



MSR Drain Tank Level Control Valve Positioner Failure

Paul Bott – Brunswick Nuclear Plant



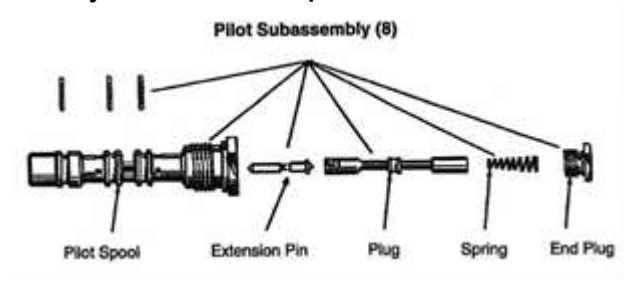
- On 1/7/2015, the East Moisture Separator Drain Tank experienced two low tank level alarms, followed by a high tank level alarm, at which point the emergency drain valve, 1-MD-LV-MSDCV-C-1, automatically opened to lower tank level. The controller for 1-MD-LV-MSDCV-H-1 was placed in manual with a 100% demand signal. Per AOP-23.0, a third Condensate Pump and a third Condensate Booster Pump were started. The level in East Moisture Separator Drain Tank stabilized with this system lineup.

- Using 1-MD-LC-MSD-H-1's manual mode, the valve was initially commanded to move from 100% open to 95% open. The valve moved in closed direction. Monitored parameters quickly changed. The valve failed to stop at 95% open and continued closing. After approximately 2" ($2/4.125 = 48\%$) of valve actuator stem movement the East Moisture Separator Drain Tank level was noted to be increasing. At approximately 18", controller 1-MD-LC-MSD-H-1 was taken to 100% full open position. The controller output was noted to appropriately go to 19.99mA; however, valve 1-MD-LV-MSDCV-H-1 did not respond as directed by its controller and instead went full closed. At approximately the same time, 1-MD-LV-MSDCV-C-1 was immediately opened by Operations to lower tank level.

Corrective Actions

- WO 1344969-11 replaced the positioner's pilot valve and the positioner was restored to service.
- The removed pilot subassembly was sent to Duke Energy Metallurgy Services for evaluation.

- A copy of the pilot subassembly schematic provided in the Vendor Technical Manual provided with the spool valve.



- A digital photograph of the spool valve in the as-received condition.



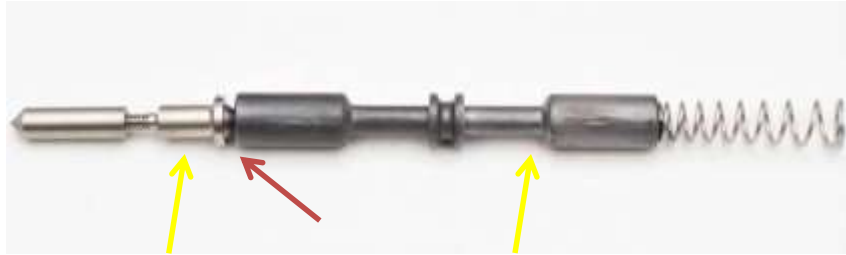
- Close-up digital photographs of the spool valve in the as-received condition showing the debris observed on the exterior surfaces of spool.



- A close-up digital photograph of the spool valve in the as-received condition showing the O-ring condition and an enhanced view of the fibrous debris.



- A close-up digital photograph of the spool subassembly showing the extension pin, plug, and spring after being removed from the spool. The yellow arrows indicate degraded areas observed on the surfaces of the cylindrical portions of the plug and the red arrow indicates a gray colored deposit observed on the chamfered edge of the cylinder.



- A digital photograph of the end-plug side cylinder where the most severe degradation was observed.



- A digital photograph of the extension pin side cylinder with a red arrow indicating the deposit observed and a yellow arrow indicating the degraded area of the cylinder.



- At time of the failure there was no PM for replacement.
- EPRI recommendations Critical positioners should have a PM replacement frequency of 10Y, or 5R.
- The failed positioner was in service for 9 years.
- Brunswick decided to have a PM replacement frequency of 6Y or 3R.

- Galling of the positioner pilot subassembly is attributed to normal service wear over an extended service life.

- Do any other utilities use Masoneilan SVI-1 positioners?
- Questions.
- Thank you.

