

Two Case Studies on Installation Effect

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Two Case Studies:

1. Results of adding additional flow conditioners into a parallel meter run station to correct an installation effect error
2. Changing upstream piping, header, and flow conditioner design to reduce audible noise while minimizing installation effect

Case 1: Adding Additional Flow Conditioner to Minimize Error caused the Station Piping (i.e. installation effect):

1. Two 8" meters were calibrated. During calibration the profile factor for both meters were very close, across the flow range, averaging a 1.16.
2. The meters were put in service. When run 1 flowed by itself, the run's profile factor matched reasonably close to the expected profile factor
3. However, when the meters flowed in parallel, run 1's profile factor shifted low by more than 5% indicating error (on the order of +/- 0.2%) caused by the station piping when the meters were operating in parallel
4. Solution: Installed additional flow conditioners at the upstream in up both meter tubes which resolved the issue. Following the work, both meter's profile factors averaged very close to the expected profile factor determined from the calibration data

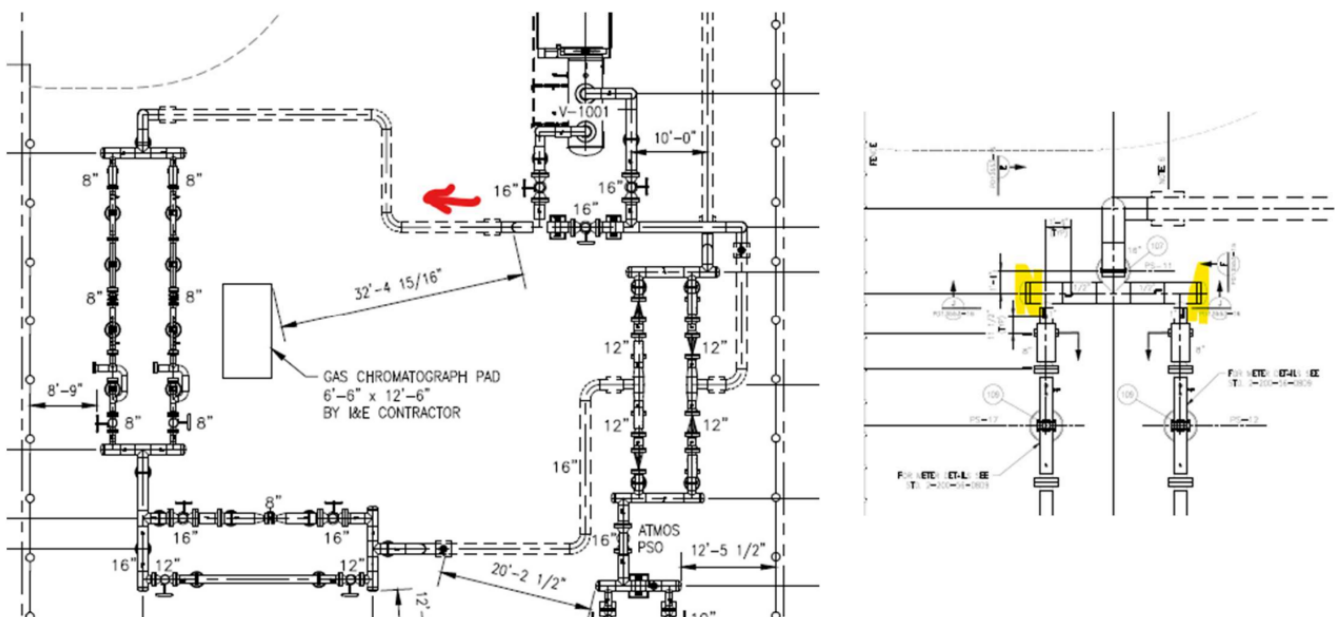


Figure 1: Diagram of Meter Station with Highlight of parallel meter runs on left.

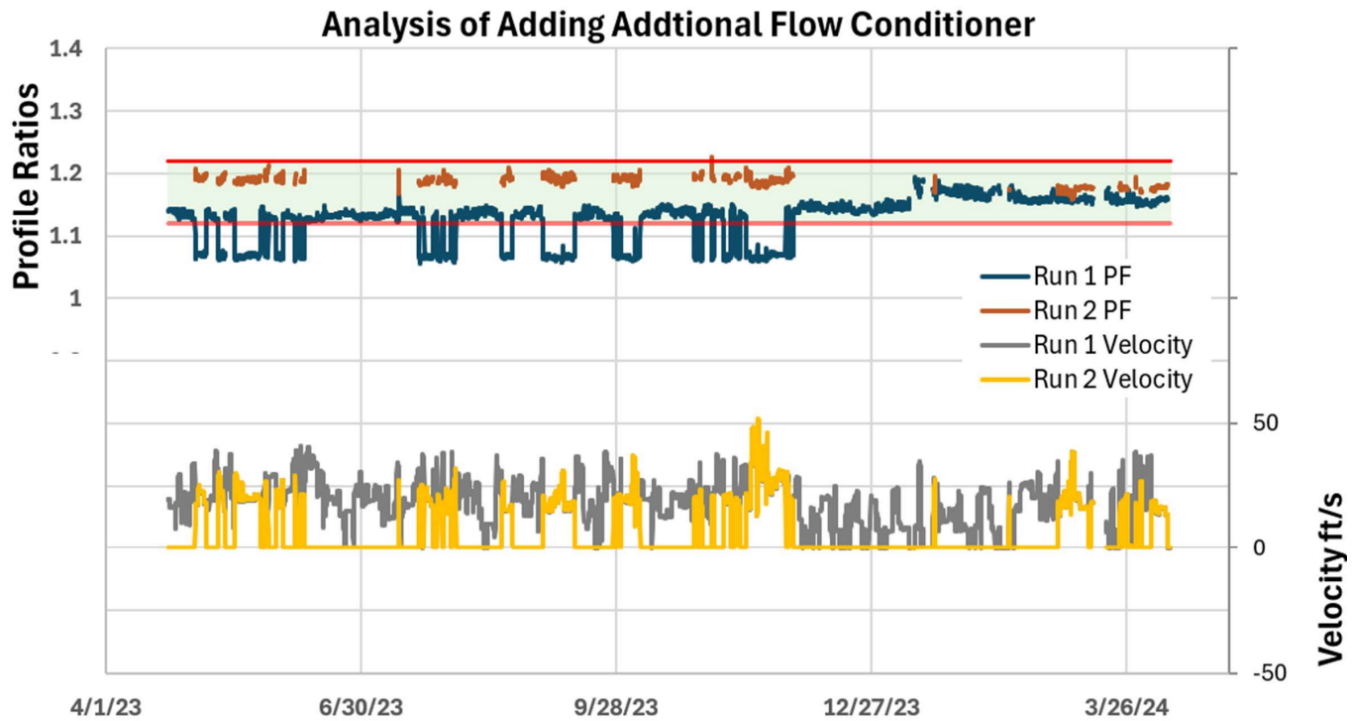


Figure 2: Analysis of adding an additional flow conditioner

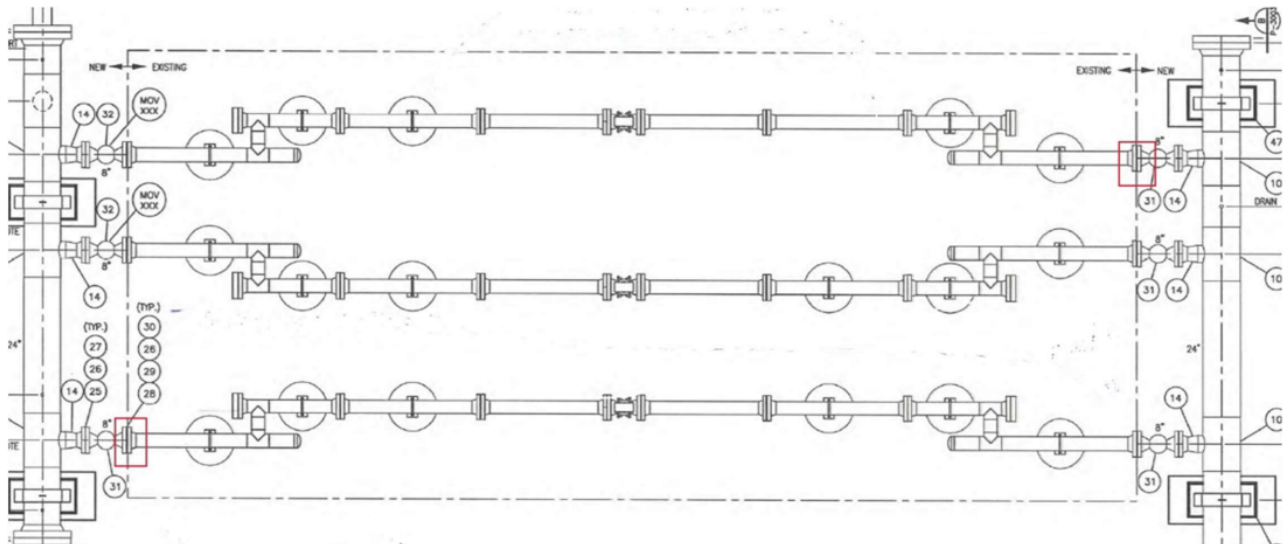


Figure 3: Bidirectional Meter Run Sight with similar issues fixed using two flow conditioners.

Case 2: Changing upstream piping, header, and flow conditioner design to reduce audible noise while minimizing installation effect.

1. 10" USM has been in service for many years. The meter became undersized as demand increased over time. This increased flow through the meter to the point where audible noise being generated by the flow conditioner became an issue.

2. The decision was made to replace the more restrictive flow conditioner with a less restrictive conditioner. The conditioner significantly reduced the audible noise but did not handle the disturbed flow profile caused by the upstream piping causing appreciable installation effect error (up to $\pm 0.7\%$). A solution was needed for the installation effect.

3. Solution: The station upstream header and piping was redesigned to meet current standards, adding a parallel meter, and the USM was recalibrated with the less restrictive flow conditioner. Once the meter was calibrated with the new conditioner, the USM's flow profile factor and symmetry began matching the calibration, thus solving the distorted gas profile issue.

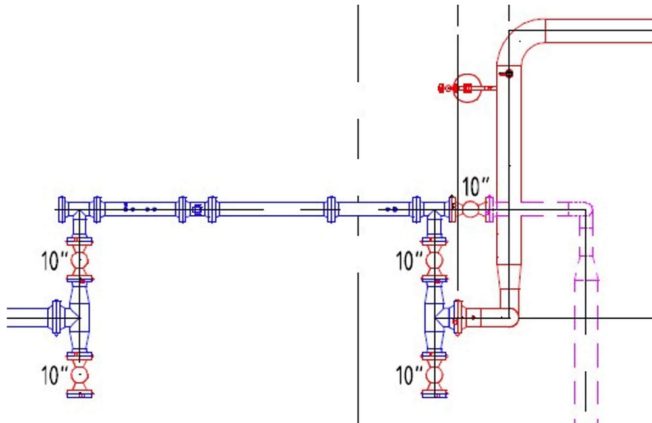


Figure 4: Diagram of installation of 10" USM

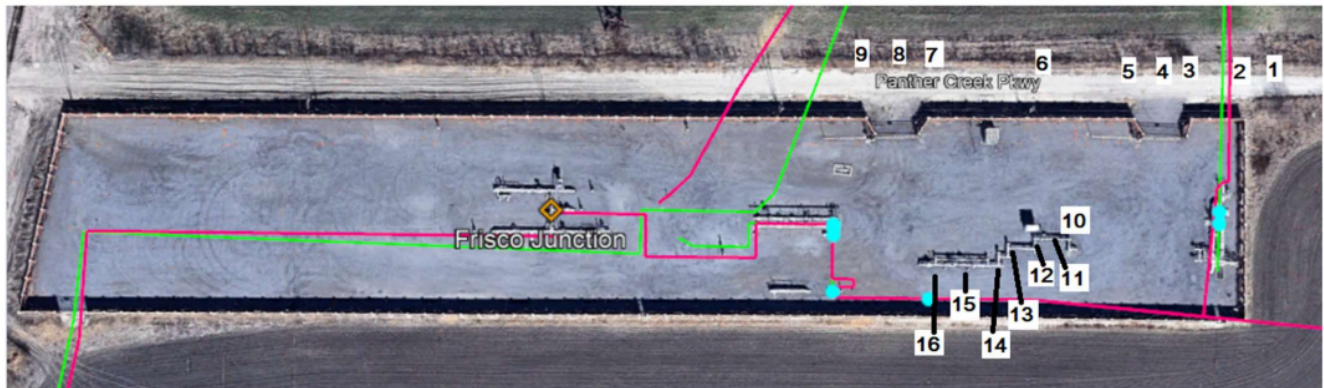


Figure 5: Photo of actual installation



Figure 6: Photo of Less Restrictive Flow Conditioner vs. More Restrictive Original Flow Conditioner

With More Restrictive Flow Conditioner Installed

Flow	Press	Temp	Velocity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MMscfd	psig	F	fps																
152	699	67	60	91	91	80		92	82	72		85	88	91	90	88	92	85	83

With Less Restrictive Flow Conditioner Installed

Flow	Press	Temp	Velocity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MMscfd	psig	F	fps																
204	780	62	70	65	60	65		55	55	60		60	73	71	85	79	91	85	85

Figure 7: Comparison of noise levels in db's between flow conditioners

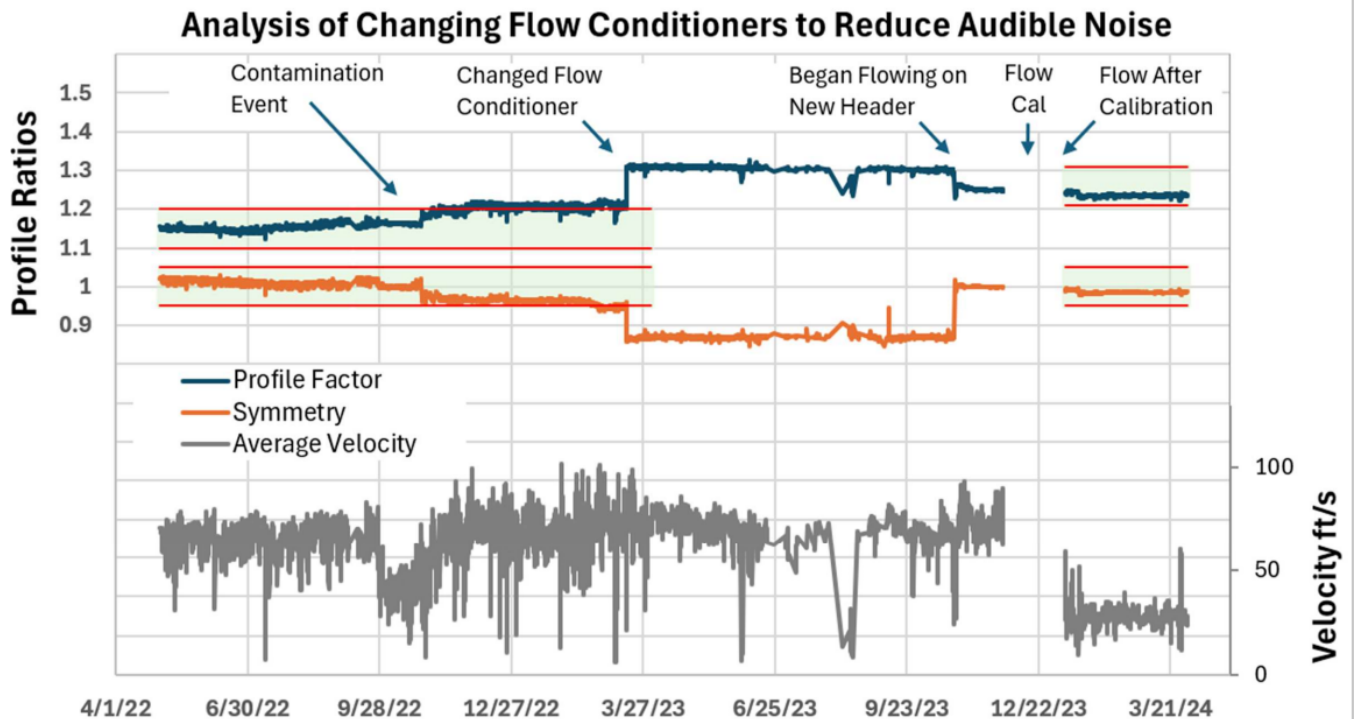


Figure 8: Analysis of changing flow conditioners to reduce audible noise.

Summary:

1. Continuous monitoring and analysis, before and after, allowed us to understand the multiple issues, see the problems change, and then be confident the problems were solved.
2. Listen to your technicians
3. Pay attention to header and piping size