SMITH ANALYTICAL, LLC

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TECHNICAL BULLETIN

SAMPLE SHUTOFF VALVE FAILURE

JANAUARY 21, 2014

OVERVIEW

A Client recently had an issue with their process analysis results changing as ambient temperature changed. During daylight hours or periods of high ambient temperature, the analysis provided by the analyzer read high. During the evening or early morning hours, the analysis reading were lower. The analysis was parts per million levels Acetylene (Ethyne) in Ethylene being performed by a gas chromatograph. See Chart 1 below. The conclusion was that this was some type of sample conditioning system related problem.

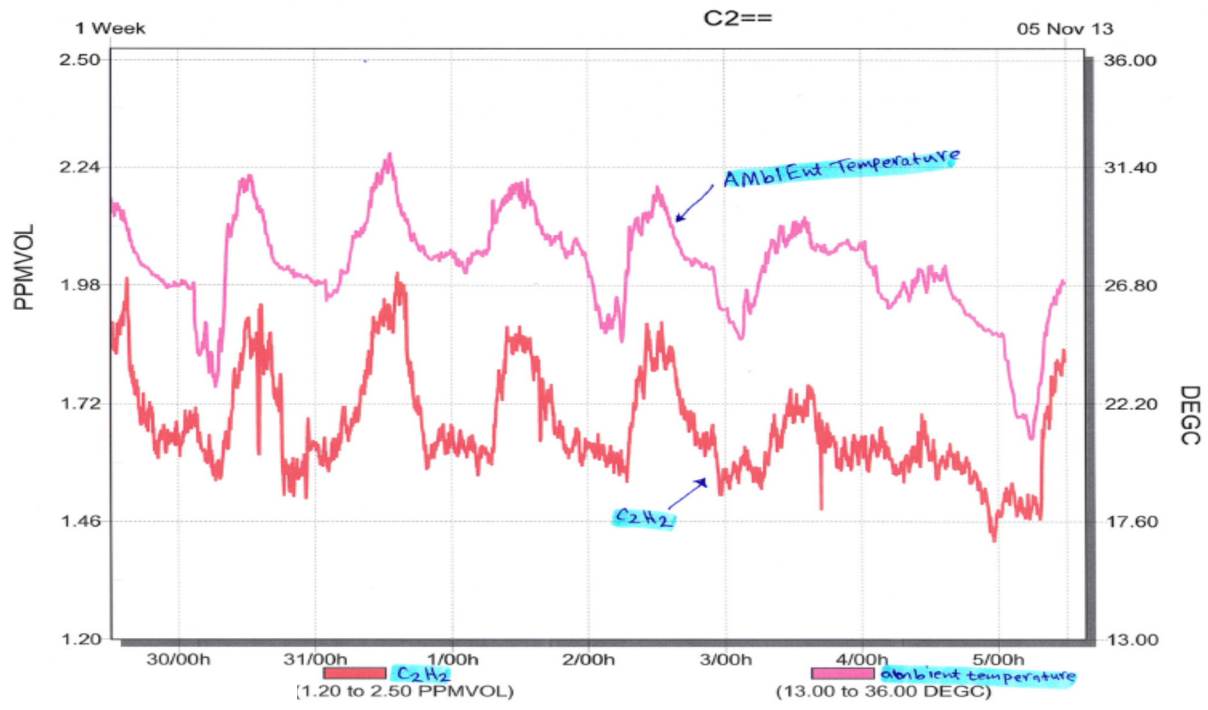

CHART 1 ACETYLENE VS. AMBINET TEMPERATURE TREND

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SYSTEM REVIEW

There were a number of test performed to isolate the problem. The first order of business was to eliminate this as being a process problem. A bias test was conducted where calibration gas was introduced into the entire system for a complete ambient heating cycle. The same results were obtained on calibration gas whether the calibration gas was introduced at the probe outlet and then through the entire system or directly to the conditioning system supplying the sample to the gas chromatograph. Higher Acetylene results during the heat of the day and lower results during the evening hours.

CORRECTIVE ACTION

After extensive testing, the problem was the result of a faulty Swagelok Sample Shut-off Valve (SSO) P/N SS-92S4-C. (Picture 1) The sealing O-ring had failed and actuator air was mixing with the process. (Picture 2). As the SSO design used by the sample system manufactured used an Air to Open actuator instead of an Air to Close actuator, there was a single point of failure. The single point of failure in the Air to Open design being the lower sealing O-ring. Had an Air to Close design been used, there would be two O-ring seals that would have to fail in order to see the same problem. As this was a hydrocarbon process (Ethylene Product) which the instrument air was mixing with, this should be viewed as a major safety concern and warrant review of Air to Open valves used in hydrocarbon service. It should be noted that this valve enjoyed years of service before the failure. The valve is not really the issue here, but the application of this particular valve configuration is and should be considered by the Sample System Designer. It should be noted that this valve (Air to Open) is commonly used in conjunction with process gas chromatographs analyzing a vapor sample thus requiring the use of a Sample Shut Off Valve.

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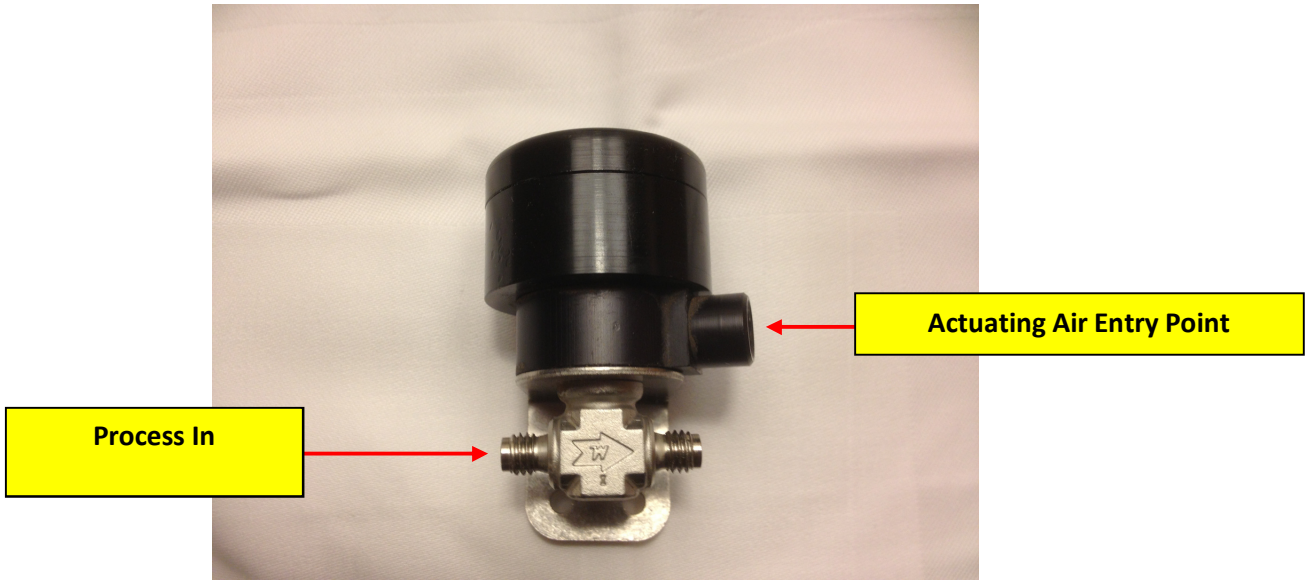
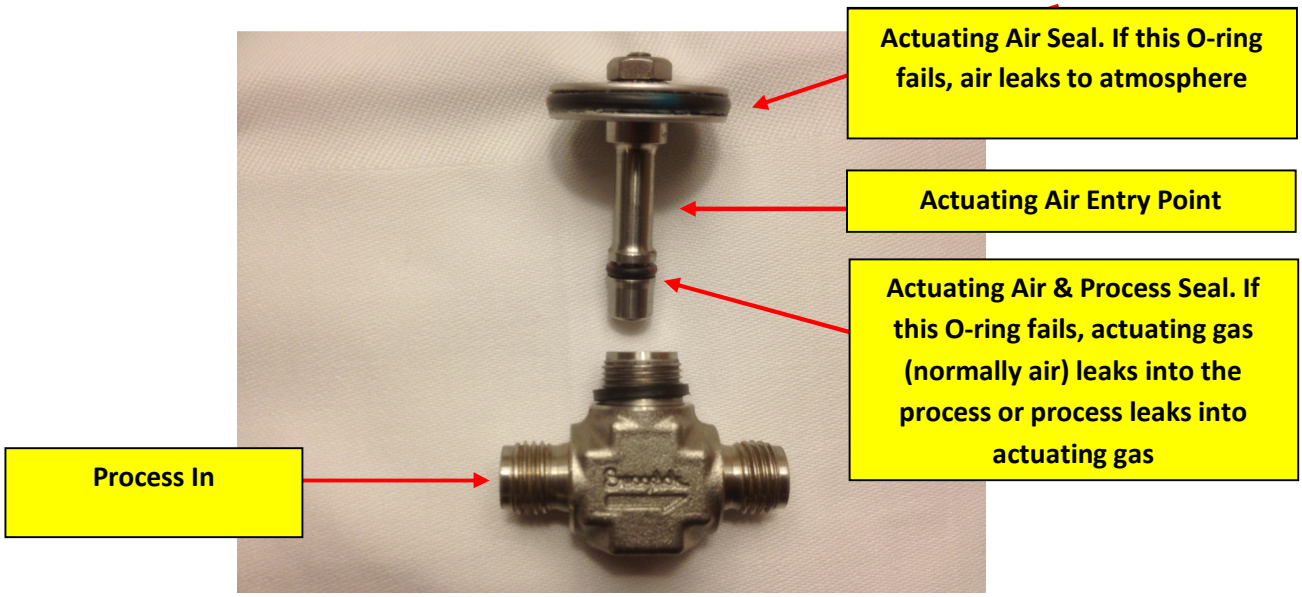


PICTURE 1 - SWAGELOK SS-92S4-C SAMPLE SHUT OFF VALVE

WITH AIR TO OPEN ACTUATOR



PICTURE 2 - SWAGELOK SS-92S4-C SAMPLE SHUT OFF VALVE