Electric-Driven Actuators
for SRV, PM Valves, and IGV
at Fort St. Vrain Station, Platteville, Colorado

7F Users Group Annual Conference, May 17, 2017
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Unit 1: GE D8 Steam Turbine
Unit 2: 7221 (COD 1996)
Unit 3: 7231 (COD 1999)
Unit 4: 7241 (COD 2001)

Combined Cycle

Units 5 & 6: 7241 (COD 2009)
Simple Cycle

403,500 Total Fired Hrs
4,375 Total Fired Starts
The Problem

- Oil varnish created by micro-dieseling in servos
- Sticking hydraulic valve actuators due to varnishing
- Turbine trips due to inconsistent valve tracking
- Annual replacement / cleaning of servos
Band-Aids

- Side-stream electrostatic filtration
- Periodic in-kind oil replacement

Solutions

- Synthetic Oil (Polyalkylene Glycol) → FSV 3
- Replace hydraulic actuators with electric → FSV 4
Considerations

• Ambient temperature challenges
• Explosive environment
• Control system interface modifications
• Control system logic modifications
• Sufficient force to move IGV rack
• Failure modes
• Reliability
• Design life
• Periodic Maintenance
Ambient Temperature Ratings

- Gas valves rated to 100°C/212°F
- IGV rated to 130°C/266°F
Electric-driven Stop/Ratio Valve (SRV)

- Installed on FSV #4 in Spring 2016
- Smooth installation and commissioning
- Minor control loop tuning issues
- Operational test for future applications
Installed May 2017 on Ft St Vrain Unit #4
Installed May 2017 on Ft St Vrain Unit #4

- Convenient step stool
- New turnbuckle
- 2Meter LVDT wiring
- 10Meter Motor wiring
- Hard-Wired
- Left hydraulic lines in place

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Control System Logic Changes

• Changed start permissive to look for valve controller faults
• Changed hardware assignments for trip oil relays (L20FG1X and L20TV1X)
• Removed trip logic from low hydraulic pressure
• Removed hydraulic protection trouble alarm
• In Post-Ignition and First-Out Trip logic, replaced low hydraulic pressure trip with electric controller fault trip.
• Changed hydraulic oil pump lead/lag logic to only run at turbine speed < 50% (for lift oil)
• Modified graphics accordingly

And remember, changing the logic and graphics is a piece of cake with Ovation!
Failure Mode / Trip Response

Gas Valves
• On a loss of power, spring action will slam valve closed (similar to spring-close)
• On unit trip, controller will rapidly close valve, but decelerate just before closed to preserve valve seat

IGV
• On loss of power, actuator will fail as-is (similar to hydraulic actuator)
• On unit trip, actuator will fail to the closed position in approximately 4 seconds
Disadvantages

• The controller box is cramped and laid out with inconvenient field wire access
• Individual control boxes per valve
• Added local reset button (site preference)
• Actuator motors are hard-wired; to pull a motor requires pulling cables back through seal-off
Future Remedies

- Redesigning control box / interface to have rack-mounted cards
- New version will have 2 racks total for PM valves and IGVs
- Quick disconnect cables for EMA products
Advantages

- No more varnished and sticky PM valves or IGV
- No more trip oil
- Hydraulic pumps only operate for lift oil when speed is less than 50% *(Can be eliminated with Independent Lift Oil system)*
- Young & Franklin were amazing to work with – very good experience
- 12 year recommended inspection interval
Questions?

(The view from Fort St Vrain Station)