

Mitigate Vibration Risk with Confidence

Two-phase flow, which commonly occurs downstream of heat exchangers and heaters in process facilities, creates dynamic forces in piping systems which can lead to vibration and fatigue failure.

Equity Engineering provides specialized consulting services to diagnose, analyze, and mitigate complex two-phase flow vibration challenges. Using our team's expertise in vibration analysis, fluid dynamics, and fitness-for-service (FFS) assessments, we deliver practical, effective solutions that improve the long-term reliability of piping systems.

BENEFITS



Prevent Catastrophic Failures



Improve Asset Reliability



Enhance Operational Safety



Optimize Maintenance Costs

Contact Equity Engineering to discuss any two-phase flow piping vibration challenges

Vibration Mitigation

Our multi-disciplinary services are focused on solving the most difficult piping vibration problems to improve safety, increase reliability, and mitigate vibration risk.

Advanced Diagnostic Analysis:

We use advanced statistical methods, including kurtosis, to assess non-Gaussian and intermittent loads typical of slug and plug flow regimes. We provide a clear picture of fatigue risk by going beyond conventional vibration RMS measurements.

FFS Assessments:

We leverage API 579 FFS standards to evaluate stress levels and determine if the measured vibration could lead to fatigue failure. We will conduct comprehensive Level 1, 2, and 3 assessments to develop clear and practical recommendations.

Root Cause Determination:

We identify the underlying flow regimes and mechanisms causing vibration. By analyzing flow rates, pipe orientation, and system configuration, we pinpoint the source of instability, whether it is turbulence-induced random vibration or high-impact intermittent flow.

Engineered Mitigation Strategies:

We tailor solutions to meet your specific operational conditions. Recommendations may include optimized piping supports designed to increase stiffness while accommodating thermal expansion, or process modifications to alter the flow regime and reduce damaging dynamic forces.

Case Study

Two-Phase Flow Vibration in Heater Inlet Piping

Type of Asset: Fired Heater Inlet Piping System

Location: USA

Issue: A process facility discovered severe vibration in the inlet piping of a fired heater that was impacting the asset's structural integrity. In addition, the high operating temperatures introduced substantial thermal expansion stress into the piping geometry. The client hired Equity Engineering to control the dynamic response and ensure the piping retained sufficient flexibility to accommodate thermal growth without exceeding allowable stress levels.

Solution: We designed and implemented a robust restraint system and additional piping supports to control the vibration. These supports were strategically placed to increase the mechanical stiffness of the system, thereby shifting the natural frequency to above the largest amplitude excitation frequencies generated by the two-phase flow. The support design accounted for thermal expansion, utilizing hardware that provided the necessary dynamic restraint while also allowing the required thermal movement. This balanced approach addressed the root cause of the fatigue risk without compromising the system's ability to handle thermal loads.

Result: The new support system delivered immediate and measurable improvements. The post-installation monitoring confirmed a significant decrease in vibration amplitudes across the heater inlet piping, bringing levels well within safe operating limits. By reducing the piping vibration, the facility achieved improved system reliability and minimized unplanned downtime and piping repairs. This project demonstrated the value of conducting a comprehensive FFS assessment to resolve complex two-phase flow challenges.