



Process System Integrity - Piping Vibration Management

Reducing the risk of vibration-induced fatigue

BUSINESS CHALLENGE

According to recent studies, 20% of process pipework failures are due to vibration-induced fatigue. Primary contributing factors are:

- Increased flow rates due to de-bottlenecking;
- Increased flow rates due to relaxation of erosion velocity limits;
- Increased use of duplex alloys for erosion and weight considerations;
- Little or no structured mean of addressing the potential problems during HAZOP or QRA studies.

This loss of containment can have serious safety, environmental and cost implications. Identifying the risk areas linked to vibration-induced fatigue is becoming a necessity for socially responsible companies.



SOLUTION

What is Process System Integrity (PSI)?

To address the problem of vibration-induced fatigue, Bureau Veritas has worked closely with the oil and gas industry as well as the regulatory authorities to develop a risk assessment methodology. New facilities as well as those already in production can benefit from this method.

For new facilities, PSI can identify pipework at risk from vibration fatigue in the design phase, so the appropriate modifications can be made before the facility is put into operation.

PSI can also be applied to operational facilities, particularly where de-bottlenecking is being performed. In such cases, the results of a formal risk assessment, supported by field measurement studies, can often completely eliminate potential failures due to fatigue. If other high-risk areas are identified, PSI can be applied to form a rational basis from which to formulate suitable mitigating inspection programs.

What are the key benefits?

- Reduction in unplanned downtime;
- Modifications targeted only at high risk pipe work and small bore connections;
- Inspection and vibration monitoring activities targeted at high risk areas instead of "measure everything" approach;
- Ability to update the assessment with any proposed process or operational changes to that potential problems can be identified and solved prior to the plant changes being implemented.

WHY CHOOSE BUREAU VERITAS ?

- Bureau Veritas is a leader in developing industry-standard risk based methodologies to address the issue of vibration induced fatigue in process piping systems.
- Proven track record in applying methodology to 40 onshore and offshore plants.
- Years of experience in solving complicated vibration issues for process plants worldwide.
- Wide range of global resources available to support any project phase—from design to urgent requests for an operational plant.

RELATED SERVICES

- Piping vibration risk assessment
- Piping vibration measurement and investigation
- Detailed simulation and prediction (including API618/API674 pulsation analysis and pressure surge simulation)



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OUR APPROACH

Bureau Veritas' Process System Integrity methodology is based on the results of a Joint Industry Project published in 2000¹, co-authored by Bureau Veritas and sponsored by a number of oil majors, government bodies and large engineering contractors. The process entails:

- Formal risk assessment;
- Inspections and surveys to identify problem areas;
- Identify and propose modifications;
- Plant modification management to ensure it is fit for service.

PSI can be embedded in an existing plant inspection management program and is a logical extension to risk-based inspection techniques, which often concentrate only on corrosion related degradation mechanisms.

¹Guidelines for the Avoidance of Vibration Induced Fatigue in Process Pipework – MTD document 99/100

FAQ

What is a piping vibration risk assessment?

It is a risk-based assessment procedure that identifies where piping fatigue failure might occur. It can be enhanced with targeted measurement surveys and detailed simulation techniques to quantify fatigue lifecycles.

When can a risk assessment be made?

During the design and construction phases of a new project, or at any point during plant operation for an existing installation.

Isn't a vibration survey sufficient?

Piping vibration varies with changes to process and operational conditions, and therefore a vibration survey is only a snapshot of the piping vibration at the time of the survey. The risk assessment approach takes into account a plant's full operational and process scope.

Can the methodology be integrated into my piping integrity management system?

Yes – the procedures, tools and techniques used can be embedded into a company's integrity management system to provide an on-going assurance process with respect to vibration-induced fatigue.

CASE STUDY



A new offshore installation was experiencing severe piping vibration at production rates of above 120,000 barrels per day (bpd). The original design case of 150,000 bpd could not be achieved, so Bureau Veritas recommended an emergency short term "fix" that was put in place and which enabled operation at the design flow rate.

However, the client aimed to push production to 180,000 bpd. Through a PSI risk assessment, Bureau Veritas screened the complete hydrocarbon system (200 main lines) for potential vibration problems at 180,000 bpd.

The results showed that five main lines needed changes to supports and 28 small bore connections needed bracing or modification.

Following the proposed modifications, the asset successfully achieved 180,000 bpd. A vibration survey performed offshore verified the findings of the study.

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