MODAL ANALYSIS FOR RESOLVING HVAC FAN FAILURES

Advanced vibration analysis identifies resonance

AVT RELIABILITY ...it's in our DNA

"ODS and Modal Testing provided a clear understanding of the vibration encountered during operation, allowing a solution to be designed specifically for the operating conditions rather than relying on trial-and-error modifications."

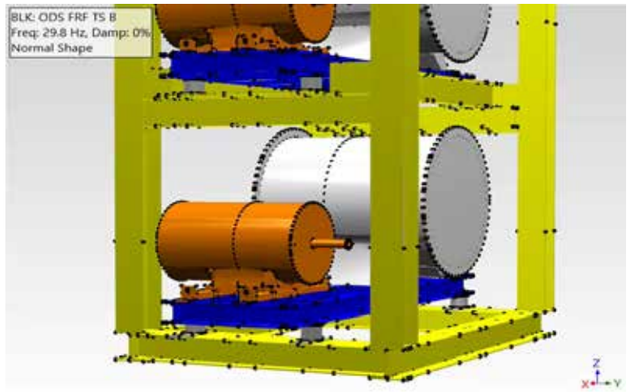
SERVICE MATTERS

AVT Reliability® was engaged to investigate recurring failures on two critical HVAC fan units operating on a manned offshore gas production platform. The objective was to identify the root cause of the failures and develop a long-term engineering solution that would improve reliability, reduce maintenance costs, and eliminate repeat breakdowns.

THE CHALLENGE

The platform relied on two identical belt-driven HVAC fan units to provide ventilation to key operational areas. Repeated failures were occurring due to excessive vibration, resulting in loss of ventilation and costly maintenance interventions.

Each failure required the removal of the motor assembly and transportation back to shore for repair, creating significant expense, logistical complexity, and operational risk. The client required a detailed engineering investigation to determine the root cause and prevent future failures.



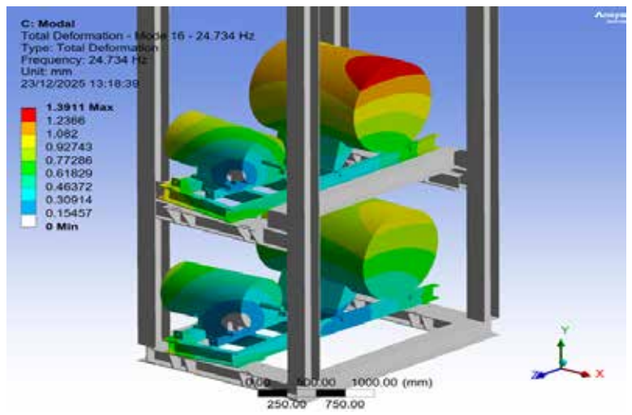
OUR APPROACH

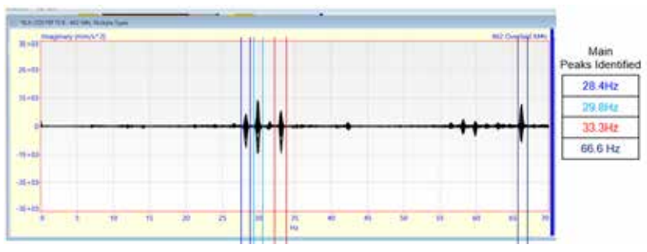
AVT Reliability's Asset Integrity Division (AID) carried out a comprehensive vibration investigation using Operational Deflection Shape (ODS) analysis and Experimental Modal Analysis.

More than 70 vibration measurement locations were assessed across both fan assemblies using a four-channel vibration analyser and tri-axial accelerometers.

The investigation consisted of:

- Operational Deflection Shape (ODS) testing while the fans were running
- Modal testing during shutdown using an instrumented impact hammer
- Identification of structural natural frequencies
- Analysis of operating vibration modes
- Creation of animated 3D models to visualise structural movement and vibration behaviour

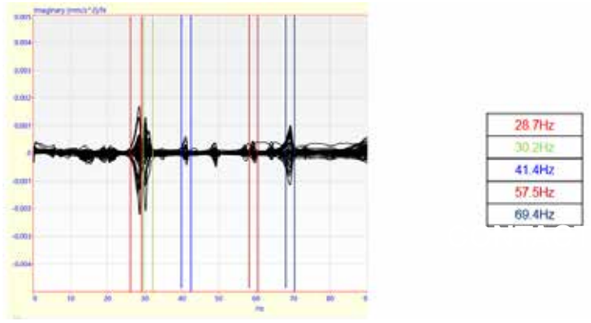




OUR FINDINGS

Analysis identified natural frequencies in the support structure close to the fan and motor operating range, indicating resonance during normal operation.

This caused excessive vibration and movement between components, leading to repeated failures. ODS animations confirmed the behaviour and helped identify the root cause.



THE SOLUTION

Using FEA, AVT assessed several design options, including changes to anti-vibration mounts, added mass, increased stiffness, and damping measures.

The selected solution increased the system's natural frequencies from 25–32 Hz to at least 43 Hz, providing sufficient separation from operating frequencies and significantly reducing the risk of resonance.

FOLLOW UP

Both fan assemblies have since been removed to undergo the recommended modifications. Once the upgrades have been implemented, AVT Reliability® will return to site to perform validation testing and confirm that vibration levels have been reduced and the resonance issue has been successfully eliminated.

By identifying the true root cause and designing a targeted engineering solution, the client avoided the risks associated with repeated failures, ongoing maintenance costs, and continued operational disruption.

AT A GLANCE

Industry: Oil & Gas

Process: Offshore Ventilation Systems

Equipment: Belt-Driven HVAC Fan Units

Services: Operational Deflection Shape (ODS), Modal Testing, Finite Element Analysis (FEA), Engineering Design

Products used: Specialist Vibration Analysis Equipment, CAD & FEA Software

Outcome: Root cause identified and engineered solution developed to eliminate resonance-related failures

Speak to an expert

If your plant is facing similar issues, reach out to AVT Reliability for expert support in condition monitoring, pipework vibration and lubrication management. We're here to keep your operations running smoothly.

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