Pipeline Pressure Control

TIP sheet - Roadmap for improving pressure control performance

1. Create a control loop performance document for all important loops.

The document should include PCV performance testing results, PID controller configuration, open loop bump test results, closed loop performance (setpoint and load response) and process variability.

2. Conduct open loop bump tests on a regular basis

(6 months to 1 year intervals) to measure the process dynamics and identify loop health problems.

- Use the fast 1st order component of the pressure response to develop Lambda tuning constants.
- If a PCV is the final control element measure the process gain in the transition between the low gain and high gain regions (typically 50 to 60% valve position)

3. Minimize the process time constant and deadtime.

Good targets are <1 second and <0.5 seconds respectively. If the dynamic response is too slow check for *sensor filtering, valve speed, and sensor bandwidth.*

- *Sensor filter should be 1 second or less*
- *Valve speed should be 10% per second or faster*

4. Minimize the valve tracking non-linearities.

A good target for backlash is less than 0.5% - good target for stiction is less than 0.25%. Minimize the actuator deadband. A good (and achievable) target is 0.2%.

5. Standardize on the Lambda tuning procedure.

Select a ***fast*** Lambda value for pressure loops. A good target for Lambda is ***3 seconds***. The Lambda value must be equal to or greater than 2 times the time constant or deadtime. The Lambda value can be easily tested by conducted setpoint step tests.

6. Install an Output linearization strategy

on mainline station pressure control loops where a PCV is the final control element. This strategy will 'speed up' the controller response in the low gain region (typically 50 to 100% valve position range). A computer simulation should be used to develop the initial linearization equation.

7. Use an analytical approach to troubleshooting process control problems.

Document the problem first and then design tests that are progressively more specific – until the ultimate source is discovered.

- The **Auto / Manual** test is conducted to determine if a process cycle is caused by the control loop
- The **Open Loop Bump** Test is used to measure the process dynamics, identify loop health problems, and identify loop design problems.
- The **Setpoint Bump Test** is used to evaluate controller tuning
- The **Coupling Step test** is used to discover the impact of one process variable on another process variable.