Case Study – Retrofit of REXA's Electro-Hydraulic Actuator at a Power Plant

Studying 2 different applications of REXA's actuators at a Power Plant
and analysing the benefits of these actuators

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REXA's Power Applications (Partial)

Turbine applications	Boiler applications	Combustion applications	Condenser applications
Turbine governor control	Boiler feed water start-up control	ID fan	Dump valve
HP/LP bypass	Feedwater regulator	FD fan	Condensate recirculation valve
Main steam shut off valve	Feedwater recirculation valve	PA fan	Water drain valve
Steam gland valve	Soot blower valve	SA fan	Condensate regulator valve
Air seal valve	Superheat attemperator spray valve	Burner tilts	
	Reheat attemperator spray valve	Ball mill valve	
	Spill over valve	Ignitor oil valve	
	Drum level control		
	Pressure reducing dump steam		
	Condensate recirculation valve		
	Ventilation valve		
	Flue gas desulfurization		
	Steam bypass header		
	Common steam dump header		
	Boiler feed pump turbine main steam system		
	Boiler throttle valve		

Features of REXA Actuators

- No oil tank, breather and oil filters: The absence of these components results in zero oil maintenance costs
- No HPU: REXA operates by oil flow instead of pressure, which prevents power and oil degradation issues
- The actuators have a compact design which brings in extreme ease for retrofitting jobs. No oil line and no air line required
- Discrete operation of the motor resulting in reduced power consumption and no churning of oil
- No servo and proportional valves: Enables the actuator to operate without filters and with an oil quality of NAS12. The quantity of oil used is very little
- Operational benefits such as accuracy of 0.1%, repeatability of 0.1% and a deadband adjustable up to 0.05%
- Quick response time of 60-90 ms, the fastest among any hydraulic actuators globally
- SIL3 rated product

Case Study 1 – Retrofit of REXA's Actuator on a Soot Blower Valve

- Client: Tata Power, PPGCL BARA, Prayagraj
- Plant capacity: 3*660MW
- Medium: Superheated steam
- Valve type: Globe
- Valve stroke: 2 inch
- Valve make: KSB MIL, will remain the same with the new actuator
- Old actuator make: Pneumatic KSB MIL
- Upstream steam pressure: 250-280 kg/cm^2
- Downstream steam pressure/header pressure: 30 kg/cm^2
- Safety valve pop-up set pressure: 42 kg/cm^2
- Allowable limit of maximum and minimum line pressure during starting and closing of soot blowing: 24-36 kg/cm^2
- Allowable limit of maximum and minimum line pressure during standstill condition: 28-32 kg/cm^2
- **Problem with the existing system:** Due to compressibility of air, the header pressure was fluctuating too much, causing the safety valve to pop up. Steam was leaking out, causing a large loss of heat
- A soot blower with non-stable header pressure is unable to clean the soot properly, creating hot spots which cause a large loss of heat

Visualisation of REXA's Actuator on a Soot Blower Valve at Unit #3

Before (KSB MIL valve with Pneumatic Actuator)

After (KSB MIL valve with REXA's Actuator)

Benefits of Retrofit of REXA's Actuator on the Soot Blower Valve

- Hunting oscillations created instability in header pressure or fluctuations with the pneumatic actuator

- **Constant and accurate header pressure**: Soot blowing with constant header pressure will clean the soot to prevent hot spots more precisely, as compared to fluctuating header pressure, and hence increase efficiency
  - **Standstill condition:** When main isolation valve is open 100%, motor operated valve is opened 100% and branch main isolation valve is opened, the REXA actuator regulates the valve in such a way, that header pressure remains in the pressure range of 29.6 to 30.3 kg/cm^2. (Set Point: $30kg/cm^2$) and hence no pop-up of the safety valve (no heat loss)
  - **Starting of soot blowing:** Maximum dip in the pressure is 5-6 kg/cm^2 on full consumption of steam
  - **Stability during soot blowing:** Pressure dip is recovering within 60 seconds on full consumption of steam
  - **Closing of soot blowing:** Pressure hike once the soot blowing is completed is 5-6 kg/cm^2 on full consumption of steam. Pressure hike is recovering within 60 seconds on full consumption of steam

- **Zero maintenance:** REXA's actuator does not need any type of calibration resetting and it can handle the impurity level NAS 12. Hence, there is no need to replace the oil

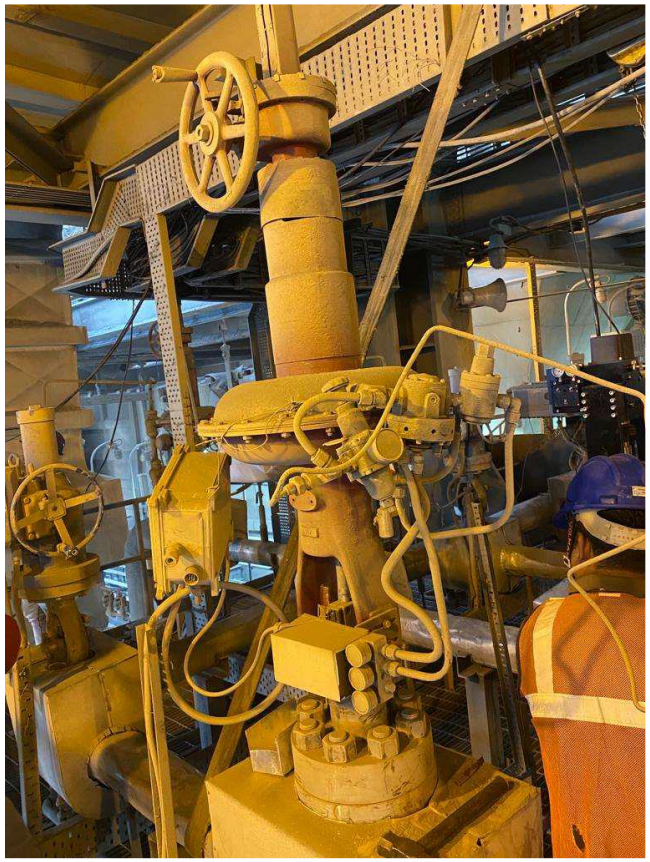
Case Study 2 – Retrofit of REXA's Actuator on a Reheater Spray Control Valve

- Client: Tata Power, PPGCL BARA, Prayagraj
- Plant capacity: 3*660MW
- Medium: Spray Water
- Valve type: Globe
- Valve stroke: 2 inch
- Valve make: KSB MIL, will remain the same with the new actuator
- Old actuator make: Pneumatic KSB MIL
- Upstream spray water pressure: 60 kg/cm^2
- Downstream spray water pressure: 58 kg/cm2
- Reheater steam pressure: 56 Kg/cm2
- Reheater threshold metal temperature: 600ºC
- Reheater steam temperature: More than 580ºC (Design at 596ºC)

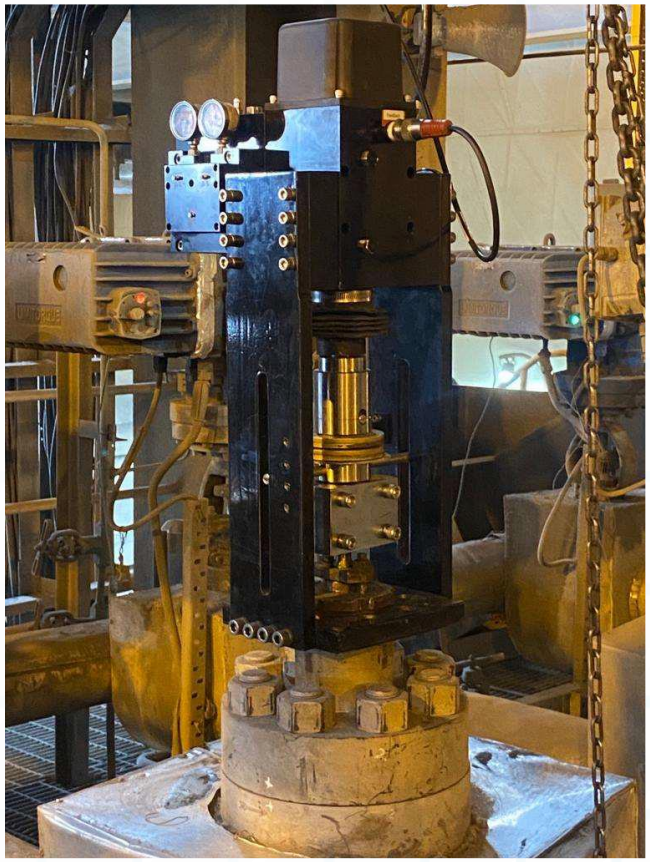
Problem with the existing system:

- During the spray of water in the reheater steam line, the actuator gets the demand of small opening. Pneumatic actuators struggle to maintain this small opening and result in hunting of the valve resulting in passing/leaking water even when fully closed. This passing of water results in dropping of reheater steam temperature and hence reduction of efficiency. User has seen 3-8 ton/hour passing during closed condition of valve with a pneumatic actuator
- Actuator starts opening the valve after 5 seconds of receiving the command which causes delay in starting of quenching, resulting in an inability to match the demand temperature of main steam. This leads to metal temperature excursion

Visualisation of REXA's Actuator on a Spray Control Valve at Unit #1



Before (KSB MIL valve with Pneumatic Actuator)



After (KSB MIL valve with REXA's Actuator)

Benefits of Retrofit of REXA's Actuator on the Spray Control Valve

- In reheater spray station, there are four control valves. Of these, it was decided to install REXA's actuator on the LHS main control valve, which was releasing a continuous spray irrespective of actual demand for this spray
- REXA's actuator operates using oil. As oil is virtually incompressible, the actuator has a very stiff positioning capability. This avoids the issue of hunting at small demand and hence stops the passing of spray water. After the installation of the REXA actuator, it was observed that the passing reduced to 0 ton/hour
- REXA Actuators have a response time of 60-90ms resulting in tight temperature control
- With proper control of spray, the boiler efficiency increases and there is less use of quenching water
- Due to the benefits listed above, there are lesser chances of breakdowns, water leakages and damage to the internal portions of the valve and actuator
- This reduces the strain on the maintenance team (REXA actuators generally require maintenance after 3-5 years) and increases safety for the plant and its workers
- Optimizing reheater spray control by replacing a pneumatic actuator with a REXA electro-hydraulic actuator: REXA's self-contained electro-hydraulic actuators are ideally suited for the required positioning resolution, frequency response, and duty cycle for minimal temperature swings. Usage of these actuators results in minimal thermal stress on materials (reducing fatigue and extending service life)

Conclusion

- “We generally operate the soot blowers every 4-6 hours, so it’s really important they work when needed. These REXA actuators work every time!” – Plant Process Control Specialist
- The most noticeable improvement that a plant operator will immediately see is precise spray water valve control on the low end of valve travel. This allows the plant to operate at lower loads efficiently, and without the risk of large temperature swings
- With high resolution and repeatable positioning, REXA’s actuators allow the steam temperature at the IP turbine to be set closer to design than ever before. An increase of 5°C equates to approximately a 0.1% increase in turbine efficiency for a standard condensing turbine

THANK YOU