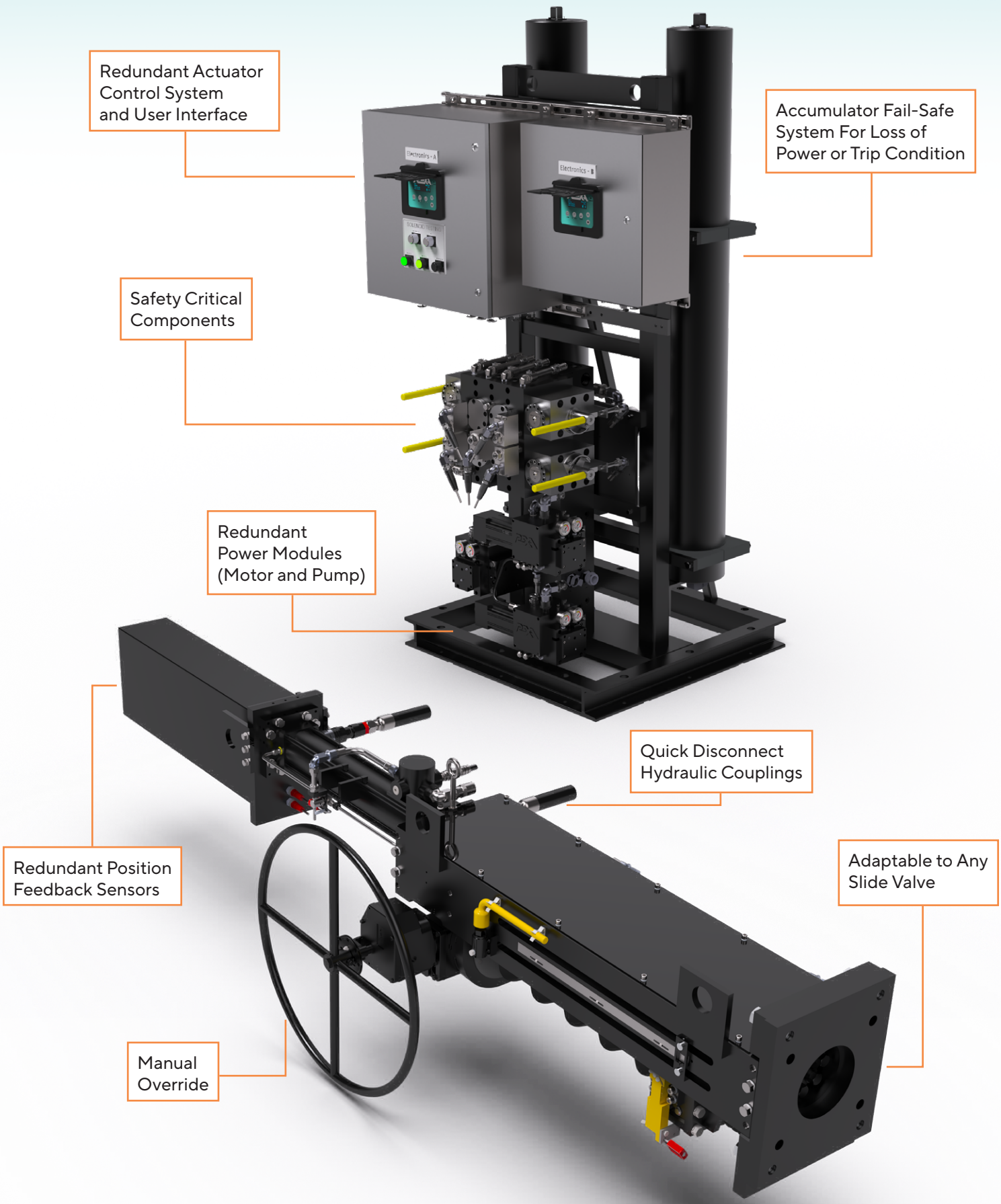


Solution

Eliminate the risk of hydraulic oil breakdown, contamination, and maintenance by **upgrading to REXA** Electraulic™ Actuation. REXA self-contained actuators combine the simplicity of electric operation, the power of hydraulics, **maximum reliability**, and the flexibility of user-configured control. The principle behind REXA Electraulic™ Actuation is a unique hydraulic circuitry called the Flow Match Valve (FMV) system. The actuator incorporates a bi-directional gear pump coupled to a motor that provides a **highly efficient** method of pumping hydraulic fluid from one side of the double acting cylinder to the other. The motor and pump only move when a position change is required. Once the target position is reached, the motor and pump shut off and the FMV system hydraulically locks the actuator in place. Motor operation is not required to maintain actuator position; the motor and pump remain idle until a new command signal is received. This maximizes operation efficiency while **minimizing wear and tear** of the actuator itself. These slide valve applications can require additional reliability to maximize plant uptime, prevent potential safety issues, and **reduce the risk of unplanned shutdown** (>$1.7M per day in gasoline production alone). The actuator can be configured with full redundancy of critical components to provide maximum reliability and availability to **get you from turnaround to turnaround** (TAR). Choosing a redundant REXA system will increase actuator reliability to a value over 99.9%.



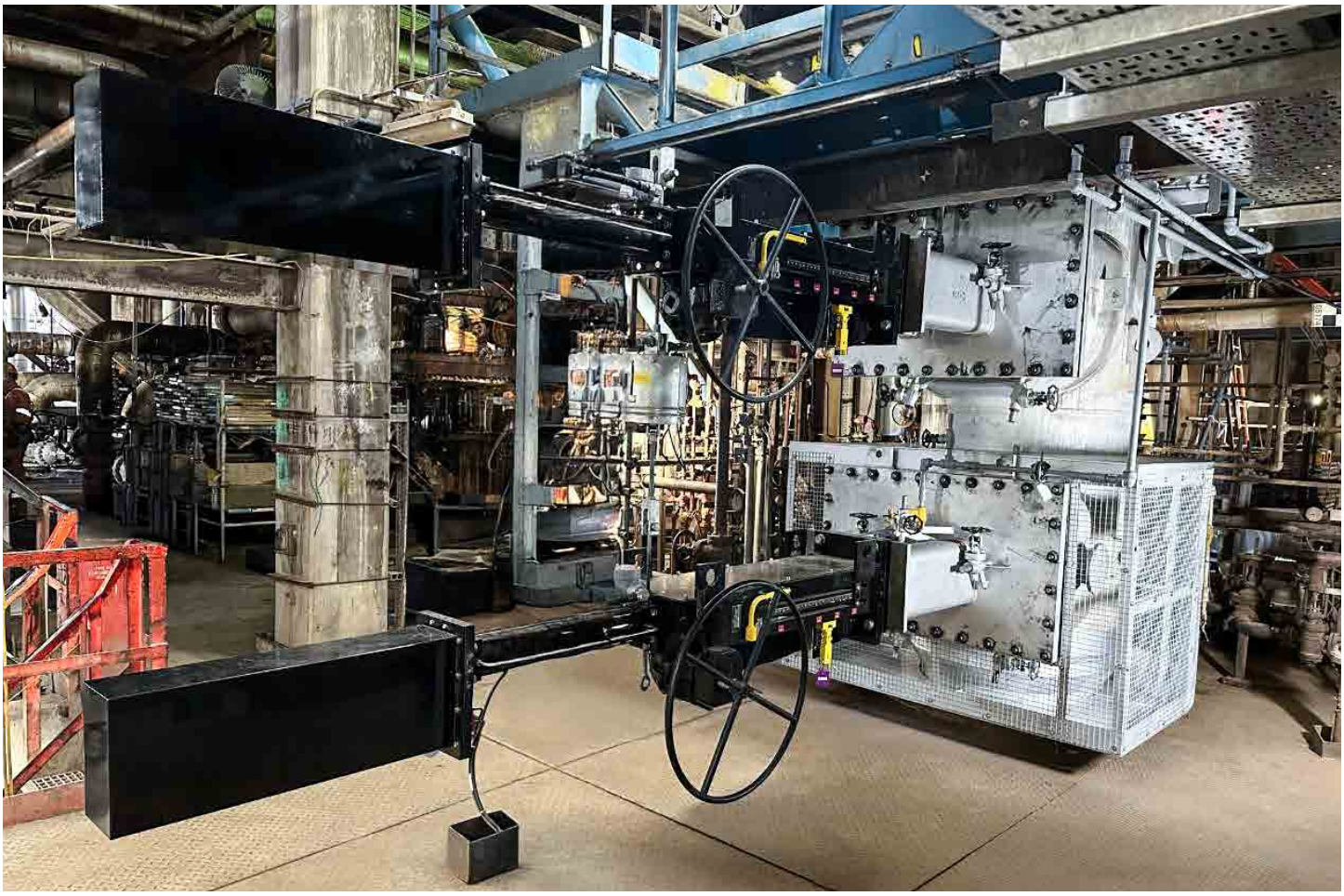
Solution


Redundant Actuator Control System and User Interface
Accumulator Fail-Safe System For Loss of Power or Trip Condition
Safety Critical Components
Redundant Power Modules (Motor and Pump)
Quick Disconnect Hydraulic Couplings
Redundant Position Feedback Sensors
Adaptable to Any Slide Valve
Manual Override

Results

With REXA Electraulic™ Actuation, the end-user gets all the advantages of a hydraulic actuator. The system **responds immediately** to control signal changes and accurately modulates the position of the Catalyst Slide Valve to ensure **efficient and safe process control**. Reliability is increased and maintenance requirements are reduced and simplified. Utilizing REXA actuators for Spent and Regenerated Catalyst Slide Valves eliminates the intense preventative maintenance routine of a conventional HPU. This means **no more routine oil maintenance**, no more fluid conditioning systems with filters, and no more constantly running pumps wasting electricity. Installing REXA Actuators on your Catalyst Slide Valves allows you to reduce and simplify your preventative maintenance list. Catalyst Slide Valves require **accurate positioning** and immediate response to control signal change. With REXA, end-users gain accurate control with maximum reliability and operational safety enabling stable regenerator pressure and steady differential pressure between the reactor and the regenerator in the FCC. This reassures end-users to have confidence to position their Spent and Regenerated Catalyst Slide Valves and reliably **maintain the desired catalyst circulation rate**.

Redundant REXA Actuator Control Systems



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